

**BELIZE NATIONAL IMPLEMENTATION  
PLAN TO MANAGE AND PHASE-OUT  
PERSISTENT ORGANIC  
POLLUTANTS**

**IN ACCORDANCE TO THE  
STOCKHOLM CONVENTION**

**SUBMITTED TO  
THE PROJECT MANAGEMENT UNIT  
POPS PROJECT  
DEPARTMENT OF THE ENVIRONMENT**

IN FULFILMENT OF CONTRACT NO. BELIZE POPS - (2008)

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## EXECUTIVE SUMMARY

This document is the National Implementation Plan (NIP) for the management and phase-out of the Persistent Organic Pollutants (POPs) in Belize. The NIP is compiled according to Article 7 of the Stockholm Convention on Persistent Organic Pollutants (POPs). Belize signed the Stockholm Convention in 2002 and is thus committed to manage and phase-out the POPs as stipulated in the Convention.

The main POPs substances are nine pesticides (Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene (HCB), Mirex, Toxaphene and DDT), polychlorinated biphenyls (PCBs), and unintentionally produced polychlorinated dibenzo-p-dioxins and dibenzofurans. Scientific studies indicate that POPs chemicals are toxic. These chemicals have a tendency to accumulate in fatty tissues and due to their persistence they are biomagnified in the bodies of animals at higher trophic levels and thus end up in humans through the food chain.

The NIP was developed between 2006 – 2008 in a process funded and supported by UNDP, by national and international experts and a large number of Belizean stakeholders involved in different aspects of POPs management. The agency guiding the NIP development has been the Department of the Environment of the Ministry of Natural Resources and the Environment. The stakeholders' interests and views were included through the Project Steering Committee (PSC) that convened a number of meetings during this development process. The NIP describes the background of the POPs issue in Belize, the current situation of POPs substances and estimated emissions into environmental media, estimated impacts and how Belize will meet its obligations under the Stockholm Convention.

Belize's current population is approximately 300,000, half of which is rural. In 1991, the urban/rural ratio was 48:52. In 2007, this ratio has changed slightly, with 49.0% of the population living in the rural areas and 51.0% living in the towns and cities. The recent population growth figure is approximately 2.7 % per annum. People under five (5) years of age make approximately 12.2% of the total population. The per capita GDP is US\$3786 with a 2.3% growth rate. Agriculture counts for some 35 % of the GDP but provides livelihood for 41 % of the population. A remarkable factor is the rapidly expanding oil and petroleum sector, which in 2007 accounted for more than US\$100 million in exports and US\$17 million of public revenue.

Belize has never produced any POP chemicals and imports all of the pesticides it uses. There is one plant that formulates pesticides from

imported active ingredients. However, these are not POPs pesticides. Belize has not imported or exported any POPs chemicals since the year 1997 when DDT was last used for malaria control. According to the preliminary inventory carried out in 2006-7 the quantity of obsolete POPs pesticide stocks is 13 tons (DDT) at one storage site in the country (Belmopan City). There is also 4.5 Kgs of Mirex at the PCB warehouse that was removed from the premises of a villager. There are very few specific studies on the impact of POP pesticides on humans, and the different ecosystems in Belize. The preliminary studies indicate the presence of DDT in most environmental and human samples.

Polychlorinated biphenyls (PCBs) are used as dielectric liquid in electric transformers and condensers. Practically all transformers in Belize belong to the Belize Electricity Limited (BEL), which is responsible for the generation (other agencies generate electricity but sell the excess to BEL), transmission and distribution of electricity in the whole country. The total number of electric transformers in Belize is estimated at around 5000 units. The total weight of dielectric liquid in these transformers is not known at this time. However, it is estimated that less than 3% may contain PCBs. PCBs are not used for the maintenance of old transformers and those transformers found to contain PCBs are either not serviced or are replaced using PCB free transformers. The BEL staff is knowledgeable about the effects of PCBs and has a PCB management plan in place to phase out the use of PCB containing equipments.

DDT has never officially been used for agricultural purposes even though one or two farmers may have used it. DDT was used for malaria vector control until 1997 at an average annual quantity of 21 tons. There is a DDT stock in Belize of approximately 13 tons in storage at the Belmopan Hospital compound.

A revision of the preliminary POPs inventory estimated that approximately 88 gTEQ/A of dioxins and furans were unintentionally released in 2004. An estimated 48 gTEQ is produced by waste incineration of medical waste and another 37 gTEQ/A from uncontrolled combustion processes.

Other important release sources are power generation and heating (1.29 Gg) and production of mineral chemicals (0.55 Gg). There are no remarkable hot spots (with the exception of the Belize City dumpsite) however certain industrial processes and burning obviously present occupational risks. Urban population and especially the population living at the outskirts of Belize City areas are exposed to the release from waste burning

The current regulatory framework does not specifically address the POPs issue. The Environmental Protection Act, The Public Health Act,

Pesticides Control Act as well as certain labor protection regulations generally address risks similar to the risks of POPs. In general Belize lacks the analytical capacity to study the impact of some POPs both in the ecosystem components as well as in humans.

Belize is committed to the management and phasing-out of the POP chemicals as stipulated in the Stockholm Convention. The regulatory framework is continuously being updated albeit not specifically to manage POPs. Further, Belize aims at applying the Polluter Pays Principle (PPP) to mobilize the economic and financial incentives in tackling the POP emissions. In the overall strategy to accomplish the objective to phase-out POPs according to deadlines in the Convention, Belize has proposed a combination of measures including Government's involvement (regulation reforms and law enforcement efforts), support to local actions, market instruments like subventions and tax-breaks and extensive international cooperation including co-funding.

Belize has set national priorities regarding the implementation of the POP management and phase-out actions. It may be noted, when setting the priorities, that there are hardly any very urgent POPs related risks and exposures to address. The proposed projects discussed later in this report, present long-term mitigation of impacts. Continuing the capacity building by strengthening the POPs unit at the Department of the Environment and initiating a rather extensive public awareness and training program are considered the first priorities on the national level. Solid waste management as well as the management of medical and other hazardous waste present actions, which, immediately improve the status of the environment and affect a large number of people by reducing risks to get in contact with POPs. Management PCB and POPs pesticides are complementary actions safeguarding that these substances do not resurface in Belize and that the adverse impacts caused by previous use are being mitigated. Green, mechanical harvesting of the sugar cane contributes to the reduced POPs releases in rural areas proposed actions to manage the POPs issues consist of one institutional project at the Department of the Environment. This project proposal is based on the very encouraging experiences gained from this NIP development process. This project is planned for a period of five years.

The NIP implementation will be achieved through five strategies. These strategies are composed of various actions plans and specific projects as summarized below.

#### Strategy for Coordination of NIP Implementation

1. Strengthening of Stockholm Convention Focal Point (DOE).

Strategy and action plans for the management and phase-out of POPs pesticides:

1. Amendment of the Existing Legal Instruments and Strengthening Pesticides Law Enforcement
2. Strengthening the Capacity to Handle POPs Pesticides and Contaminated Sites
3. Raising Awareness of POPs Pesticides with Particular Reference to Waste and Contaminated Sites
4. Undertaking Ecologically Sound Measures to Eliminate Obsolete POP Pesticides

Strategy and action plans for the management and phase-out of PCBs (within the operational framework of the Belize Electricity Limited).

1. Develop Legal Instruments and Technical Guidelines for Managing PCBs
2. Comprehensive Inventory of Equipments, Accessories and Articles Consisting of, Containing, or Contaminated with PCBs.
3. ESM for in use equipment.
4. Environmentally Sound Management during Maintenance and Repair of PCB Containing Electric Equipments.
5. Strengthening Laboratory Capacity for PCB Analysis.
6. Environmentally Sound Management (ESM) for obsolete equipment.
7. Capacity Building for Awareness Raising.

Strategy and action plans for the management and phase-out of dioxin and furans releases:

1. Policy and Legal Framework for the Management of Unintentionally Produced POPs (UPOPs)
2. Capacity Building and Technical Support.
3. Municipal and Hazardous Waste Management.
5. Public Awareness and Technical Networking.
6. Land fills and Hazardous Waste Co-incineration.
7. Inventory of Unintentionally Produced POPs.
8. Medical Wastes Management.

Strategy and action plan for the management and phase out of DDT:

1. Country Needs Assessment,
2. Institutional Operational Research,
3. Monitoring and Evaluation of DDT Alternatives,
4. Public Awareness and Community Participation.

The timing of the actions and technical interventions is expected to fall mainly in the period of 2008 – 2015. The final disposal of the DDT obsolete stock in particular needs to be addressed as soon as possible as funding has already been identified and made available. Activities addressing dioxins and furans releases, especially those regarding the uncontrolled burning of waste and municipal waste treatment are long term projects but with great social and environmental benefits.

Total cost of the proposed actions and the related projects for the five strategies is estimated at US\$15,600,000. The totals for the individual strategies are:

<b>Action area</b>	<b>Costs of the proposed projects USD</b>
Institutional Strengthening	1,176,000
POPs Pesticides	100,000
PCB	30,000
DDT/Vector control	500,000
UPOPs	13,800,000
<b>TOTAL</b>	<b>15,600,000</b>

That amount presents capital investments as well as incremental costs. The industry related actions may fall outside of the incremental cost concept since the actions might be regarded as normal investment by the industry. Belize expects that most of the proposed external funding will be available from the Global Environment Facility, European Union and UN related sources, but will be actively seeking other sources of co-financing such as international NGOs, private companies and donations.

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## ACRONYMS

ARI	Acute Respiratory Infections
BAHA	Belize Agricultural Health Authority
BAT/BEP	Best Available Techniques and Best Environmental Practices
BEB	Belize Electricity Board
BECOL	Belize Electric Company Ltd
BEL	Belize Electricity Limited
BELCOGEN	Belize Co-Generation Energy Limited
BEP	Best Environmental Practices
BMLC	Breast milk lipid concentration
BSI	Belize Sugar Industry Limited
BSWMP	Belize Solid Waste Management Program
BW	Body weight
CAC	Commission of Environmental Cooperation
CFE	Comisión Federal de Electricidad (Mexico)
COP	Conference of the Parties
CSO	Central Statistical Office
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DVC	Disease Vector Control
DOE	Department of the Environment
EC	Emulsifiable Concentrate
EPA	Environmental Protection Act
ESM	Environmentally Sound Management
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GEF	Global Environmental Fund
GOB	Government of Belize
HCB	Hexachlorobenzene
IARC	International Agency for Research on Cancer
IDI	Infant daily intake
IPM	Integrated Pest Management
IVM	Integrated Vector Management
IICA	Inter-American Institute for Cooperation on Agriculture
IPCS	International Programme on Chemical Safety
IRS	Indoor Residual Spraying
JECFA	Joint FAO/WHO Expert Committee on Food Additives
JMPR	Joint Meeting on Pesticides Residues
KMHM	Karl Huesner Memorial Hospital
LIC	Land Information Center
LOAEL	Lowest Observed Effect Level

MAFC	Ministry of Agriculture, Fisheries and Cooperatives
MC	Milk Consumption
MAF	Ministry of Agriculture and Fisheries
MNRE	Ministry of Natural Resources and the Environment
MOH	Belize Ministry of Health
MW	Megawatts
NHDAC	National Human Development Advisory Committee
NHDR	National Human Development Report
NIP	National Implementation Plan
NOAEL	No-observed-adverse-effect-level
NSWA	National Solid Waste Authority
PAHO	Pan American Health Organization
PCA	Pesticides Control Act
PCB	Belize Pesticides Control Board
PCBs	Polychlorinated Bifurans
PCDD/PCDF	polychlorinated dibenzo-p-dioxins and dibenzofurans
PHB	Public Health Bureau
PMF	Percent milk fat
PMU	Project Management Unit
POPs	Persistent Organic Pollutants
PSC	Project Steering Committee
PTDI	Provisional Tolerable Daily Intake
PTMI	Provisional Tolerable Monthly Intake
PUC	Public Utilities Commission
PVC	Poly Vinyl Chloride
RUP	Restricted Use Pesticidas
SC	Stockholm Convention
SICA	Central American Integration Systems
TCDD	tetrachlorodibenzo-para-dioxin
TDE	Treponema denticola
TDI	Tolerable Daily Intake
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalent
TOR	Terms of Reference
UNDP	United Nations development Programme
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organization
USA	United States of America
UPOPs	Unintentional Production of Dioxins and Furans
WHO	World Health Organization
WP	Wettable Powder
WWF	World Wildlife Fund

## **1.0 INTRODUCTION**

### **1.1 THE OBJECTIVE OF THE NATIONAL IMPLEMENTATION PLAN**

In 1992, the world's governments met in Rio de Janeiro to collectively confront environmental problems that are now global in nature. Among those selected for long term planning and resolution was the problem of global pollution by a group of industrial chemicals known as persistent organic pollutants, or "POPs". These chemicals have toxic properties, resist degradation, bio-accumulate and are transported, through air, water and migratory species, across international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems.

The Stockholm Convention on Persistent Organic Pollutants came into force on 17 May 2004, with Belize signing the Convention on May 14 2002.

The Convention aims to protect human health and the environment from the effects of persistent organic pollutants (POPs) with a range of control measures to reduce and, where feasible, eliminate POPs releases, including emissions of unintentionally produced POPs such as dioxins. The Convention also aims to ensure the sound management of stockpiles and wastes that contain POPs.

The Government of Belize, through a project funded by the Global Environment Facility, is charged with the creation of an enabling environment which supports Belize's own sustained capacity to meet its obligations in the context of the Stockholm Convention, including the preparation of a National Implementation Plan (NIP) on Persistent Organic Pollutants (POPs). The NIP will elaborate a strategy for the fulfilment of the convention obligations, as well as indicate actions for addressing stocks of pesticides and PCBs, and a strategy for carrying out environmentally sound management of chemicals and contaminated sites that pose high risks for health and the environment. This report details Belize's NIP.

### **1.2 THE STOCKHOLM CONVENTION**

The Stockholm Convention is an international legally binding agreement on persistent organic pollutants (POPs). In accordance with paragraph 1 of Article 7 of the Stockholm Convention, each Party shall develop and endeavor to implement a plan for the implementation of its obligations



under the Convention and to transmit its plan to the Conference of the Parties within two years of the date on which the Convention enters into force for it.

In 1995, the Governing Council of the United Nations Environment Programme (UNEP) called for global action to be taken on POPs, which it defined as “chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment”.

Following this, the Intergovernmental Forum on Chemical Safety (IFCS) and the International Programme for Chemical Safety (IPCS) prepared an assessment of the 12 worst offenders. Known as the Dirty Dozen, this list includes eight organo-chlorine pesticides: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene; two industrial chemicals: hexachlorobenzene (HCB) and the polychlorinated biphenyl (PCB) group; and two groups of industrial by-products: dioxins and furans.

Although some critics have alleged that the treaty is responsible for the continuing death toll from malaria, in reality the treaty specifically permits the public health use of DDT for the control of mosquitoes (the malaria vector). From a developing country perspective, a lack of data and information about the sources, releases, and environmental levels of POPs, hampers negotiations on specific compounds, and indicates a strong need for research.

There are currently other substances that have been proposed for adding to the protocol: hexachlorobutadiene, octaBDE, pentaBDE, pentachlorobenzene, polychlorinated naphthalenes, SCCPs, dicofol, endosulfan, and PFOS.

Belize has not yet ratified the convention, but is expected to do so in the near future. While the organo-chloride pesticides were used in Belize in application against herbs, insects and termites, these are now banned for importation and use. However, DDT can be used only by the Ministry of Health in the event of an outbreak of malaria as it is a restricted pesticide. None of the dirty dozen chemicals are produced in Belize, with the exception of Dioxins and Furans that are produced only as a result of unintentional release from combustion of biomass and waste.

### 1.3 THE PROCESS OF NIP COMPILATION IN BELIZE

The Focal Point within the Department of the Environment, supervises all activities with respect to the preparation of Belize's NIP, through technical and administrative support of the PMU. The Preliminary National POPs Inventory Report completed in May 2006, formed the basis for the preparation of the Environmental Health and Socio-economic Impacts of POPs by first identifying potential sources and hence exposure of the Belize population to POPs. The inventory report identified the POPs previously used in Belize, previous and current storage sites of POPs in Belize and provided estimates of incidentally formed POPs.

The NIP process was facilitated by the POPs Project and its National Coordinating Committee and supported by the services of consultants. The process included the formulation of Terms of Reference and work program for the NIP process, as well as the allocation of financial resources to carry out activities supported by consultants and the POPs administrative efforts.

The POPs Project is being implemented by the UNDP and is being executed by the Department of Environment. The Project commenced on the 15<sup>th</sup> August 2005. The project has been programmed for its implementation in five phases as per the UNEP generic guidelines:

- Phase 1: Establishment of a coordinating mechanism and a process organization.
- Phase 2: Establishment of POPs inventories and assessment of national infrastructure and capacity.
- Phase 3: Priority assessment and objective setting.
- Phase 4: Formulation of the NIP.
- Phase 5: Endorsement & submission of the NIP.

A consulting firm, Natural Resource Consulting, was hired to assist in facilitating the NIP process. The objectives of the process were as follows:

- To identify and gather information on possible options for management of POPs to meet Belize's obligations under the Stockholm Convention with indication of the scope of application, limitations, costs and benefits of each,
- To prioritize the options available and actions necessary to meet the requirements of the Stockholm Convention and country objectives,

- To develop a National Implementation Plan (NIP) to enable Belize to meet its obligation under the Stockholm Convention, its country-specific objectives and priorities, coordinated with national activities on sustainable development where necessary and appropriate,
- To identify requirements for assistance in the completion of additional assessments and information gathering to complete and implement the NIP,
- The identification of financial mechanisms to implement the NIP and components of the national policy on chemicals management.

The methodology for the process included five activities, designed to obtain information to prepare draft and final reports. These are:

- Literature Review.
- Consultation with Stakeholders.
- Identification of Management Options to meet the Obligations of the Convention.
- Preparation of Financial Mechanism.
- Compilation, Analysis and Presentation of results.

The literature review was conducted in order to determine previous work that has been done in Belize either directly or indirectly related to POPs. Other relevant documents such as previous investigations with Annex A chemicals were also researched. Documented experiences in other countries were also investigated and any useful applicability to the Belize circumstances would be noted.

Consultation involved meetings with the POPs project management and its steering committee, stakeholders, and national consultation meetings and a national validation workshop on the final draft document. The process of consultation was on-going throughout the life of the POPs project and the preparation of the NIP.

An exercise aimed at identifying management options based on assessment of the results of the POPs inventory exercise, environmental and socio-economic impact assessment exercises, priority setting through national profile development, was also conducted, followed by a cost/benefit analysis of implementing the Stockholm Convention taking into account the option for environmentally sound management of POPs and other chemicals. This was concluded by a revision and analysis

process where appropriate mechanisms for financing the implementation of the NIP and the national chemicals management policy with an aim to making their implementation sustainable were recommended.

It should be noted that the prevalent impacts of POPs in Belize are hardly tangible. Therefore the socio-economic as well as environmental impacts are shown only by indicating the areas where it is likely that the population may suffer from adverse impacts. It is difficult to define any detailed impacts or figures presenting the population exposed to POPS' adverse impacts. The priorities of the proposed actions have been discussed in the workshops and within the expert group.

## **2.0 COUNTRY BASELINE**

### **2.1 The Profile of Belize**

#### **2.1.1 Geography and Population**

Belize is located on the South-eastern edge of the Yucatan Peninsula, (Northern Central America) being bordered to the North by Mexico, to the South and West by Guatemala and to the East by the Caribbean Sea (Figure 2.1). Belize is located between 15° 52' 9" and 18° 29' 55" North latitude and 87° 28" and 89° 13' 67" West Longitude. Using an offshore territorial limit of 20 km. (12 miles), the national territory covers about 46,620 sq. km (18,000 sq. m), of which 49% is land. Belize's land mass includes more than 1,000 tiny islands known as cayes, totaling about 690 sq. km (266 sq. m).

The climate is sub-tropical, with temperatures ranging from 21 degrees Celsius from October to February, and increasing to 32.2 degrees Celsius during May to September. The annual mean relative humidity is 81.8%, while total annual rainfall varies from 1,588 mm in the north to 4,290 mm in the south. There are two distinct seasons: the rainy season, which normally begins in late May and lasts until November, and the dry season, which begins in December and ends in early May. Topographic variations throughout the country are responsible for major fluctuations in air temperature, humidity and rainfall.

Belize has a relatively low topographic relief. Freshwater river systems and many perennial streams supply most of its water needs. The country is well endowed with both surface water, and water stored in aquifers. The Land Information Center (LIC) has identified thirty-two watersheds, although the National Hydrological Services classifies twenty-two major watersheds for Belize. Streams draining the southeastern and eastern slopes of the Maya Mountains have well-developed branching patterns with relatively steep, straight courses in the mountainous areas. On the coastal plain, streams become progressively more sluggish and drainage is less effective. Near the submerging coast, numerous lagoons, mangrove swamps, deep estuaries, and river-mouth bars are well-developed.

The barrier reef, the second longest in the world and the longest in the Northern hemisphere, extends 200 km (132 miles) from the Mexican border to the Sapodilla Cayes; along Ambergris Caye it is only a few

hundred meters offshore, whereas it is over 40 km (25 miles) offshore at Placencia. Seaward of the barrier reef, the continental margin is a series of discontinuous marine ridges with NNE-SSW orientation; two of these ridges have coral atolls upon them, known as Glover's and Lighthouse Reefs, separated by waters 360-1100 m deep. Seaward of the marine ridge supporting these atolls is an escarpment descending more than 4,000 m into the Cayman Trough.

The northern half and south eastern fringe of the country comprise a plain of low relief. The Maya Mountains, 300-1100 m in altitude, occupy the south centre and dominate much of the remainder of the country. They rise steeply to a maximum of 1,120 m at Victoria Peak in the Cockscomb Range, and they slope down to the Vaca Plateau in the west. The third major physiographic feature of the country comprises karst landscapes, sometimes hilly and sometimes rolling, on the north and west of the Maya mountains. Prominent discontinuous foothill ranges exist in the southern interior and comprise much of the hinterland of the Southern Toledo District.

Most of the northern half and much of the southern third of the country, plus the entire coastal area and all the islands, are flat and low-lying. Parts of the coastline have an elevation of less than 1m to a distance of several miles inland. In the north, the land rises to a maximum of approximately 250 meters above sea level (ASL). The central part of the country is dominated by the Maya Mountain/Mountain Pine Ridge massif, rising to 1124m ASL (3688 ft) at its highest point.

Belize consists of six districts, which are comprised of cities, towns and villages. The northern districts of Corozal and Orange Walk (Figure 2.1) consist of predominantly Mestizo and Spanish-speaking ethnic groups. The Belize district is comprised primarily of English-speaking Creole. The Cayo district, located in the geographic centre of the country is more mixed, with Creole, Mestizo, Mayan, and Mennonite communities. Further south, the Garifuna dominates the Stann Creek district, while more than 60% of the Toledo district is Mayan. Three Mayan languages are spoken throughout Belize, Ket'chi, Mopan and Yucatec.

The 2007 Mid-Year population estimates for Belize is 311, 480<sup>6</sup>. Based on the 2007 year Mid-Year population estimates, 51% lives in urban centers while 49% lives in rural areas. The male/female population is almost divided equally. Belize's inter-censal growth rate has been established at 2.7% per annum (Table 2.1).

The Belize district continues to represent the largest proportional share of the total population (Table 2.1), i.e., 29.9%. While the Cayo district, the second largest populated district represents 23.5% of the total population;

Orange Walk represents 15.1%, while Corozal represents 11.7% in 2007<sup>6</sup>. The Southern Districts of Stann Creek and Toledo have 10.3% and 9.4%, respectively.

Belize has a larger rural population than urban. In 1991, the urban/rural ratio was 48:52. In 2007, this ratio has changed slightly, with 49.0% of the population living in the rural areas and 51.0% living in the towns and cities.

Belize has two cities (Belmopan and Belize) and seven towns (Corozal, San Pedro, Orange Walk, San Ignacio/Santa Elena, Benque Viejo, Dangriga and Punta Gorda) that are considered the urban centers (Table 2.1). The rest of the country is classified as rural.

Tables 2.2 and 2.3 provide data on demographic indicators for the year 2007 in Belize. Crude birth rate reported is 27.7 per 1,000 persons. Infant mortality rate per 1,000 live births is 15, while stillbirth rate is 10.1 and fertility rate is 3.6<sup>42</sup> (Table 2.3). Crude birth rate, stillbirth rate and infant mortality rates all indicate a gradual improvement since 2000.

<b>Table 2.1: Belize: 2007 Mid-Year Population Estimates.</b>						
Districts and Subdivisions	Total	%	Male	%	Female	%
Country Total	311,480.0	100.0	154,665.0	100.0	156,815.0	100.0
Urban	158,930.0	51.0	76,635.0	49.5	82,295.0	52.5
Rural	152,550.0	49.0	78,030.0	50.5	74,520.0	47.5
Corozal	36,365.0	11.7	18,150.0	11.7	18,215.0	11.6
Corozal Town	9,110.0	2.9	4,315.0	2.8	4,795.0	3.1
Corozal Rural	27,255.0	8.8	13,835.0	8.9	13,420.0	8.6
Orange Walk	47,145.0	15.1	23,985.0	15.5	23,160.0	14.8
Orange Walk Town	15,990.0	5.1	7,965.0	5.1	8,025.0	5.1
Orange Walk Rural	31,155.0	10.0	16,020.0	10.4	15,135.0	9.7
Belize	93,215.0	29.9	45,335.0	29.3	47,880.0	30.5
Belize City	63,670.0	20.4	30,315.0	19.6	33,355.0	21.3
San Pedro Town	10,445.0	3.4	5,350.0	3.5	5,095.0	3.2
Belize Rural	19,100.0	6.1	9,670.0	6.3	9,430.0	6.0
Cayo	73,325.0	23.5	36,340.0	23.5	36,985.0	23.6
San Ignacio/Santa Elena	18,265.0	5.9	8,760.0	5.7	9,505.0	6.1
Benque Viejo	8,160.0	2.6	3,960.0	2.6	4,200.0	2.7
Belmopan	16,435.0	5.3	8,005.0	5.2	8,430.0	5.4
Cayo Rural	30,465.0	9.8	15,615.0	10.1	14,850.0	9.5
Stann Creek	32,180.0	10.3	16,360.0	10.6	15,820.0	10.1
Dangriga	11,600.0	3.7	5,490.0	3.5	6,110.0	3.9
Stann Creek Rural	20,580.0	6.6	10,870.0	7.0	9,710.0	6.2
Toledo	29,250.0	9.4	14,495.0	9.4	14,755.0	9.4
Punta Gorda	5,255.0	1.7	2,475.0	1.6	2,780.0	1.8
Toledo Rural	23,995.0	7.7	12,020.0	7.8	11,975.0	7.6
<i>Source: Statistical Institute of Belize<sup>6</sup>.</i>						



**Table 2.2:** Basic Statistics for Belize.

<b>Basic Statistics</b>	<b>2007 Data</b>	<b>Source</b>
Population, total	311,480	CSO 2007 Mid Year Estimates
Female Population	50%	CSO 2007 Mid Year Estimates
Population 19 or Younger	36.9%	CSO 2006 Mid Year Estimates
Population under 5	12.2%	CSO 2006 Mid Year Estimates
Rural population	49.0%	CSO 2007 Mid Year Estimates
Life Expectancy at birth	75.6	UNDP HDR 2007 <sup>4</sup>
GDP per capita	US\$3,786	UNDP HDR 2007 <sup>4</sup>
GDP growth rate	2.3%	UNDP HDR 2007 <sup>4</sup>
Rate of inflation	2.6%	Budget Speech, 2003
Unemployment rate	11.0	UNDP HDR 2007 <sup>4</sup>
Human Poverty Index	Rank (43); value (17.5%)	UNDP HDR 2007 <sup>4</sup>
Prevalence of HIV Country	2.5%	UND HDR 2007 <sup>4</sup>

**Table 2.3:** Demographic Indicators for Belize 2007.

<b>TOTAL POPULATION</b>	<b>311,480</b>	
Crude birth rate (1,000 pop)	27.7	
Crude death rate (1,000 pop)	4.6	
Percentage of low birth weight % (babies)	4.4	
Stillbirth rate	10.1	
Infant Mortality rate (1,000 live births)	15	
Population growth rate (%)	2.7	
Total fertility rate	3.6	
Percentage population > 65 years	1.46	
Urban population (%)	49.9	
Life expectancy at birth (2005)	72.2	
Malaria cases	Total	1,065
	Incidence (per 1,000 Pop)	3.8

*Source: Epidemiology Unit, Ministry of Health, 2005<sup>42</sup>.*

According to the Human Development Report<sup>4</sup>, Belize ranks higher than its neighbor Guatemala but lower than its other neighbor Mexico in terms of its HDI rank. Belize ranks 80 on the HDI rank, while Guatemala ranks 118 and Mexico ranks at 52. Other ranked indicators include: Life Expectancy of 75.9 for Belize, 69.7 for Guatemala and 75.6 for Mexico. Belize also has a literacy rate of 75.1, Guatemala 69.1 and Mexico 91.6. The GDP index for Belize is 0.712, while for Guatemala it is 0.638 and Mexico 0.781.

## 2.1.2 The Economy and Political Profile

Belize has a small open economy. Its principal sectors are currently (i) agriculture, (ii) agro-processing and (iii) services, which primarily includes tourism. The contribution to GDP (at current prices in percent) of the hotel and restaurant sector was 3.7% in 2002, 4.3% in 2003, 4.7% in 2004 and 4.7% in 2005<sup>2</sup>. During the same period, the agriculture and forestry sector contributed 18.8% in 2002, 18.8% in 2003, 17.9% in 2004 and 8.9% in 2005 to the GDP<sup>11</sup>. Agriculture, agro-product manufacturing and tourism are the major foreign exchange earners. Currently, sugar, citrus and bananas account for at least 60% of the earnings accruing from merchandise exports. Also, marine products (including seafood such as shrimp) and small manufacturing make notable contributions to exports. Significant proportions of these products are sold under preferential arrangements that ensure access to markets and generate higher than world market prices.

Belize's major export market is the United States of America (USA), which accounted for approximately US\$ 84.361 Million (52.7%) of total export value in 2001<sup>2</sup>. The European Market accounted for approximately US\$50.061 Million (31.2%) of total export value in 2001.

The economy of Belize is moving gradually from one that is primarily agricultural based to one that is more service-oriented. The Service sector contributed 59.5% to the GDP in 2001, whilst the primary sector contributed just 16.8%<sup>11</sup>.

The primary sector consists of agriculture, forestry and logging, fishing and mining, while the secondary consists of the manufacturing sector, electricity, water, and construction, and the service sectors involves trade, restaurants, hotels, transportation, communication, finance, insurance, real estate, business services, public administration and other services<sup>2</sup>. Agriculture, accounted for 12.7% of GDP and close to half of merchandise exports in 2005<sup>3</sup>.

The economy is being diversified towards tourism, other service industries and recently, oil exploration. Economic growth averaged 7.4% during 1999 – 2004, fuelled by expansionary fiscal policies that included increased capital and social expenditures. However, fiscal deficits widened, averaging about 9% of GDP and the public debt stock doubled to 100% of GDP<sup>3</sup>. Facing mounting fiscal and balance of payments pressures, the government implemented fiscal and monetary measures in 2005 and the overall fiscal deficit fell by more than half to 3.4 % of GDP and further to 3.1% of GDP in 2006 while real growth slowed from 4.6% of GDP in 2004 to 3.1% in 2005<sup>3</sup>. Economic growth improved to 5.8% in 2006 driven largely by activity in the budding oil sector<sup>3</sup>.

While significant progress has been achieved in several of the social indicators, the alleviation of poverty continues to be major challenge for the country of Belize. Based on the 2002 Living Standard Measurement Survey, poverty levels were unchanged at 33.5 percent compared to the 1996 survey data<sup>36</sup>. Belize is poised to meet the Millennium Development Goals relating to education, access to clean water, child and maternal mortality, but other goals are presenting difficulty including reducing poverty levels. In addition, Belize's Human Development Index rating declined from 58 in 1998 to 95 in 2006. However, the HDI increased to 80 in 2007 (based on 2005 data)<sup>4</sup>.

Belize is a sovereign state having gained independence from the United Kingdom on 21 September, 1981. It is governed by a representative democracy with bicameral legislature based on the Westminster model. The Prime Minister and Cabinet form the executive branch, while the National Assembly forms a bicameral legislature comprising of a 29-member elected House of Representatives and a thirteen-member appointed Senate.

Belize is a constitutional monarchy and parliamentary democracy on the Westminster model and is a member of the Commonwealth of Nations. Queen Elizabeth II is head of state and is represented in the country by Governor General Dr. Colville N. Young, Sr., a Belizean. The primary executive organ of government is the Cabinet led by a Prime Minister (head of government). Cabinet Ministers are members of the majority political party in Parliament and usually hold elected seats in the National Assembly concurrently with their Cabinet positions.

Legislative power is vested in both the government and the Parliament of Belize. The party system is dominated by the People's United Party and the United Democratic Party. The present government is formed as of February 7<sup>th</sup> 2008 by the United Democratic Party (UDP). Constitutional safeguards include freedom of speech, press, worship, movement, and association. The Judiciary is independent of the executive and the legislature. Jurisprudence is based on English common law.



## **The Agriculture Sector**

Agriculture still continues to form the foundation of the productive sector and the rural economy of Belize. At least, 35% of GDP (\$338 million at constant prices) and 41% of total employment is directly dependent on agriculture, fisheries & forestry<sup>4</sup>. This is so because 90% of all manufacturing (which constitutes 17% of GDP and 12% of employment) is based on input (sugar, citrus concentrate, animal feed, agriculture chemical, furniture, jams, jellies, chips, juices, milk, ice cream, sausages, packaging etc) from/for the primary sectors of agriculture, fisheries and forestry. Primary agriculture and fisheries are responsible for 29% of employment and more than 21% of GDP (constant prices)<sup>4</sup>.

Belize's export trade is dominated by agricultural exports, particularly the traditional products sugar, bananas, citrus and in recent years, marine products. In 2002 total domestic exports amounted to \$322.3 million, of which agricultural exports contributed 86%<sup>4</sup>. The traditional crops (sugar, citrus and bananas) and fish products accounted for 80% of domestic exports and 92% of total agricultural exports (excludes forestry products) while non-traditional agricultural exports (papayas, peanuts, black eye peas, cocoa beans, honey, chicle, and pepper products) accounted for only 8% of agricultural exports<sup>4</sup>.

Since agriculture production is an important contributing sector to the economy of Belize, small – scale and large – scale production continues to grow in importance as large farms expand to satisfy external markets, while small farmers depend on cash crops as a means of earning a living. Belize has about 11,000 farmers using a total land area of 265,000 acres, or 5% of the total land mass, 146,000 acres being for crops and 119,000 acres for pasture<sup>4</sup>.

## **Belize's Energy Sector**

The National Energy Plan Project (Bravo & Launchpad Consulting, 2003), Belize acquires its energy from four main sources, specifically, imported Fossil Fuels (66%), Biomass (26%), Hydro (3%) and imported Electricity (5%). Belize currently imports most of its fossil fuels used. However, recent discovery of petroleum deposits in commercial quantities will change the composition of Belize's fossil fuel production and possibly its usage. The new administration which took over after the February 7<sup>th</sup> national elections has promised a small refinery. The main petroleum based sub-products are gasoline, kerosene and diesel, supplied by three main retailers. In the LPG (butane/propane) market, there are four main importers.

According to the National Energy Plan Project, Belize acquires its energy from four main sources, specifically, imported Fossil Fuels (66%), Biomass (26%), Hydro (3%) and imported Electricity (5%)<sup>9</sup>.

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Although a part of the energy mix, fuel wood and other traditional biomass products are not part of the formal energy equation<sup>9</sup>. While there is evidence of an emerging market, there is presently no formalized industry structure facilitating the supply and sale of biomass materials.

### **Electricity Sub Sector**

Belize's electricity market is liberalized and regulated. Although there are meaningful attempts to encourage competition in generation, the distribution/transmission market is currently dominated by a single privately owned bundled supplier (BEL), who is required by law to provide transmission facilities to any generator capable of paying its fees.

In the electricity sub-sector, roughly 50% of electricity produced is imported from Mexico. Hydro, diesel (both grid and private) and bagasse (this is expected to come on board by 2009) account for the balance (with bagasse accounting for approximately 5% of total electricity production). Belize Electricity Limited is the main commercial provider. Aggregate peak demand for electricity in 2002 was 54MW and this is expected to more than double by the year 2010.

Energy use per capita (kg oil equivalent) is *713 kWh in 2002*. Energy from renewables excluding combustible renewables and waste are as follows: (% of total supply): 3 % - *hydro*; 26 % *biomass (5% electricity from biomass)* (*Energy Sector Diagnosis, 2003*).

Belize Electricity Limited (BEL) is Belize's main commercial transmitter, seller, supplier and distributor of electric current. It is a Limited Corporation owned by Fortis Incorporated of Canada (67%), Social Security Board (25%) and various small shareholders (8%)<sup>44</sup>. Current licensing agreement extends to 2015 and under the terms of the license, the Company has the right of first refusal on any subsequent license grant.



BEL's national grid currently serves the Northern districts, including the off shore community of San Pedro, the Central and Western districts and a small portion of the South. There are small local grids in the most southern communities and the other populated off shore community of Caye Caulker. Under the Power IV project, which was to be completed in 2005, the grid is being extended to interconnect the existing local grids in the south with the national grid. The grid transmission and sub-transmission systems consist of 115kV, 34.5kV and 22kV lines, while the distribution system voltages range from 6.6 kV to 34.5 kV<sup>9</sup>.

Beside BEL's local and national grids, there is a small local grid in the Mennonite community of Spanish Lookout in the Central Cayo District, owned and operated by Farmers Light Plant Cooperative. Transmission of electricity is provided to 480 customers through a 70 mile 2.4 kV line transmission system<sup>9</sup>. Recorded losses are extremely high at 21%. There is also a small operator, Earth Tech providing service in the Corozal Commercial Free Zone<sup>9</sup>.

## **Health Sector**

### **Basic Services**

The Government of Belize is the main provider of health services. The basic structure for health care delivery is provided by seven government hospitals: one in each of the six districts plus another in Belmopan. There are three private hospitals, two in Belize City and one in Santa Elena, Cayo. Presently the construction of a new hospital just outside of San Ignacio is in process.

Public health spending increased by 0.2% of the GDP from 1996-98, but decreased by 0.4% in 1999<sup>1</sup>. This spending includes a little less than 9% of the recurrent budget allocated to the health sector, but of which 73% is for salaries.

For the period 2001 to 2005, again public health spending increased slightly. Revised estimates of expenditures as percent of GDP for the fiscal year 2001 was 2.4%, for 2002 2.5%, for 2003 2.4%, for 2004 2.5% and for 2005, 3%. These figures are shown in Table 2.4. Table 2.4 also illustrates public health spending as a percent of the total GOB budget, which ranged from 8.42% in 2001 to a high of 9.57% in 2004. The trend during this period is for continued government investment in the health sector.

The average number of doctors per 10,000 persons in Belize for the period 1996 to 1998 is 6.3 (CSO, 1999). The average number of hospital beds per 10,000 persons for the same period is an estimated 24.3. During

the period 1990 to 2004, the number of physicians per 100,000 people was reported as 105<sup>10</sup>.

**Table 2.4:** Ministry of Health Budget as % GDP and % of GOB Budget<sup>1</sup>.

Year	% GDP	% of GOB Budget
2001	2.40%	8.42%
2002	2.50%	8.58%
2003	2.40%	8.43%
2004	2.50%	9.57%
2005	3%	9.12%
<i>Source: CSO, 2006.</i>		

### Nutrition

A 1992 assessment of data gathered for children aged five and under attending clinics revealed that 25% showed some degree of malnutrition, 1.3% showed severe malnutrition, while 15% showed signs of obesity<sup>1</sup>. The age groups most affected were in the 1-2 year old bracket and the group that is 6-12 months old. The National averages were heavily influenced by the Toledo District, which indicated that more than 40% of children showed some level of malnutrition, with 15.5% either moderately or severely malnourished<sup>1</sup>. According to the UNDP NHD Report, 1999, the indigent households (per district) with low daily calorie intake by percent are as follows: Toledo 40.2, Cayo 15.9, Corozal 5.9, Belize 4.9, Orange Walk 2.9 and Stann Creek 2.2. These results were given a rating of worse in this report. The report also showed that 6% of children fewer than 5 years were underweight<sup>1</sup>.

### Health and Sanitation

Belize endured several Cholera outbreaks in 1994, with 296 confirmed cases between 1992 and 1993 resulting in a high per capita incidence. Since then, cholera remains endemic and infected rivers continue to be a threat for new outbreaks, although no significant outbreaks were reported since 1998. According to the MOH, there were no new cases of cholera reported for the period 2001 – 2005<sup>12</sup>.

Other important water- borne diseases commonly found throughout Belize are Diarrhea and Hepatitis. There were no viral hepatitis reported in 2001, one in 2002, 4 cases each in 2003, and 2004 and 8 cases in 2005<sup>12</sup>. However, “other viral hepatitis” reported for the same period were 44 cases in 2001, 40 cases in 2002, 24 cases in 2003, 15 cases in 2004 and 38 cases in 2005<sup>12</sup>.

Mosquito vector borne diseases are one of the most important environmental health issues. Malaria and Dengue are the most frequently occurring endemic diseases. A total of 1,853 cases of malaria were



reported throughout Belize in 1999 and 1,498 in 2000, a decrease of 25%<sup>31</sup>. The three districts with the highest incidence for the year 2000 were Cayo, 753, Toledo, 691, and Stann Creek, 287, which are the Southern Districts and also receive the most rainfall per annum<sup>12</sup>.

During the period 2001-2005, dengue cases were reported as follows: 4 in 2001, 41 in 2002, 8 in 2003, 41 in 2004 and 652 in 2005<sup>12</sup>. The drastic increase in 2005 was due to an outbreak of dengue in the Cayo District, which reported a total of 614 of the total cases for that year<sup>12</sup>. Table 2.5 indicates the reported cases of malaria during 2001 to 2005. The number of cases has remained fairly constant, but in 2005 there was a slight increase above the average of 1,203 for the period in question (Table 2.5). The three districts where malaria is more prevalent are Cayo, Stann Creek and Toledo, which report the majority of the cases annually. For example in 2004, these districts reported 356 (Cayo), 307 (Stann Creek), and 303 (Toledo). The same districts reported 479 cases in the Cayo District, 653 in Stann Creek, and 358 in Toledo<sup>12</sup>.

**Table 2.5:** Reported Malaria Cases for Period 2001-2005<sup>12</sup>.  
Source: Epidemiology Unit, MOH, 2006.

Year	Reported Cases
2,001	1,163
2002	1,113
2003	1,124
2004	1,066
2005	1,549

With respect to the POPs project, the previous use of DDT for controlling the malaria vector (see following section) is of importance.

### **Maternal and Child Health**

Belize's life expectancy keeps improving annually. The infant mortality rate improved further over the past few years. Infant mortality rate has declined from 26 per 1000 live births in 1996 to 24 in 1997 and to 21.2 in 2000<sup>2</sup>. The infant mortality rate has further decreased during the period 2001-2005. The rates for this period are: 16.6 in 2001, 19.2 in 2002, 14.8 in 2003, 14.7 in 2005 and 18.4 in 2005<sup>12</sup>.

### **Respiratory Diseases**

In the year 2000, the category of *diseases of the respiratory system* was ranked fifth (5<sup>th</sup>) in the order of importance with respect to the ten principal causes of death in Belize<sup>10</sup>. In Belize respiratory illnesses are often attributed to the inhalation of smoke from anthropogenic sources.

### **Cancer**

In the year 2001, there were 160 deaths as a result of malignant neoplasms<sup>12</sup>. There were 137 such deaths in 2002, 129 in 2003, 162 in 2004, and 168 in 2005.

Limited data on DDT levels in environmental samples are available in Belize. Sampling done by Fernandez<sup>31</sup> in 2001 showed that sediments in 3 locations and human breast milk in 5 women indicated some levels of DDT. However, these results do not allow for full assessment of the human health and environmental impacts. Based on allowed daily intake it has been estimated that mothers and infants (two high risk groups) have a low exposure to DDT levels in their diet. These ADI are below the provisional tolerable daily intake value set by the WHO.

Ambient air measurements of organochlorine pesticides conducted in 1995 & 1996 at two locations in Belize<sup>34</sup> found several POPs pesticides (DDT, aldrin, dieldrin and toxaphene). Overall geometric mean DDT concentrations of 970 pg/m<sup>3</sup> at Belmopan, and 216 pg/m<sup>3</sup> at Belize City, were higher than levels found in the Great Lakes region of the United States<sup>35</sup>. Aldrin (1,625 pg/m<sup>3</sup> at Belmopan and 92pg/m<sup>3</sup> at Belize City) and dieldrin (1,233 pg m<sup>3</sup> at Belmopan and 119 pg/m<sup>3</sup> at Belize City) concentrations in Belize were also higher than levels found in the Great lakes region. Although these chemicals were formally banned at the time of sampling, the high levels and the ratio of DDT and its metabolite DDE suggested recent usage.

## **2.2 INSTITUTIONAL, POLITICAL AND LEGISLATIVE FRAMEWORK**

### **2.2.1 Environmental and Sustainable Development**

The Government of Belize is committed to the conservation of biological diversity, sustainable use of biological resources and the fair and equitable sharing of benefits derived from the use of genetic resources (Boles, NCSA, 2005). The Belize Biodiversity Strategy and Action Plan 1998-2003 (Jacobs and Castañeda 1998, eds.) were prepared in 1998. Belize recently prepared its Third National Report to the Convention on Biological Diversity (UNCCD); which it signed in 1992.

On February 7<sup>th</sup> 2008, Belize held its National Elections and elected a new administration under the United Democratic Party (UDP). The UDP manifesto<sup>45</sup> included 17 major programmes of action; of which Tourism, Agriculture and Fisheries, and Natural Resources Management and the Environment were included. Among others; some actions proposed in the manifesto include the reviving and updating of a national land use plan, updating and implementing coastal zone development guidelines, and Implementation of a comprehensive solid waste management program.

Belize is considered as having a healthy biological resource base, with many healthy and functional ecosystems. Belize's healthy ecosystems are attributed in part to the low demographic pressures. It has recently been established that Belize has 26.6% of its total national territory (including marine territory) under some form of protection. Forests cover about 67.4% of our terrestrial ecosystems. The Central American Ecosystems Mapping Project (Meerman and Sabido, 2004<sup>46</sup>), identified 87 distinct types of terrestrial and marine ecosystems in Belize.

Thirty perennial river basins range in size from small coastal creeks to large trans-national watersheds such as Rio Hondo and Belize River, most of these originating in the Maya Mountains. Belize's marine ecosystems, including mangroves, sea grass beds and coral reefs, are some of the most productive in the Caribbean. Almost 80% of the Mesoamerican Barrier Reef System (MBRS), a World Heritage Site, occurs within Belizean waters.

There is a documented 3,600 species of plants (including 613 medicinal plants) in Belize. Species confirmed in the country include 46 amphibians, 141 reptiles, 577 birds and 163 mammals. An estimate of 634 genera, representing 1,302 species of algae, invertebrates and fishes are documented from the marine ecosystems of Belize. Presently, 58 plants, two species of fishes, two species of amphibians and one species of reptile have been determined to be endemic to Belize and 137 species of plants and animals occur on the IUCN Red List of Threatened Species,

ranging from “extinct” to “least concern.” Forty-three mammal species occurring in Belize are endangered, rare and/or hunted range-wide. Thirteen mammal species are listed in the CITES as being of international concern, under the US Endangered Species Act or occur in IUCN Red Data Books (Programme for Belize, 1995).

Presently forty-one pieces of legislation address biodiversity and ecosystem issues and empower fourteen different GOB ministries, departments and institutions to deal with these issues as necessary. At least thirty-eight local NGOs and CBOs and sixteen international organizations are partners in working toward common goals and responsibilities, a growing number being involved in co-management of protected areas. Belize has signed at least twenty-five regional and international conventions and agreements relevant to biodiversity and ecosystem issues, including the United Nations Convention on Biological Diversity (UNCBD).

Belize completed and adopted its National Protected Areas Systems Plan and formally adopted it in January 2006<sup>10</sup>. The Forest Department currently manages 600,386 hectares (1,482,954 acres) of protected areas, representing seventeen forest reserves, sixteen national parks, seven wildlife sanctuaries, four nature reserves and four natural monuments. Co-management agreements with either NGOs or CBOs exist for twenty-two of these protected areas. The Belize Fisheries Department (BFD) manages eight marine reserves, four of which have co-management agreements with local NGOs or CBOs. The Institute of Archaeology is in charge of eleven archaeological reserves throughout the country.

## **2.2.2 Roles and Responsibilities of Stakeholders in POPs Life Cycle**

The five principal organizations with legal arrangements for the handling or management of POPs in Belize are: (i) Department of the Environment (DOE), (ii) Pesticides Control Board (PCB), (iii) Public Health Bureau (PHB), Ministry of Health, (iv) the Belize Agriculture Health Authority (BAHA) and, (v) the Belize Electricity Limited (BEL). These organizations include GOB agencies, with the exception of BEL. BEL is a private institution without legal jurisdiction over POPs management as the primary distributor of electricity. The DOE is the agency within the MNREI, who is the focal point for the POPs convention. The Ministry of Health also has a vector control programme, with responsibility for the management of anti malaria service. The PCB regulates the importation of pesticides into Belize, and also ensures that POPs are not imported since these are prohibited substances.

BAHA's activities are oriented towards agricultural health monitoring at the national regional level.

The Belize Electricity Limited (BEL) is the primary distributor of electricity in Belize. The Company, which is 70% owned by Fortis Inc. of Canada, serves a customer base of approximately 71,000 accounts and is regulated by the Public Utilities Commission (PUC). BEL's contribution to POPs management stems through its program of screening of transformers that it handles under its program of electrification, or that it services for private sector industries.

BEL has an on-going programme for the elimination of POPs carrying products including transformers. However, a small industry whereby copper is removed from scrap cables by burning has emerged. This is governed under the scrap metal regulations requiring exporters to obtain a license for export of scrap metals including copper from cables.

These organizations all have representation at the POPs Project Steering Committee (PSC) and the POPs Technical Committee. Through this inter-agency cooperation at the management and technical level, Belize is poised to implement the POPs project and its subsequent programs including Belize's NIP, which will likely include legal and regulatory requirements for POPs management.

### **The Department of the Environment**

The Department of the Environment was legally established by the enactment of the Environmental Protection Act, 1995 (EPA). It is a Department within the Ministry of Natural Resources, Environment and

Local Government (MNREI). The DOE, as it is known by its acronym, has a wide function in matters pertaining to environmental protection and the control of pollution. It is responsible for monitoring all activities that impact on the environment and health. The Environmental Protection Act mandates that the DOE require from industry the preparation of Environmental Impact Assessments and risk analyses, and to make suitable recommendations to mitigate the harmful effects of any proposed action on the environment. Its duties include: monitoring environmental health; advising the Government on the formulation of policies relating to the good management of natural resources and the environment; conducting studies and making recommendations on standards relating to the improvement of the environment and maintenance of a sound ecological system; through Inter-ministered Cooperation, and to foster the prudent use and proper management of the natural resources of Belize.

Several Statutory Instruments have been passed under the EPA. One such instrument is the Effluent Limitations Regulations, 1995, which, among other things, requires that Industry maintain a registry of pollutants and that industry meet certain standards for effluent discharges. The DOE is the representative of the Ministry of Natural Resources and Environment at the Pesticides Control Board. The DOE is also represented at the Registration Committee of the PCB. The DOE is headed by a Chief Environmental Officer, and has ten trained staff, in addition to project management staff, and two support staff.

While the DOE laws and regulations do not specifically mention the management of POPs, they do participate in regulatory actions against the importation of prohibited substances (prohibited under the PCB Act), by supporting the PCB at the Board level and Technical levels.

### **Solid Waste Management Authority**

The Solid Waste Management Authority Act, Chapter 224, Revised Edition 2000, establishes the Solid Waste Management Authority (SWMA) with powers of a board to provide for the collection and disposal of waste. The Minister responsible for the environment appoints the Board of Directors. This board has presently been appointed and an interim office established. To date however, the SWMA has not been fully established.

The overall goal of the SWMA Act is to establish a mechanism or system that would collect, treat and dispose of solid wastes generated by urban and rural groups in an environmentally and socially satisfactory manner including managing sites as proper sanitary landfill sites.

SWMA has the authority to: declare service areas; arrange for collection and disposal services; explore available recycling alternatives; devise

modern methods and techniques for the efficient disposal of solid waste; and explore recycling possibilities of waste material.

### **The Pesticides Control Board**

The Pesticides Control Board was legally established by the Enactment of the Pesticides Control Act (PCA) <sup>14</sup>; and is as an agency within the Ministry of Agriculture and Fisheries. The PCB is headed by the Secretary to the Board, and has five technical staff and two supporting staff in addition to the members of the Board. The Board is comprised of an inter-sectoral body with representation from various agencies, which are represented in several committees. The Board meets regularly to decide matters such as registration and policy Direction. It has a secretariat whose function is to carry out the decisions and administrative activities of the Board. The functions of the Board are as follows:

- (i) Registration of pesticides,
- (ii) Licensing of pesticides imports and manufacture,
- (iii) Authorization for sale of restricted pesticides,
- (iv) Registration of premises for sale of restricted pesticides,
- (v) Authorization for use of restricted pesticides,
- (vi) Classification of pesticides, and;
- (vii) All other aspects of pesticide manufacture, importation, packaging, preparation for sale, disposal and use.

The goals of the PCB are:

- To safeguard the health of the Belizean people by promoting the availability of wholesome foods free of pesticide residues;
- To safeguard the environment by providing protection from the adverse effects of pesticides;
- To assist in economic development by enhancing the quality of agricultural production.

## **The Ministry of Health**

The Public Health Department under the Public Health Act (Chapter 40, Revised Edition 2000), regulates matters concerning the general public health.

The Public Health Act (Chap, 40) provides the Director of Health Services with the authority to make regulations regulating the performance of duties by Health Officers<sup>23</sup>. The Minister of Health is empowered under the act to appoint a Central Board of Health whose function is to act in an advisory capacity. Health Officers are responsible for the inspection of facilities such as dwelling buildings, workplaces, recreation sites, etc., that the public uses during the course of their day-to-day activities. The Public Health Bureau is the implementing agency of the regulations under this Act. The Act defines the duties of the Public Health Inspectors. The duties related to pesticide utilization and handling includes monitoring the use of chemicals, herbicides, insecticides, pesticides and industrial wastes; Assisting in the Vector Control Programme; Monitoring of water quality; and monitoring of sewage, and liquid waste management.

The Public Health Bureau is an agency of the Ministry of Health. The MOH is a member of the PCB. The Ministry of Health also has an Environmental Health Program. The purpose of this program is to contribute to the development and maintenance of a clean, safe and healthy environment, so as to reduce the prevalence of diseases that are associated with poor environmental conditions.

## **Belize Agriculture Health Authority**

The Belize Agricultural Health Authority (BAHA) is a statutory body designed to modernize the Agricultural Health Services in Belize. It was established under the Laws of Belize "Belize Agricultural Health Authority Act, Chapter 211 of the Substantive Laws of Belize Revised Edition 2000."<sup>25</sup> BAHA is governed by a Board of Directors, which is the policy making organ of the Authority, with representatives from both Government and the Private Sector.

BAHA' mission statement is "To provide optimum, competent and professional services in Food Safety, Quarantine, Plant and Animal Health in order to safeguard the health of the Nation and facilitate Trade and Commerce."<sup>24</sup>

BAHA's activities are oriented towards agricultural health monitoring at the national, transboundary and regional level, capacity building activities (e.g. international training and short-term external training), technical



partnerships (e.g. PAHO, IICA) and slightly less so towards replicable cases studies (e.g. BAHA itself (structure and operations), (Mealy Bug Project) and international initiatives (e.g. CBD-Biosafety and FAO projects). BAHA also participates as a primary supporting agency to the PCB and the DOE in its POPs management via its participation at the PSC, and also offers laboratory services to agencies and individuals in the research of POPs.

Agricultural Health Programmes are administered by BAHA (e.g. Medfly Surveillance Programme). Exotic pest and disease introduction continues to be the foremost deterrent to free trade and this organization remains vigilant for the early detection of injurious pests and diseases. It is also integrated with the regulation of importation of plants and plant products with that of Pest and Disease Surveillance and the Quarantine Department of BAHA. The Mediterranean fruit fly and Pink Hibiscus Mealy Bug Programmes are two areas where early detection results in minimal economic loss to the agricultural sector<sup>24</sup>.

The Plant Health Department ensures the agricultural health protection for plants from invasive pests and diseases<sup>24</sup>. BAHA's role has become increasingly important in areas such as certification of wholesomeness of raw plant products for export; negotiation of phyto-sanitary measures, both bilaterally and multilaterally; crop loss assessment due to pests, diseases and natural disasters and in the regulation of all important plant and plant products through Pest Risk Analyses.

### **The Belize Electricity Limited**

BEL meets the country's peak demand of about 67 megawatts (MW) from multiple sources of energy. These sources include electricity purchases from Belize Electric Company Ltd. (BECOL), which operates the Mollejon Hydroelectric Facility in the Cayo District; the Chalillo Hydroelectric Facility in the Cayo District, from Comisión Federal de Electricidad (CFE), the Mexican state owned electricity company; and from BEL's gas turbine unit and diesel fired generators<sup>9</sup>. All major load centers are connected to the country's national electricity system, which in turn is connected to the Mexican electricity grid, allowing BEL to optimize its power supply options.

Prior to 1992, the government of Belize was the sole owner of the Belize Electricity Board. Then under the Electricity Act, no. 13 of 1992, BEB ceased to function as it was privatized and became Belize Electricity Limited (BEL). In that year, the Minister of Energy and Communications issued a license under section 15 of the Electricity Act<sup>26</sup>, 1992, granting BEL the exclusive authority to generate, transmit and supply electricity.

The license was effective starting January 7, 1993, and is valid for 15 years.

Under the license, BEL has exclusive power to:

- Generate electricity for the purposes of giving a supply to or enabling a premises in Belize;
- Transmit electricity for the purposes of giving a supply to or enabling a supply to be given to any premises in Belize; and
- Distribute and supply electricity to any premises in Belize as a public electricity supplier.

Belize Electricity Limited is the primary distributor of electricity in Belize, selling almost 360 GWh of electricity yearly, and 25 MW from Comisión Federal de Electricidad. BEL also owns and operates a 22 MW Gas Turbine Unit at its West Lake Generating Plant and Substation, and operates 4 diesel plants and maintains 26 substations.

### **Belize Customs and Excise Department**

The Belize Customs and Excise Department is responsible for revenue collection at ports of entry, and it is also one of the nation's major border enforcement agencies. It is also responsible for enforcing some thirty (30) Agency duties for other departments, which laws deal with a wide range of issues from moral to financial, and even protecting the environment. The Customs Department is at the frontline of the monitoring of chemical importation since all records of chemical imports and exports must be reported and recorded by them through their data system administrator and the support staff.

### **Belize Port Authority**

The Belize Port Authority, under the Belize Port Authority Act (*Chapter 233, Revised Edition 2000*), allows for the regulation and management of waste in Belize's ports. In particular the authority regulates air and water pollution via monitoring discharge from ships such as sanitary sewage, gaseous liquids and solids, carcasses, gasoline, oils, ballasts, butchers offal, garbage, residuum of gas, tar or refuse, trade waste or any other material that is capable of producing floating matter on the surfaces of water, sediment or obstruction on the bottom of the sea or odors of gas of putrefaction.

The Belize Port Authority collaborates with the International Merchant Marine Authority of Belize to enforce the Harbors and Merchant Shipping Act which regulates the discharge of solid materials from a vessel.

### **2.2.3 International Commitments and Obligations**

Belize signed the Convention on Persistent Organic Pollutants (POPs) in the year 2002. The purpose of the Stockholm Convention is to restrict and eventually prohibit the production, use, emissions and import and export of highly toxic substances known as persistent organic pollutants (POPs). As part of its obligations under the convention, contracting parties are required to prepare and implement a National Implementation Plan (NIP).

Belize's NIP will form the basis for the management of POPs in the country. The development of the NIP requires country specific information that must be obtained to determine the present status of the country. Included in this is the need to assess the environmental, socioeconomic and health effects of the use and management of POPs in Belize.

The Ministry of Natural Resources, Local Government and the Environment (MNRLGE) established a Project Steering Committee (PSC), and a Project Management Unit (PMU) to oversee the preparation of the NIP. The PMU and the PSC were established in 2005, and has its offices at the Department of the Environment in Belmopan.

Several important conventions that Belize has signed or ratified related to the environment are: the Convention on Persistent Organic Pollutants (POPs) (signed 2002); the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (BASEL) (acceded Apr. 21, 1997); the International Convention for the Prevention of Pollution from Ships and the 1978 Protocol MARPOL (ratified Aug. 26, 1995) the Convention on the Inter-Regional Organization for Plant and Animal Health (OIRSA); the International Plant Protection Convention (acceded May 14, 1987); the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Ozone Depleting Substances (acceded Sept. 7, 1997); the UN Convention of the Laws of the Sea (ratified Aug. 13, 1983); the 1992 Protocol to the International Convention on Civil Liability for Oil Pollution Damage (1972) and 1992 Protocol to the Convention Establishing the Fund for Compensation for Oil Pollution (acceded July 1, 1991).

The Stockholm Convention is a global treaty to protect human health and the environment from the effects of persistent organic pollutants (POPs), while the Basel Convention is intended to prevent or control the trade in hazardous wastes and authorizes the disposal of hazardous wastes only in participating countries, which have given prior, informed consent; and

the MARPOL 73/78 Convention requires that states provide adequate reception facilities for oily wastes.

The Rotterdam Convention establishes a first line of defence by giving importing countries the tools and information they need to identify potential hazards and exclude chemicals they cannot manage safely. The Convention promotes the safe use of imported chemicals through labeling standards, technical assistance and other forms of support. It also ensures that exporters comply with the requirements. The Convention creates legally binding obligations for the implementation of the Prior Informed Consent (PIC) procedure. The Rotterdam Convention entered into force on 24 February 2004. Belize has accepted the Convention on 20<sup>th</sup> April, 2005, but has not signed the instruments of accession.

Other agreements signed include the Convention on Biological Diversity on June 13 1992 in Rio de Janeiro, Brazil, ratified December 1993. Belize is also party to the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES) since 1981; the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention) in 1989; The International Convention for the Regulation of Whaling (1982); the Convention on the Conservation of Migratory Species of Wild Animals, Bonn (The Migratory Species Convention); and the Convention Concerning the Protection of the World Cultural and Natural Heritage (The World Heritage Convention) (ratified Nov. 6, 1990).

Belize has also signed several important agreements on Biodiversity at the regional level. Belize is signatory to the Convention for the conservation of Biodiversity and the Protection of Priority Areas of Central America (1992), and joined the Central American Alliance for Sustainable Development (ALIDES) in 1994. Belize has also signed the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC). Other regional conventions signed include the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (The Cartagena Convention) and the Protocol Concerning the Cooperation in Combating Oil Spills in the Wider Caribbean Region (ratified Dec. 11, 1997), the Convention on Nature Protection and Wildlife Preservation in Western Hemisphere (The Western Hemisphere Convention), and signed the Belize/ Mexico Bilateral Agreement (signed September 1991).

## **2.2.4 Current Legislation and Regulations**

### **Existing POPs Legislation**

Presently, Belize has no legislation addressing POPs chemicals directly; except the Pesticides Control Act that prohibits the importation of POPs pesticides. Belize signed the Convention on Persistent Organic Pollutants (POPs) in the year 2002. As part of its obligations under the convention, contracting parties are required to prepare and implement a National Implementation Plan (NIP). This NIP is expected to propose action plans for the development and adoption of legislation as it pertains to POPs chemicals in Belize, since Belize's NIP will form the basis for the management of POPs in the country. The development of the NIP requires country specific information that must be obtained to determine the present status of the country. Included in this is the need to assess the environmental, socioeconomic and health effects of the use and management of POPs in Belize.

The Ministry of Natural Resources and the Environment (MNRE) established a Project Steering Committee (PSC), and a Project Management Unit (PMU) to oversee the preparation of the NIP. The PMU and the PSC were established in 2005, and has its offices at the Department of the Environment in Belmopan.

### **The Pesticides Control Act**

The Pesticide Control Act of 1985, (PCA), grants authority to the Pesticides Control Board (PCB) to control the manufacture, importation, sale, storage, transportation and use of pesticides in Belize<sup>14</sup>. The PCB is an inter-sectoral body comprising of representatives from the Ministry of Agriculture, Fisheries and Cooperatives, Ministry of Health, Ministry of Environment, Agriculture Producer Associations, and the Pesticide Industry.

According to the PCA, registered pesticides are those pesticides, which have been approved by the PCB for use in Belize. Restricted Use Pesticides (RUP's) are defined in the PCA as those, which, "...if used in accordance with a widespread and commonly recognized practice, may generally cause, without additional regulatory action, unreasonable affects on the environment, including injury of the applicator"<sup>19</sup>. It is required that persons purchasing these pesticides be certified pesticide applicators.

Prohibited pesticides (Schedule IV), include those not yet registered in Belize. These include all POPs, which would not meet criteria for

importation. However, DDT has restricted use since the MOH currently has a policy of reserving the right to import DDT for emergency use during the outbreak of malaria.

In 1989, the Government approved a Statutory Instrument, the *Registered and Restricted Pesticide (Manufacture, Import and Sale) Regulations, 1988*, S.I. No. 8 of 1989. This was followed by the *Registered and Restricted Pesticides (Registration) Regulations, 1995*, S.I. 77 of 1995<sup>15</sup>. Further Legislation passed includes the *Registered and Restricted Pesticides (Manufacture, Import and Sale) (Amendment) Regulations, 1996*, S.I. 30 of 1996<sup>17</sup>. These regulations provide the legal requirements for registration, labeling, importation and sale of pesticides.

An application for registration of a pesticide should be submitted to the PCB prior to importation and should be accompanied by chemical, toxicological and environmental impact data. Any person wishing to register any pesticide must also submit details of the labels of packaging. Duration of the certificate of registration is valid for five years.

Further legislation under the PCA has been enacted in order to expand the legal requirements of the PCA. These include *the Restricted Pesticides (Certified User) Regulations, 1996*, S.I. 112 of 1996 and the *Pesticides Control (Sale and Confiscation) Regulations, S.I. 71 of 1998*.

S.I. no. 112 of 1996 required that formal training of farmers, applicators and retailers be conducted on safe and efficient pesticide management. The enactment of S.I. No. 112, of 1996, required the pesticide user to pass a written or oral exam. Schedule III of this legislation required that the trainee comply with a number of stipulations include the ability to read and understand labels, safely and adequately prepare mixtures of pesticides, the proper calibration and use of equipment, among others.

With the enactment of S.I. No. 71 of 1998, *Pesticides Control (Sale and Confiscation) Regulations 1998*, the PCB was granted further powers to enforce S.I. no. 112 of 1996<sup>18</sup>. This S.I. required that establishments maintain a register of sales of restricted pesticides, and may only sell Restricted Use Pesticides (RUP's) to persons in possession of a certified user's license.

### **Pesticide Use in Belize**

As a result of the importance of the agriculture sector in Belize, the use of pesticides is predominant in order to facilitate the rapid growth of plants by eliminating competing plants, animals and pathogens. The predominance of pesticide and agrochemical use in the agriculture industry was accelerated due to several factors. These are the influx of immigrants who were accustomed to chemical intensive agriculture, marketing

strategies by pesticide dealers, the decrease in soil fertility and the increase of pest resistance<sup>7</sup>.

In Northern Belize (the Districts of Corozal and Orange Walk) produce 1.2 million tons of cane annually<sup>21</sup>. The average ton per acre produced is 20. Approximately 60,000 acres are burnt annually for sugar cane production. Herbicides used in the Sugar Industry include ametryne, methamidophos, atrazine, diuron, glyphosate, 2,4D and paraquat<sup>21</sup>.

In the Belize District the main commodities are cattle, rice, vegetables and fruits while in the Western part (Cayo & Parts of Orange Walk), corn, beans, poultry, pork, dairy and beef are the main products.

The Citrus Industry is concentrated in the West and South of the Country, mainly in the Cayo and Stann Creek Districts. Mineral fertilizers (mainly dolomite) are used by this industry. Herbicides and pesticides are also used as well as fungicides. Commonly used pesticides in the citrus industry include glyphosate, alachlor, atrazine, ametryne, diuron and propanil<sup>19</sup>. The most commonly used herbicides are paraquat and glyphosate (Table 2.3). Data is for 2006, but trends for use in 2007 are similar.

In the banana industry, aerial spraying for Black Sigatoga is frequent, and exposures to employees have been of concern, especially in the last two decades. Social concerns as a result of the spraying became an issue during the 1990's<sup>19</sup>. The industry, however, has taken steps to improve the overall working conditions of farmers and therefore, reducing the risk of pesticide contamination.

There are no manufacturers of pesticides in Belize. At present there is one formulating plant, two main importers and 38 distributors.

**Table 2.6:** The Ten Most Commonly Used Pesticides In Belize. *Source: PCB 2006<sup>8</sup>.*

<b>Pesticide</b>	<b>Kilograms Imported</b>	<b>% of Total</b>
Glyphosate	185,742	24.5
Mancozeb	139,466	18.4
2,4-D	107,141	14.1
Paraquat	99,197	13.1
Terbufos	75,193	9.9
Fenamiphos	39,864	5.3
Chlorpyrifos	39,812	5.2
Ethoprophos	31,220	4.1
Malathion	22,205	2.9
Picloram	19,286	2.5
<b>Total</b>	<b>759,126</b>	<b>100.0</b>



### 2.2.5 Key Approach

Belize has neither significant nor immediate problems with POPs. Adverse impacts have not been thoroughly analyzed and it is difficult to point out where the most effective and efficient measures should be exactly addressed to. Presently the whole POPs issue is little known, both within the authorities as well as within the general public. There are some regulations, which indirectly cover some aspects of POPs (mainly pesticides). However, in general the regulatory framework does not recognize POPs or its components, neither hazardous waste, which are an essential ingredient in the unintentional production of POPs.

Belize has therefore chosen to manage and phase-out POPs by initiating far-reaching regulatory framework and institutional strengthening, which will materialize in continuing and supporting the work of the POPs unit at the Department of the Environment. This activity will be supported by and extensive training and public awareness program targeted both to the authorities as well to the general public.

Regarding obsolete pesticides and possible use of DDT in vector control Belize relies on international and regional (Caribbean/Middle American) to manage these issues.

The PCB issue is believed to be solved by an intensive cooperation between the authorities and the national electricity supplier without any extensive regulatory measures.

Unintentional production of dioxins and furans is addressed by three technical projects, out of which a large solid waste management project and medical/hazardous waste incineration are being based on tested technology and will result in improved environment as well as reduced dioxin/furan production. The burning of sugar cane remains an old practice, but also a big dioxin/furan source, and will be addressed by an experimental mechanical harvesting project.

Presently, the primary law regulating the importation of POPs is the Pesticides Control Act, as previously elaborated. However, the POPs project is overseen by a multi-sector committee comprising of Government, the private sector, and semi-government agencies. Under guidance of this committee, it is envisioned that a chemical management protocol for Belize will be established.

The primary outcome of the present project is to prepare a National Implementation Plan (NIP) which will also be used to form as a guide to the implementation of management of chemicals and hazardous waste in Belize. Chemical and hazardous material handling will require the

identification and definition of these materials, and the establishment of protocols for their management. The policy will also look at the enhancement of training for officials in the management of hazardous waste such as municipal and medical wastes, as well as training in hazardous chemical management. In addition, public awareness programs in order to sensitize the general public on the handling and management of waste will be carried out.

## 2.3 ASSESSMENT OF THE POPS ISSUE IN BELIZE

### 2.3.1 ANNEX A/I SUBSTANCES, PESTICIDES

#### 2.3.1.1 Imports

Table A1 is a list of Part I of the Annex A chemicals. This list comprises the majority of the convention chemicals previously used in Belize. All of Annex A and B chemicals have been previously used in Belize. Belize has no production and acted as an importer of these substances before they were prohibited under the Pesticides Control Act, 1985 (PCA). Prior to the enactment of the act, there was neither means of controlling importation nor the prohibition of their uses.

#### 2.3.1.2 Use

There is little data that would give an indication of the quantity of these chemicals used. The primary uses of these chemicals were as insecticides or termiticides. Mirex and Aldrin were used in the control of leaf cutting ants, especially in the citrus industry.

#### 2.3.1.3 Registration and Control

The PCA placed pesticides into three categories: schedule 1 or general use, schedule 2 or restricted use and schedule 3 or prohibited use. All of the POPs pesticides with the exception of DDT were placed under Schedule 3 and their use or importation prohibited. In 1995 the registration of pesticides was changed from active ingredient to formulation.

**Table 2.7: Part I Substances and Status in Belize**

Category	Chemical	CAS #	Stockholm Convention Annex	Use	Status in Belize
Pesticides	Aldrin	309-00-2	A	Insecticide	Prohibited
	Chlordane	57-74-9	A	Insecticide, termiticide	Prohibited
	Dieldrin	60-57-1	A	Insecticide	Prohibited
	Endrin	72-20-8	A	Insecticide, rodenticide	Prohibited
	Heptachlor	76-44-8	A	Insecticide, termiticide	Prohibited
	HCB	118-74-1	A	Fungicide	Prohibited
	Mirex	2385-85-5	A	Insecticide, termiticide	Prohibited
	Toxaphene	8001-35-2	A	Insecticide	Prohibited
	Polychlorinated Biphenyls (PCB)		A		Not produced in Belize

#### **2.3.1.4 Obsolete Stocks, Reserves, Contaminated Areas**

The Pesticides Control Board presently stores in its warehouse approximately 4.5 kilograms (10 pounds) of mirex formulation (a POPs pesticide) that was located in the possession of a villager in the Cayo District. This substance has now been prohibited for importation and is no longer in use. There is presently no other documented stocks of mirex, and there is also no known reserves. Contaminated areas have not been determined as its use was diffuse.

#### **2.3.1.5 Impacts**

In Belize the impacts of the use of Annex A1 substances, including mirex, have not been researched. However, there is presently no further risk for contamination as these substances are prohibited for importation and use.

Nonetheless, a study conducted by Alegria<sup>34</sup> in 1995/1996 showed average levels of aldrin concentrations measured 1,625 pg /m<sup>3</sup> in Belmopan and 92pg/m<sup>3</sup> in Belize City. Dieldrin levels measured 1,233 pg m<sup>3</sup> in Belmopan and 119 pg -m<sup>3</sup> in Belize City.

The relatively high levels of chemicals in Belmopan may be attributed to the fact that it is in an agricultural region. The levels in Belize City cannot readily be accounted for since the city is not a source region for these chemicals (aldrin, dieldrin, etc.). The city is 15 miles from the nearest agriculture producing area.

In addition, preliminary results of pesticide concentration (mg/kg) in selected marine species indicated that aldrin was present in the samples<sup>29</sup>. Aldrin was found in eight (8) of the ten (10) samples tested and ranged from 0.000025 to 0.015mg/kg of body weight<sup>29</sup>. However, these levels are considered trace levels.

## 2.3.2 ANNEX A/II SUBSTANCES (PCBS)

### 2.3.2.1 Imports

The principal use of PCBs in Belize was as a dielectric fluid in electrical transformers. The properties of PCBs allows for its application as insulators. Consequently, there is no importation of these substances; and the importation of PCB – containing equipment has been eliminated.

**Table 2.8: Polychlorinated Biphenyls**

Category	Chemical	CAS #	Stockholm Convention Annex	Use	Status in Belize
Industrial Chemical	Polychlorinated Biphenyls (PCBs)	1336-36-3	A	Industry manufacture; coplanar PCBs area by product of combustion	Use discontinued

### 2.3.2.2 Use

In 1976 the Belize Electricity Board (BEB) was in charge for the distribution of electricity in Belize. A policy decision was made to phase out the use of equipment containing PCBs as soon as these malfunctioned.

### 2.3.2.3 Registration and Control

The use of equipment containing PCBs has been phased out initially by the Belize Electricity Board and lately by the Belize Electricity Limited (BEL), its successor company. BEL has a PCB identification program to determine whether or not equipment contains PCB oils. A positive identification results in the equipment being removed from service. As part of the policy, any transformer that ceased to function is replaced by a new transformer that is certified free of PCBs.

Privatization of the BEB in 1992 resulted in the formation of the Belize Electricity Limited (BEL). BEL has continued this policy of phasing out equipment containing PCBs. To date BEL claims that most of their equipments are PCB free.

#### **2.3.2.4 Obsolete Stocks, Reserves, Contaminated Sites**

Since the country is not a producer of these substances, there are no obsolete stocks, nor reserves. However, there may still be minute quantities but this cannot be confirmed. Minute quantities may exist in old equipment containing PCBs that are in use mainly by private companies.

There is one site that is possibly contaminated; albeit the level of contamination not been determined. This site is an area previously used for stock piling of dielectric equipment such as transformers by the BEL in its old warehouse at Belize City. Nonetheless this site was previously cleared of topsoil and disposed at a designated public dump site.

#### **2.3.2.5 Impacts**

No known investigations on the result of industrial PCBs have been conducted in Belize. However, the use of PCBs in electrical equipment can pose a threat to human health since contaminated equipment was often stored along with contaminated waste oil. Waste oil has been used in a small smelting industry in Belize, practiced primarily by the Mennonite communities.

### 2.3.3 ANNEX B/I – DDT (1,1,1-trichloro-2,2-bis (4chlorophenyl) ethane

#### 2.3.3.1 Imports

DDT was first used in Belize in 1957 when the National Malaria Eradication Service (NMS) was established and was used continuously (except for a short break from 1974-79) until 1995. It was used briefly again in 1997 and has not been used since. Table BI is a summary description of the DDT status in Belize.

**Table 2.9: DDT**

Category	Chemical	CAS #	Stockholm Convention Annex	Use	Status in Belize
Pesticide	DDT	50-29-3	B	Insecticide	Can be imported only by MOH in the event of Malaria Outbreaks

#### 2.3.3.2 Use

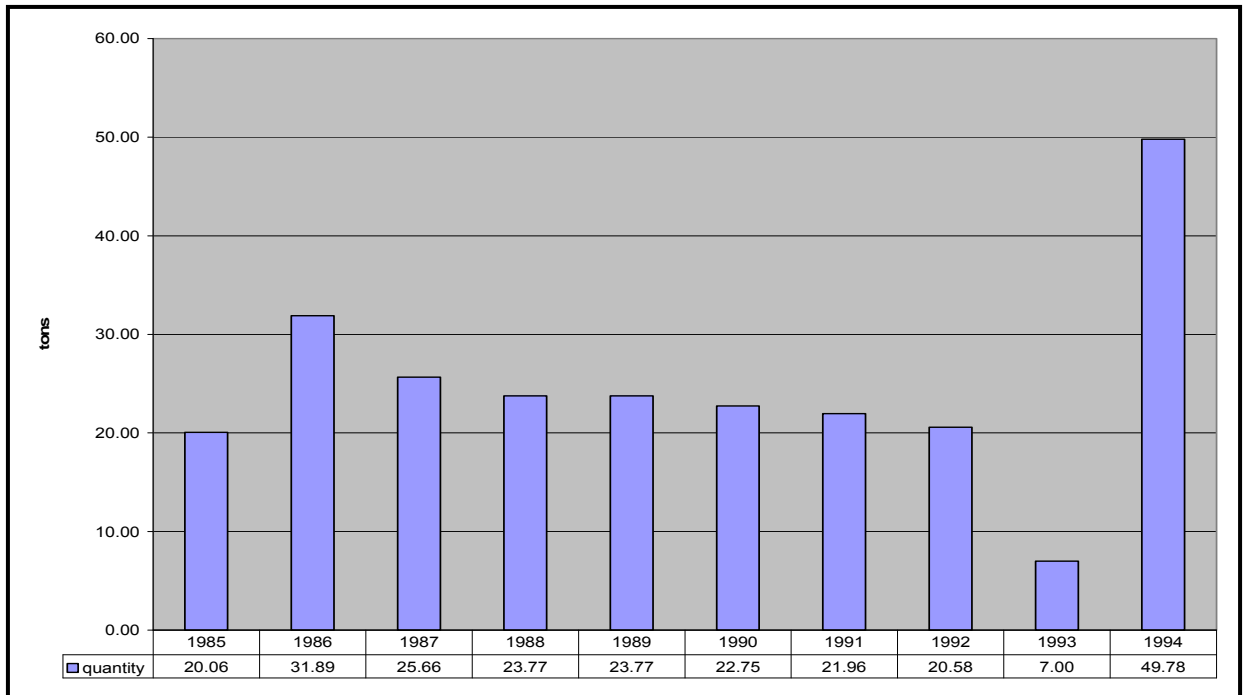
DDT was used exclusively by the MOH for vector control, primarily against the mosquito that carries the agent that causes malaria and dengue fever.

The usage pattern of DDT has changed with the different strategies employed to control the incidence of malaria. During the initial period of the program, DDT was applied to domiciles in the urban and rural area. This was done at least twice a year. Groups of spray applicators would travel from District to District applying DDT to all the houses in each community.

The decrease in the incidence of malaria prompted a review of the program so that spraying was discontinued in the Belize District as well as the District Towns. In 1976 only 166 cases of malaria were reported. This contrasted with 4,595 cases in 1983.

In the late 1980's, due to budgetary constraints and a policy aimed at reducing the use of pesticides, spraying had been reduced to the ten localities in each District with the highest incidence rate. The switch from the use of DDT to other more benign chemicals has not resulted in a major increase of the incidence of malaria.

On average it requires approximately 28 ounces of 75%WP DDT formulation to spray one house. This figure is used to estimate how much DDT was used on an annual basis in Belize. The annual work plan of the NMS (Figure B1) shows that approximately 20 tons of DDT was used on an annual basis between 1985 and 1994. In the latter part of the program DDT use was decreased, and in 1997 66.7 kg of DDT was used, while in 1993 only 7 tons of DDT was used. However, this was offset by the approximately 50 tons that was used in 1994. High rates of infection were recorded in both 1993 and 1994 with over 16,000 cases for that period. High and low incidence of malaria is shown in Figure B2.



**Figure 2.2** Annual Quantity of DDT Used in Belize for the Period 1985-1994.

### 2.3.3.3 Registration and Control

DDT is a restricted substance in Belize, under the Pesticides Control Act, 1985. However, the Ministry of Health retains the right to import in the event of a malaria outbreak. There is no other agency with authorization to import DDT.

Belize is in the process of executing a DDT/GEF project. The objective of this project is to eliminate the remaining DDT stockpiles from Central American countries, while developing alternatives to pesticides to combat endemic malaria in the area.



The initiative to completely eliminate the use of DDT came from the Commission of Environmental Cooperation (CAC) which operates within the framework of the North American Free Trade Agreement. Mexico made the commitment to eliminate its DDT reserves by 2002.

Subsequently in 2003, and under the DDT/GEF project, the initiative was extended to Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama under the coordination of the Pan American Health Organization (PAHO) through the Global Environmental Funds (GEF) financed by the United Nations Environment Program (UNEP). After two years of implementation, the eight countries met in Costa Rica in September 2005 to monitor their achievements and refine their plans to meet their objectives.

To date, the remaining DDT stock has not been eliminated via the project.

#### **2.3.3.4 Obsolete Stocks, Reserves, Contaminated Areas**

There are no usable DDT reserves in Belize, and contaminated sites have not been documented. Recent investigations on DDT residues indicate that the levels detected in several species of fish were trace.

Belize has a stock of obsolete DDT. The Ministry of Health (MOH) has approximately thirteen (13) tons of DDT in storage. This is presently stored at the compound of the Western Regional Hospital in Belmopan. The Malaria Control Program of the MOH discontinued the use of DDT in 1997. Since that time the DDT that was already in the country has been stored at various locations. These locations include the former Public Health Compounds at the Old Belize City Hospital, its compound at Princess Margaret Drive in Belize City, the San Ignacio Hospital compound in San Ignacio at its present location.

The present stock of DDT is the subject of an elimination programme. However, it is not known when its elimination will be carried out.

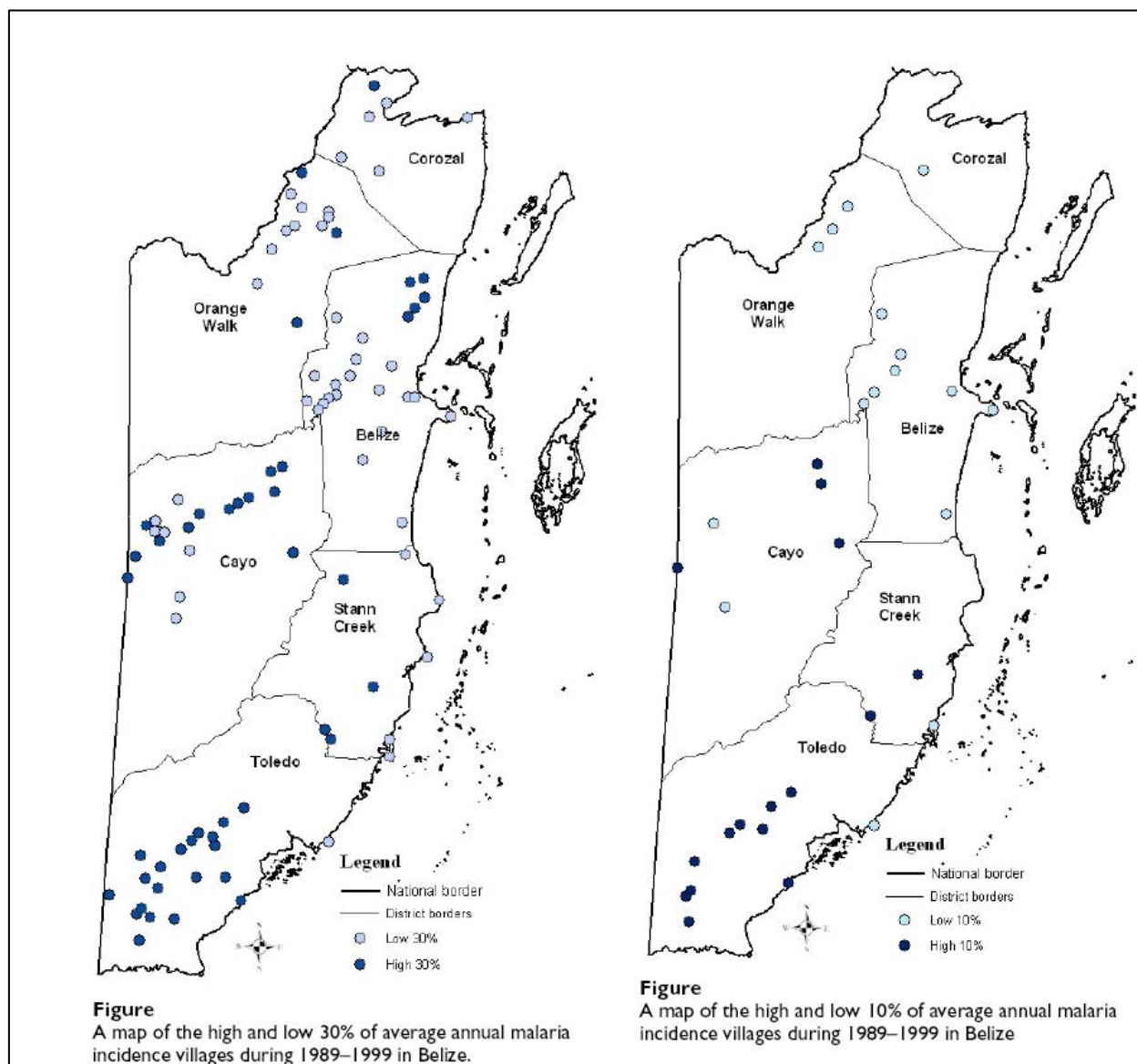
#### **2.3.3.5 Impacts**

The impacts from the use of PCBs have not been thoroughly investigated. However, Alegria's<sup>34</sup> study conducted in 1996 showed average levels of DDT concentrations of 970 pg /m<sup>3</sup> for Belmopan. The relatively high levels of chemicals in Belmopan may be attributed to the fact that it is in an agricultural region. Additionally, several communities around Belmopan were being sprayed with DDT to reduce incidences of malaria. Belize City is 15 miles from the nearest agriculture producing area and spraying with

DDT in the city had been discontinued during the time the investigation was carried out.

In another investigation by Fernandez<sup>31</sup>, levels of organochlorine (DDT+ DDE + DDD) in environmental and biological sample were determined. Results showed that levels of DDT in breast milk ranged from 0.07 to 0.27 ppm (mg/l) while sediment samples tested showed levels of DDT ranging from 3.35ppm from samples taken at the upper Macal River to 5.38ppm (mg/kg) from samples taken at the mouth of the Belize River<sup>31</sup>.

The data for breast milk was derived from only (5 samples) and, the fish samples (10) were equally small. Therefore no firm conclusion should be drawn from them. There is however, a need for further studies to be conducted in these areas in light of the potential impact of the presence of these chemicals in the food chain and their potential impact on human health, coastal and marine resources, and the tourism industry.



**Figure 2.3:** Map showing High (30%) and Low (10%) of Average Annual Malaria Incidence in villages during 1989 -1999. *Source*<sup>53</sup>: *Hakre et al, 2004.*

Another investigation conducted by Hakre<sup>53</sup> et al, in 2004 showed the relationship between the averages high and low annual malaria incidences by villages in Belize for the years 1989-1999. The results of the investigation showed that malaria incidence over the 10 year period in the villages indicated a spatial pattern such that the southern and western (Figure B2) parts of Belize had consistently higher rates of malaria than northern areas. In addition, there existed a significant difference among districts and among months. Villages with more broadleaf hill forests, agriculture land, and wetland vegetation types and rivers had higher malaria rates than others. The 10 percentile malaria incidence in villages

along western and southern Belize had more rivers within two kilometers of the village centers<sup>53</sup> (Figure B2).

While this report and no other known report have investigated the malaria incidences as it relates to the DDT spraying patterns, it is highly likely that the DDT spraying carried out between 1985 to 1994 was conducted in the areas of high 10 percentile malaria incidences show in Figure B2, and possibly in other areas. Figure B1 shows the malaria incidences at the country level.

## 2.3.4 ANNEX C SUBSTANCES – DIOXINS AND FURANS

### 2.3.4.1 Emission Source

Table C details the categories of Annex C substances and the present status in Belize. It should be noted that while hexachlorobenzene was used sparingly in Belize prior to its prohibition for importation with the enactment of the Pesticides Control Act in 1985. HCB can be produced as a by-product of the manufacture of chlorinated solvents, pesticides, and the application of pesticides and the incineration of HCB containing waste products.

Dioxins and furans are a by-product of the combustion processes. It is estimated that Belize produces approximately 88 grams toxic equivalent (gTEQ) of dioxins and furans from unintentional release.

**Table 2.10: C**

Category	Chemical	CAS #	Stockholm Convention Annex	Use	Status in Belize
Pesticides	Hexachlorobenzene (HCB)	118-74-1	C	Pesticide	Was used sparingly in Belize. Now prohibited.
Unintended By-Products	Polychlorinated dibenzo-p-dioxins and dibenzofurans (Dioxins & Furans, PCDD/PCDF)	Several	C	By-product	~ 88 gTEQ produced in 2004
	Polychlorinated biphenyls (BCP)	Several	C	By-product	

### 2.3.4.2 Emissions by Source Categories

The inventory revealed that for the year 2004, approximately 87.67 gTEQ of dioxins and furans were produced (Table C2). These were classified according to the recommended classification system as described in the guidance document. Dioxins and furans are produced as unintentional by-products from various sources including waste incineration, uncontrolled combustion, vehicle emissions, wood burning, and lime production. The sectors that account for much of the unintentional release of these products are, waste incineration (48 gTEQ/A) and uncontrolled combustion processes (37.89 gTEQ/A) (Figure 4.5).

The bulk of dioxins and furans were released to the air (63.26gTEQ/A) and land (24.16gTEQ/A) with a smaller percentage being deposited as residue (0.25gTEQ/A) (Figure 2.2, 2.3, 2.4).

**Table 2.11:** Revised Estimates of Release of Dioxins and Furans in Belize for 2004.

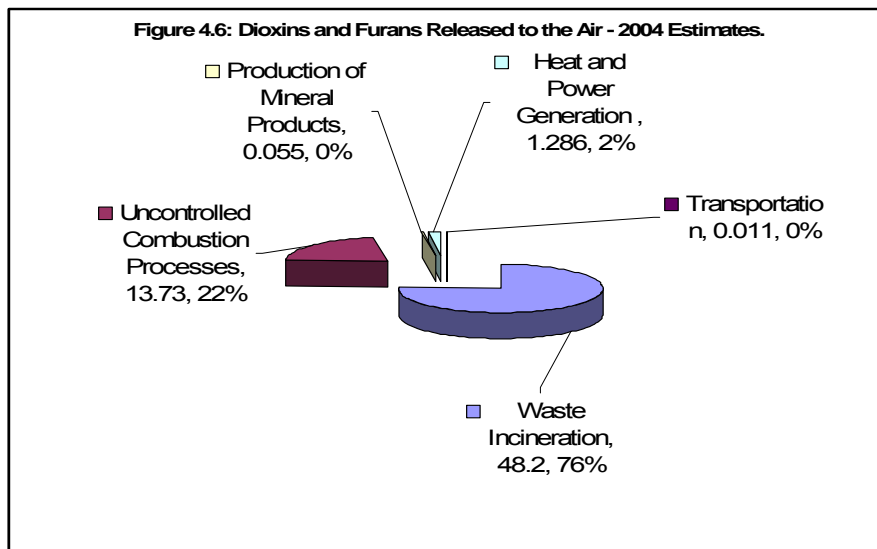
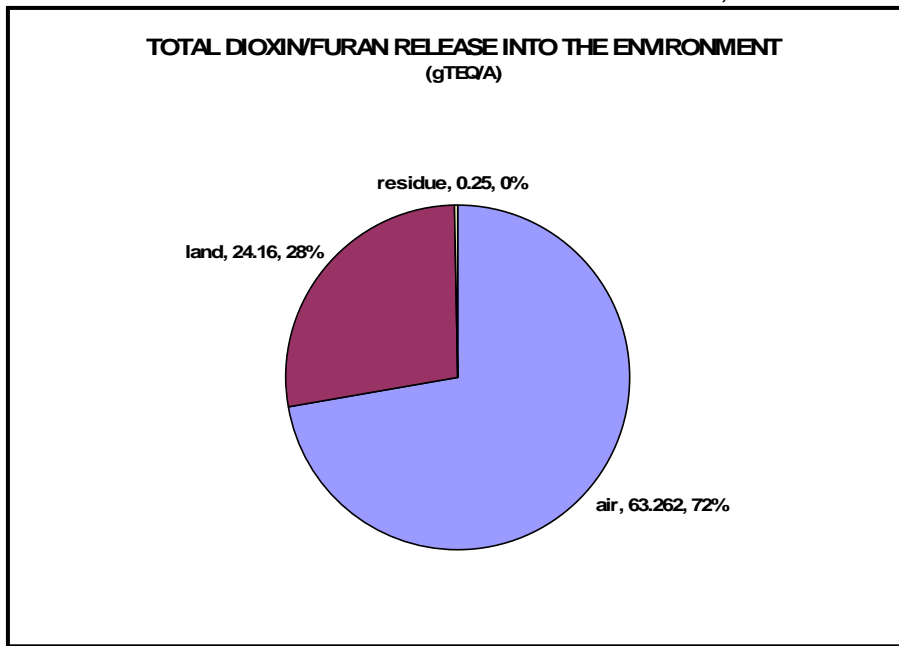
Source Categories	Subcategories	Air gTEQ/A	Land gTEQ/A	Residue gTEQ/A
Waste Incineration	Medical Waste			
	Uncontrolled batch type	42.72		0.21
	Controlled batch type	5.46		0.04
	<b>subtotal</b>	<b>48.18</b>		<b>0.25</b>
Heat and Power Generation	Fossil Fuel Power Plants	0.01		
	Biomass power plants	1.159		
	Household heating and cooking – biomass	0.116		
	Domestic heating and cooking – fossil fuel	0.001		
	<b>Subtotal</b>	<b>1.286</b>		
Production of Mineral Products	Lime production	0.055		
	<b>Subtotal</b>	<b>0.055</b>		
Transportation	Diesel engines	0.006		
	Gasoline engines	0.005		
	<b>Subtotal</b>	<b>0.011</b>		
Uncontrolled Combustion Processes	Fires/burnings – sugarcane	0.116		
	Burning at dumpsites	2.169	1.301	
	Domestic waste burning	11.429	22.856	
	Accidental vehicle fires	0.016	0.003	
	<b>Subtotal</b>	<b>13.730</b>	<b>24.160</b>	
<b>Total</b>	<b>Total</b>	<b>63.262</b>	<b>24.160</b>	<b>0.25</b>
	<b>Grand Total</b>		<b>87.67 gTEQ/A</b>	

### Medical Waste Incineration

The National POPs Inventory revealed that in 2004 Belize released approximately 91 gTEQ per annum of dioxins and furans<sup>1</sup>. The Toxic Equivalent (TEQ) is based on the toxicity of 2, 3, 7, 8 TCDD, the most toxic dioxin which is assigned a toxicity of one. All other dioxins or furans have toxicity less than that of 2, 3, 7, 8 TCDD. An analysis of the POPs inventory revealed a number of calculation errors which along with the use of alternate methodologies have resulted in a slightly lower total POPs release value. These changes are described here.

In the Belize National Inventory Report, waste incineration accounted for 48.2 gTEQ/A, which is 54% of the total emissions<sup>6</sup>. Figures for Uncontrolled combustion processes (or Uncontrolled Domestic Waste Burning, UCDWB), were also revised and increased from 5 gTEQ/A to 37.890 gTEQ/A. The remaining 2% was produced by the production of mineral products, heat and power generation and the transportation sector (Figure A1).

**Figure 2.4:** Total Dioxin Release into the Environment, 2004.



**Figure 2.5:** Estimates of Dioxins and Furans Released.



**Figure 2.6:** Map of Belize City Showing Location of Dump Site, KMH And BEL Substation.





**Figure 2.7: Belize Map Showing Population Centers and Approximate Location of Major Dump Sites. N.B: Red circles denote Approximate location of dump sites.**

## Open Burning Processes

### *The Agriculture Sector*

According to the Ministry of Agriculture and Fisheries Agriculture (MAF), agriculture production still continues to form the foundation of the productive sector and the rural economy of Belize. At least, 35% of GDP and 41% of total employment is directly dependent on agriculture, fisheries & forestry<sup>18</sup>.

### *Burning of Sugar Cane*

Belize's sugar cane industry was commenced in the 1970s. In Belize, sugar cane production includes cane farming, harvesting and processing of harvested sugar cane at the Belize Sugar Industries at Tower Hill, Orange Walk. A total of 68,000 acres of sugar cane are under cultivation with the resulting production of 1.2 millions long tons of sugar<sup>31</sup>. A total of 100% of sugar cane fields is burnt in preparation for harvesting. Harvesting occurs from December to June every year. Based on these figures, a total of 9,714 acres are burnt for each month during the harvest period, on an average.

A total of 28 communities and two (2) large Towns are located in the surrounding cane fields (Figure A4). Most population centers are villages, while the two towns are Corozal and Orange Walk. In the Orange Walk District a total of 35,000, acres are in cultivation, while 33,000 acres are in cultivation in Corozal<sup>31</sup>.



There are three (3) reasons for the burning of sugarcane fields (See photo on left). These are:

1. Labor efficiency.
2. Snake bite Prevention.
3. Accessed labor is more productive.

According to BSI<sup>31</sup>, a total of 3,300 acres under cane cultivation (80,000 tons) belong to BSI, who has a plan to move towards green cane harvesting within 5 years. BSI also has a program to move towards the production of electricity by the burning of the bagasse. This program has received the approval of the relevant authorities, and will be run by BELCOGEN (Belize Cogeneration Company). The system is designed to



**Photograph of bagasse burning.**

run on the burning of 1.2 million tons of cane, which is the existing capacity of factory<sup>31</sup>. The capacity of the factory is presently limited by the number of boilers available. However, the problem posed by its limitation in production capacity, is that the amount of bagasse produced from the 1.2 million tons of cane cannot sustain a year round operation at the energy plant; thus the need to burn 6,000 tons of fossil fuel every year. In order to overcome this limitation, it would be necessary to grind more cane or higher quality cane fiber. The photo on the left shows bagasse burning.

Estimated 1.35 to 1.4 million tons of cane would give a year round supply of bagasse for the plant<sup>1</sup>.

The POPs Inventory Report<sup>6</sup> reported the burning of sugar cane under “Category 6: open burning process”, and estimated that the sugar cane industry produced 0.116. g TEQ in 2004.

### **Landfill Fires**

Landfill fires have been estimated to produce a total of 0.43 g TEQ of dioxins and furans from landfill sources in 2004<sup>1</sup>.

*The CSO estimates that 3% of all urban waste is burnt, mostly at landfill fires. This means that 2,169 tons of waste is burnt at urban landfills per year, resulting in a release of 2.169 g TEQ/a and 1.301 g TEQ/a to the land, for a total of 3.47 g TEQ/ year into the air (Table C2).*

According to the Inventory, the estimated production of dioxins and furans for landfills in Belize was 0.27 and 0.162 g TEQ to the air and land, respectively. These figures have now been revised to a total of 3.47 g TEQ/a as described above (Table 4.6).



**Photograph of Waste Burning.**

A similar method was used to estimate the amount of solid waste burnt per annum in rural Belize. The 2004 midyear population (Table 4.7) and the rural solid waste production rate of 1.17 kg/person/day (CSO, 2006) was used to arrive at a total of 60,470 tons produced per year, resulting in 38,096 tons burnt per year. It should be



noted that the rates are the same for all of rural Belize, but the rate of burning of waste is 63%, which is much greater than that of urban landfills due to the lack of disposal sites<sup>20</sup>. The result is the release of 11.43 g TEQ/a to the air and 22.9 g TEQ/a to land, for a total of 34.33 g TEQ/a from UDWB. The total release in gTEQ/a for Category 6, (Open burning process), is 13.73 to the air and 24.16 to land, for a total of 37.89 g TEQ/a (Table C2).

**Table 2.12<sup>47</sup>:** Estimates of Release from Open Burning Processes.

<b>Estimates - Category 6, Open Burning Process</b>				
<b>Type of Combustion</b>	<b>Production (tons per annum)</b>	<b>g TEQ/a (air)</b>	<b>g TEQ/a (Land)</b>	<b>Total Release/yr. (g TEQ)</b>
<b>Landfill (C1, Urban)</b>	2,169	2.169	1.301	3.47
<b>UDWB (C3, Rural)</b>	38,096	11.429	22.856	34.285
<b>Open Burning Process</b>		<b>13.598</b>	<b>24.157</b>	<b>37.755</b>

### **2.3.4.3 Impacts**

The impacts of dioxins and furans are unknown due to the lack of scientific investigations. However, it is known that these are possible cancer causing substances.

Dioxins and Furans continue to be produced and are present in the Belize environment. Unless point sources are eliminated they will continue to be produced on an ongoing basis<sup>49</sup>. Dioxins and Furans enter the environment initially mostly into air but will reach the other media (soil, water and sediment) through atmospheric deposition and inadequate disposal of ash residue (from hospital incinerator) or dispersal of ash or leaching of ash from burning of municipal wastes and sugar cane fields when airborne.

Presently, the (safe) transportation of chemicals is not addressed in any regulation and there is no equivalent of the “transportation of dangerous goods legislation. The health and safety aspects of workers handling solid waste and the combustion of waste products are addressed in the Solid Waste Management Act although there are no proper landfills and/or hazardous waste disposal sites established as yet.

From Figure A4, above, it can be seen that all major waste dumps are located within a few kilometers from the most important population centers, which include towns, cities and villages. This poses a major health and sanitation hazard to inhabitants, not only from the possible release of POPs chemicals into the atmosphere, but also from the general threat to water bodies and the atmosphere. The burning of municipal waste disposal sites (as well as the lack of proper landfill sites) and the use of poor incineration equipment for medical waste in part reflects the absence of suitable regulatory or non-regulatory instruments for the control of dioxins and furans and the wider issue of the management of municipal and medical wastes<sup>49</sup>. Figure A3 illustrates the proximity of the residential and commercial sector of Belize City to the existing dump sites; the hospital and the old BEL site are located.

There is also a need for effective policies for medical and veterinary wastes and legislation that will set dioxins and furans emission standards for incineration sources<sup>49</sup>. Policy and economic or other instruments and other measures (namely public education) are also needed to minimise the other sources of dioxins and furans namely – agriculture related slash burning, burning of domestic garbage, and burning of sugar cane field for harvesting. Careful study of the factory and field implications of green cane harvesting is needed<sup>49</sup>.

### **2.3.5 INFORMATION ON THE STATE OF KNOWLEDGE ON STOCKPILES AND CONSTAMINATED AREAS AND WASTES**

The inventory report identified the POPs substances previously handled in Belize, previous and current storage sites of POPs in Belize and provided estimates of incidentally formed POPs.

All of the Annex A and B POPs pesticides appear to have been used in Belize. However, with the exception of DDT, there is little data that would give an indication of the quantity of these chemicals used. The primary uses of these chemicals were as insecticides or termiticides. Mirex and Aldrin were used in the control of leaf cutting ants, especially in the citrus industry.

Before 1985, when the Pesticides Control Act (PCA) was enacted, there was no method to control the importation and use of pesticides. The PCA has three categories of pesticides as follows: schedule 1 or general use, schedule 2 or restricted use and schedule 3 or prohibited use. All of the POPs pesticides with the exception of DDT were placed under Schedule 3 and their use or importation prohibited. DDT was designated as a schedule two pesticide, and was restricted for importation and use only by the MOH. In 1995 the registration of pesticides was changed from active

ingredient to formulation. The status of DDT was changed to unregistered, and up to the present time is still classified as restricted.

A national chemical awareness survey of 215 individuals was conducted to determine the general populace awareness and knowledge of and exposure to chemicals, its practices that contribute to the volume and exposure to POPs, and its medium preferences to receive POPs information<sup>54</sup>.

In addition, three regional consultative workshops were conducted to ensure that the public awareness strategy is consistent with the other education and public awareness activities that are presently being undertaken in Belize relative to chemical management and POPs and to ensure that education and public awareness representatives are actively engaged in planning and designing of this Strategy. Workshops were conducted in Belmopan for the Central Region, Orange Walk Town for the Northern Region and Independence Village in the Stann Creek district for the Southern Region<sup>54</sup>.

Furthermore, a national consultative workshop was conducted in Belmopan to give stakeholders feedback on information collected from the survey, literature review, interviews of stakeholders, and consultative workshops.

The survey showed that most Belizeans are not aware of POPs and are engaged in practices that contribute to the volume of and exposure to POPs especially among rural residents<sup>54</sup>.

### **POPs Pesticides**

Annex I chemicals appear to have been used in Belize. Hexachlorobenzene, HCB (an annex A chemical) is also included as it was used as a fumigant. With the exception of DDT there is little data which would give an indication of the quantity of these chemicals used. There primary used were as insecticides or termiticides. Mirex and Aldrin were used in the control of leaf cutting ants especially in the citrus industry.

### **DDT**

DDT was first used in Belize in 1957 when the National Malaria Eradication Service was established and was used continuously (except

for a short break from 1974-79) until 1995. It was used briefly again in 1997 and has not been used since.

In the late 1980's, due to budgetary constraints and a policy to reduce the use of pesticides, spraying has been reduced to the ten localities in each district with the highest incidence rate. The switch from the use of DDT to other more benign chemicals has not resulted in a major increase of the incidence of malaria.

On average it requires approximately 28 ounces of DDT to spray one house. The annual work plan (1984) assumed the application of DDT to approximately 17500 homes. This works out to approximately 15 tons of DDT used on an annual basis. In the latter part of the program this quantity is expected to have decreased given the reduced application schedule. In 1997 only 66 kg of DDT was used.

### **PCBs**

Since 1976 the Belize Electricity Board (BEB), the agency that was in charge for the distribution of electricity in Belize, has ensured that their transformers are free of PCBs. BEL has in place a procedure under their Environmental Management System to ensure that transformers are PCB free. The national inventory did not determine the number of contaminated sites nor the number or location of any transformers containing PCBs.

### **PCB Identification Program**

The BEL has in place a program to identify and remove used equipments that have PCBs. This program is also applied when the private sector requires servicing or replacement of equipment by private owners. Determination of whether a piece of equipment is PCB free is based on whether there is a nameplate or other form of identification which states that the equipment is PCB free. The absence of such identification would trigger a rapid qualitative test to be performed on the equipment. If the test suggests the presence of PCBs a further confirmatory test is conducted. If this test is positive the equipment is either replaced if it is the property of BEL or, it is not serviced if it belongs to someone else. It is assumed that the presence of a nameplate will guarantee that the equipment is PCB free and therefore no further tests are necessary. This may be based on the fact that these equipments are acquired from countries that have similar programs in place and which would be expected to have a regulatory structure in place to monitor these products.

## **Dioxins and Furans**

Dioxins and furans occur as byproducts from various sources including waste incineration, burning of garbage, agricultural fields, firewood, from the production of lime, and from wastewater produced from industrial processes. There is no previous information about the unintentional production of dioxins and furans in Belize. It is clear that the production of these harmful chemicals has continued as long as the above mentioned sources have been operational.

### **2.3.6 FUTURE PRODUCTION, USE AND RELEASE OF POPS – REQUIREMENTS FOR EXEMPTIONS**

Belize does not produce POPs chemicals. The future use and production is presently prohibited; with the exception of DDT that is not produced but can be imported only by the Ministry of Health in the event of a break out of malaria since it is restricted. Therefore, the only chemical presently requiring exemption from importation is DDT.

### **2.3.7 EXISTING MONITORING AND IMPACTS ARRANGEMENTS**

There are no formal program of identification and monitoring of POPs chemicals in Belize. Reporting and investigations are ad hoc, and limited.

The Interim Report identified the lack of data on the impact of POPs on the public health as the most significant gap. It has been determined that in Belize there are very limited studies on the public health impacts of POPs. Consequently, the health impacts of POPs cannot directly be attributed to exposure. The information gap on the health impacts of the general public, and especially among the exposed population with greater risks, i.e., the applicators, rural communities (especially agriculture based communities), the immigrant population, etc.



### **2.3.8 CURRENT AWARENESS AND AWARENESS PROGRAMS**

Belize's lack of resources by agencies handling or regulating POPs in the past resulted in the prioritization of activities such as the application of POPs for agriculture use instead of awareness on its potential impacts. There was also a lack of information dissemination or a public awareness program during or after the period when the application of DDT for vector control was carried out.

The lack of financial capacity and technical deficiencies pertaining to solid waste management is perhaps the most significant limitation that presently leads to inadequate solid waste management in Belize municipalities. Solid waste management is an important health and sanitation issue, especially in terms of uncontrolled combustion at dump sites, and its proper management cannot be over-emphasized. The illicit burning of waste, and uncontrolled burning at dump sites, either authorized or non-authorized are not recorded, and its resulting production of dioxins and furans cannot be determined with accuracy. The lack of resources for the implementation of the National Solid Waste Management Plan is a contributing factor hindering monitoring and evaluation of POPs derived from unintentional release. The plan has two primary objectives:

- (i) Develop a national strategy for information exchange, education, communication and awareness raising among stakeholders, taking into account risk perception of POPs by the public; and,
- (ii) Conduct a needs assessment on POPs and potential POPs, their effects on health and the environment, alternatives emphasizing non-chemical alternatives, pollution prevention and sustainable production and consumption.

### **2.3.9 ACTIVITIES OF NGOS**

The NGO community of Belize is very actively involved in the sustainable development agenda; and the conservation/environmental movement. The NGO community is involved at all levels of the conservation/environmental agenda, through established public consultation processes, community participation in government decision making on issues of importance to the protection of the environment, and in the planning and management of Belize's national system of protected areas. However, the NGO community has not prioritized the issue of POPs chemicals as one of its area of importance.

Through the implementation of the national awareness program being developed, the NGO community and other social partners will be targeted for increased awareness of POPs chemicals, their impacts and the need to mitigate their impacts. The result of this awareness program is expected to include greater awareness of POPs and its impact on the environment, and behavioral changes that benefits the society at large.

**Table 2.13: List of Some of the Major Environmental Organizations Operating in Belize.**

LIST OF STAKEHOLDERS RELEVANT TO POPs ISSUES					
NO	NAME	ORGANIZATION	TELEPHONE	ADDRESS	EMAIL
<b>BELIZE CITY</b>					
1	Anna Hoare/BAS	Belize Audubon Society	223-4434/4987	12 Fort Street	<a href="mailto:executivedirector@belizeaudubon.org">executivedirector@belizeaudubon.org</a>
2	Michael DeShield	Belize Agricultural Health Authority BAHA	223-4457/224-4794	St Joseph Street	<a href="mailto:foodsafety@bt.net">foodsafety@bt.net</a>
3	Noel Jacobs	Meso-American Barrier Reef System Project	223-3895	Newtown Barracks, Belize City	<a href="mailto:mbrs@bt.net">mbrs@bt.net</a> / <a href="mailto:noel_jacobs@yahoo.com">noel_jacobs@yahoo.com</a>
4	Director	Belize Enterprise for Sustained Technology	227-0254/0946	4 Coffin Street	<a href="mailto:best@bt.net">best@bt.net</a>
5	Director	Belize Zoo	220-8004	29 Mls Western Hwy	<a href="mailto:bzezo@bt.net">bzezo@bt.net</a>
6	Edilberto Romero	Programme for Belize	227-5616/5617	1 Eyre St	<a href="mailto:pfbel@bt.net">pfbel@bt.net</a>
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### **2.3.10 CURRENT ASSESSMENT AND MONITORING OF POPS**

There is presently no assessment and monitoring of POPs and its impacts in Belize. However, a few reports, not specific to POPs have revealed trace amounts of POPs chemicals in the environment.

A report conducted by Mario Fernandez in 2002 cites levels of DDT residue in breast milk<sup>31</sup>. However, this report focused on the levels of DDT residue in media sampled and was not intended to determine potential health impacts of the residue levels. The results indicated that most of the DDT residue was washed out by sediments into the rivers and eventually into the sea (1). The samples tested revealed that blood samples indicated average residue levels of .08 ppm, 0.45 ppm in breast milk, 0.26 ppm in soils, and 4.16 ppm in sediments (1). With this type of basic background information, and the existing gap in the medical consequences of the DDT levels, the need for further investigation into the extent and consequences of POP residues is essential.

Another important limitation is the lack of information on the impact and fate of POPs and other contaminants in the Belize ecosystem. There are no studies that have been done to determine the actual route or amounts attributed to the transportation of POPs via the environment. Such investigation would be considered important given Belize's strong economic ties with its natural resource base. Reports have been conducted on the transport of agrochemicals, but not focusing on its toxicity or environmental fate. An investigation into the existing levels of DDT and other agrochemicals are presently being conducted in the Belize City harbor, but the study focuses on the levels in samples to be tested. The results indicated only trace amounts of several species of fish.

An important gap is the lack of available baseline data on the past use and application of POPs. Record keeping in Belize has historically been unreliable or not centralized, especially in sectors that did not yield economic returns and did not result in revenue generation. The result of record keeping in the POPs use is the lack of detailed baseline data that would serve as an important precursor to any investigation into the health and ecological impacts of POPs.

In addition POPs use in Belize was done by several sectors and its use and regulation was not centralized. For example, the use of DDT and its application and handling was done by the Ministry of Health (Public Health Bureau); the use of POPs pesticides in the agriculture sector regulated by the Ministry of Agriculture and the use of POPs in dielectric fluids in the electricity sector (primarily BEL). The impacts of hurricanes in the past, as well as administrative changes of management in the health and environmental sectors of Belize have also often led to data loss, data

misplacement etc, hence compounding the availability of baseline data. Nonetheless, Belize's low population has resulting in a fairly acceptable level of reliance on personal knowledge and experience in data collection. There are no known investigations on the use of and impacts of POPs on a specific target population. The selection of a target population center as an investigative case study has never been done, and this prevents present decision makers from having a comprehensive knowledge and information as to the impacts of POPs in a specific population.

The issues described above are often interrelated, and when combined, serve to compound management issues as well as implementation of POPs management at all levels in Belize.

### **2.3.11 IMPACT OF POPS; PEOPLE AND ENVIRONMENT**

#### **2.3.11.1 POPS Occurrence in the Environment**

The inventory revealed that for the year 2004, approximately 87.67 gTEQ of dioxins and furans were produced (Table C2). Dioxins and furans are produced as unintentional by-products from various sources including waste incineration, uncontrolled combustion, vehicle emissions, wood burning, and lime production. The sectors that account for much of the unintentional release of these products are, waste incineration (48 gTEQ/A) and uncontrolled combustion processes (37.89 gTEQ/A) (Figure 4.5).

The bulk of dioxins and furans were released to the air (63.26gTEQ/A) and land (24.16gTEQ/A) with a smaller percentage being deposited as residue (0.25gTEQ/A) (Figure A1 & A2).

In Belize, sugar cane production includes cane farming, harvesting and processing of harvested sugar cane at the Belize Sugar Industries at Tower Hill, Orange Walk. A total of 68,000 acres of sugar cane are under cultivation with the resulting production of 1.2 millions long tons of sugar<sup>31</sup>. A total of 100% of sugar cane fields is burnt in preparation for harvesting. Harvesting occurs from December to June every year. Based on these figures, a total of 9,714 acres are burnt for each month during the harvest period, on an average.



**Figure 2.8:** Map Showing Most Population Centers of Corozal and Orange Walk Districts. Sugar Cane Burning occurs in most areas.

### **2.3.11.2 Exposure of People to POPS**

A total of 28 communities and two (2) large Towns are located in the surrounding cane fields (Figure A5). Most population centers are villages, while the two towns are Corozal and Orange Walk. In the Orange Walk District a total of 35,000, acres are in cultivation, while 33,000 acres are in cultivation in Corozal<sup>31</sup>. The result from sugar cane burning that occurs in the two northern districts is that more than 80,000 persons are exposed to POPs released as dioxins and furans (Figure A5). An additional 130,000 persons living in Towns and Cities are also exposed to dioxins and furans from the burning of waste at landfill fires (Figure A4).

When included in the population at risk, most towns throughout Belize are next to a major dump site; thus resulting in more than 150,000 persons at risk from dioxins and furans that can occur in landfill fires alone.

### **2.3.12 LISTING OF NEW CHEMICALS**

Belize presently has no additional chemicals under the Stockholm Convention to report. In the event that any chemical is identified under the Stockholm Convention Secretariat; then these will be reported by Belize's National Focal Point, and will be included in the POPs NIP programme at an appropriate time.



### **3.0 STRATEGIES AND ELEMENTS OF ACTION PLANS OF THE NIP**

#### **3.1. POLICY STATEMENT**

The Government of Belize is a signatory to the Stockholm and Basel Conventions. As a member of the international community, Belize is contributing to manage, reduce, phase-out and eliminate the chemicals now regulated and those that may be regulated in the future following the international agreements, conventions and practices considered suitable and applicable to the sustainable development of Belize. Furthermore, the Government of Belize recognizes that the management and phasing out of the Persistent Organic Pollutants, within the framework of the Stockholm Convention and other agreements, requires international and regional cooperation, in which Belize is actively participating.

The use of pesticides and PCBs are largely based on importation of these chemicals from developed, and industrialized countries. Belize is not a producer of these chemicals and considers, therefore, that the adverse effects of these substances should be mitigated with the support of those countries which, directly and indirectly have profited from the introduction of these chemicals. Belize has never produced or formulated POPs chemicals and has discontinued the importation and use of the regulated chemicals. The use of DDT was discontinued in 1997 even though there is a stockpile of this chemical at one location in the country. Belize naturally recognizes its role in the implementation of the SC and will act in a responsible and cooperative manner as a member of the international community. The unintentional production of dioxins and furans in Belize is linked to the economic development of the country, the unregulated incineration of medical waste, and the practices of burning agricultural residues, waste and wood. Dioxins and furans (in combination with particulate matter) are one of the most important health hazards. However, new energy sources as well as new sugarcane harvesting methods are alternatives to reduce the production of dioxins and furans, or at least reduce the future growth.

Belize aims to apply the Precautionary Principle and the Polluter Pays Principle (PPP) when mitigating the POPs generated problems. These principles would make a more direct link between the root causes and the corresponding financial phase-out costs. However, taking into consideration that the economic structure in the country is rapidly changing (as a result of international commitments such as WTO and CARICOM), the PPP has limited opportunities regarding the problems from the past, but the PPP is to be incorporated in the future activities.

Belize is continuously revising and updating its regulatory framework regarding the environmental issues and environmental management. The



POPs management, phase-out and elimination issues are being integrated in the environmental protection and solid waste agenda where appropriate, and in general as part of the framework for the management of chemicals and specifically under the waste management initiative.

The Government will review the National Implementation Plan for POPs reduction and/or elimination submitted by the DOE with the objective of seeking its adoption, and is committed to undertaking the appropriate activities in order to comply with the tasks included in the NIP action plans while fulfilling the Stockholm Convention provisions.

### **3.2 IMPLEMENTATION STRATEGY**

This implementation strategy serves as a road-map on how to fulfill the objectives set out in the Stockholm Convention. The main elements of the strategy, from a Belizean perspective, are as follows:

- Belize is prepared to eliminate the use of the eight pesticides mentioned in Annex A. In practice this objective means that Belize will not allow the re-use or re-introduction of these substances, which are no longer in use and, further, will actively seek cooperation and means to manage and dispose of any existing obsolete stocks if any is either found or identified in the future. The pesticide strategy is supported by a concrete action plan.
- Belize will identify, label and remove from use the equipment using polychlorinated biphenyls (PCB) and make all efforts to minimize the risk to health and safety from the exposure to equipment containing PCB which are still in use. Further, Belize will make a concerted effort to manage and treat the PCB containing equipment and PCB substances by the agreed deadlines of 2025 and 2028, respectively. An accelerated phase-out of PCB is sought. The PCB elimination strategy is supported by a concrete action plan.
- Belize will restrict the application of DDT in disease vector control when in utmost need only, if ever, and apply it in accordance with the World Health Organization recommendations. However, Belize will actively continue to work on alternative methods and substances to replace DDT. To safeguard against a national crisis, however, Belize will seek an entry of DDT in the register of exemptions as established by the Stockholm Convention. However, Belize is aware that entry to the register is a temporary action that doesn't replace the efforts to phase-out and eliminate the use of DDT.
- Belize will identify the known and assumed sources of the production of dioxins and furans and will further put extensive efforts and other

resources to reduce the unintentional production by adopting the Best Available Technologies (BAT) and the Best Environmental Practices (BEP). The strategy is supported by concrete action plans covering the most important and critical emission sources.

### **3.2.1 OPERATIONAL OBJECTIVES**

The implementation strategy consists of five major components covering the operational objectives for the management, phase-out and elimination of POPs; these five components are:

- a) Development and enabling of the necessary legal and administrative framework including public awareness of the affected stakeholders, as well as non-sector specific support activities such as information exchange, monitoring and reporting so as to inform the international community and the parties of the Stockholm Convention of the actions that Belize is taking to keep abreast of ongoing developments.
- b) Management of POP pesticides and their obsolete stocks,
- c) Management of unintentional production of dioxins and furans,
- d) The management and elimination of PCB, and
- e) Management and/or elimination (as appropriate) of DDT in vector control.

The overall strategy to fulfill the objectives established above will consist of a combination of several measures including direct government involvement (regulations and law enforcement efforts), support to the local stakeholders, direct market instruments such as possible subventions and tax-breaks, as well as establishing international cooperation and co-funding.

An essential part of the POPs management and phase-out efforts is the regional and international cooperation regarding both the impacts assessment as well as the management and phase-out measures, both regulatory and technical. The major, tangible implementation strategies are supported by action plans and largely quantified programs and projects while some activities still require further elaboration and designing within the proposed strategy before being converted into more tangible actions and projects. Further, the important support activities such as monitoring, reporting and POPs related research and development are also addressed.

### 3.2.2 PRIORITIES

The overall strategy is based on national priorities, which have been set, based on consultations and other discussions involving all the relevant stakeholders. Before setting these priorities the NIP compilation process made efforts to provide all stakeholders with complete information regarding the current status, the known facts and the estimated impacts using legal and regulatory requirements, estimated and/or known environmental and ecological impacts, human exposure and urgency as priority criteria. The priority setting should not be an expression of an interest group policy but a balanced view representing the whole community and thus covering the purposes expressed in Article 3, Article 7, Article 10, Article 11 and in Annex A of the SC. The set priorities aim to express also realistic implementation opportunities.

Priorities indicate the POPs categories and sources which should be tackled first. Priorities should take into consideration the risks and adverse impacts the POPs have or may have in people and in the environment. Environmental impact usually includes the potential impact to humans but in a more indirect and long term manner.

To set priorities one has to have certain criteria, a model to screen, assess and justify for outsiders why some target or action is prioritized. This priority setting report is based on the POPs inventory and the assessment of the possible adverse impacts, prevalent and forthcoming, of POPs. Further, background information and views for the priorities was collected from the two steering group/stakeholders' seminars held in November 2007 and March 2008. At these meetings the participants expressed their views of the status of POPs in Belize. However, the information about the various POPs chemicals is not accurate and, therefore, the impacts and possible risks to the people and environment cannot be analyzed in detail. This means also that the priorities can be based on qualitative classification only. When setting the priorities the following criteria (1-3) have been considered:

1. Reducing human exposure and risks:
2. Reducing ecological exposure/risk
3. The urgency to address the POPs impacts

Since Belize hardly has any POPs hot spots and immediate problems that would result risks to human health, it is reasonable to initiate the POPs management by activities, which serve the immediate needs as well as

the long-term objectives in POPs management and phase-out. The support to the on-going activities of the POPs implementation unit at the Department of Environment, as well as initiating public awareness programs can be considered urgent as well as pragmatic activities, which can be initiated immediately. The necessary administrative structure, as well as supporting structures (such as steering committee), are in place to continue the POPs program implementation as envisioned in the NIP. Regarding the public awareness program the NIP background work resulted in a well-elaborated awareness program, which has been summarized in the NIP document.

Noting the large size of the proposed solid waste management project, it is recommendable that the preparation of the project is initiated immediately. To make the physical interventions (waste management arrangements, logistics improvements), which really affect the POPs status will in any case take several years.

Presently, medical waste is being incinerated at one hospital. Improving this process and extending it to cover other hazardous waste fractions is feasible, but should be supported by institutional arrangements, especially those, which regulate hazardous waste.

PCBs obviously do not present any acute problem but it is advisable that the small project managing PCB containing equipment is initiated immediately when the POPs Unit at the Department of Environment is capable of regulatory and guidance work.

Handling POPs pesticides is related to public awareness. The issue is not so much about the POPs pesticides as currently existing substances but mainly about mitigating the adverse impacts of their past use and storage.

Green harvesting of sugar cane is initially an experimental project involving both new technology but also a culture change; burning the biomass is an old and accepted practice that replacing it by a new and uncommon practice will certainly take a long time.

In summary the proposed priority order of the planned actions are as follows:

1. Extended support to the POPs Implementation Unit at the Department of the Environment,
2. Public awareness and training program,
3. Solid waste management program,

4. Medical/hazardous waste incineration facility,
5. PCB management,
6. Management of POPs pesticides, and;
7. Green harvesting of sugar cane.

The above order does not reflect the implementation possibilities and finance opportunities. Also the implementation of the projects is mutually very interdependent except that the first two are, at least to a certain extent, necessary for a reasonable implementation of the other projects. In terms of volume, PCB management and POPs pesticides management are quite small.

### 3.2.3 TIME SCHEDULE

**Figure 3.1:** Summarizes the overall time schedule for the National Implementation Plan for managing and phasing out of POPs in Belize.

Actions Time	2008	2009	2010	2011	2012	2103	2014
<i>Strengthening of Stockholm Convention Focal Point Strategy and action plans for the management and phase-out of POPs pesticides:</i>							
1. Amendment of the Existing Legal Instruments and Strengthening Pesticides Law Enforcement	X	X					
2. Strengthening the Capacity to Handle POPs Pesticides and Contaminated Sites		X	X				
3. Raising Awareness of POPs Pesticides with Particular Reference to Waste and Contaminated Sites		X	X				
4. Undertaking Ecologically Sound Measures to Eliminate Obsolete POP Pesticides				X	X		
<i>Strategy and action plans for the management and phase-out of PCBs (within the operational framework of the Belize Electricity Limited).</i>							
1. Develop Legal Instruments and	X	X					

Technical Guidelines for Managing PCBs						
2. Comprehensive Inventory of Equipments, Accessories and Articles Consisting of, Containing, or Contaminated with PCBs.	X	X				
3.ESM for in use equipment			X			
4.Environmentally Sound Management during Maintenance and Repair of PCB Containing Electric Equipments			X			
5.Strengthening Laboratory Capacity for PCB Analysis				X		
6.Environmentally Sound Management (ESM) for obsolete equipment			X	X		
7. Capacity Building for Awareness Raising Strategy and action plan for the management and phase out of DDT:			X	X	X	
1. Country Needs Assessment	X	X				
2. Institutional Operational Research			X	X		
3. Monitoring and Evaluation of DDT Alternatives			X	X		
4. Public Awareness and Community Participation Strategy and action plans for the management and phase-out of dioxin and furans releases:				X	X	X

1. Policy and Legal Framework for the Management of Unintentionally Produced POPs (UPOPs)					X	X		
2. Capacity Building and Technical Support.					X	X		
3. Municipal and Hazardous Waste Management							X	
5. Public Awareness and Technical Networking						X	X	
6.								X
7 Inventory of Unintentionally Produced POPs				X	X			
8. Medical Wastes Management								
Support activities: Information exchange, monitoring, reporting	X	X	X	X	X	X	X	X

### 3.2.4 COORDINATION

The POPs chemicals are scattered over several economic sectors as well as over a very wide geographic area in Belize. The coordinating strategy is to have all the efforts coordinated and monitored by one institution within the Government, i.e. by the Department of the Environment (DOE), while at the same time allowing the various sectors (public and private) to implement the individual activities in a smooth and coordinated manner. The existing coordination unit (PMU) does not have any further mandate to coordinate the implementation of the NIP. However as indicated in section 3.3.1 the DOE capacity should be strengthened to establish a POPs Program to safeguard the utilization of results already achieved and to serve as a coordinating body within the government and, as appropriate, within other agencies. Hence the DOE will be the lead agency in the implementation of the NIP and associated actions that include:



1. Undertaking regular monitoring and evaluation of the NIP implementation.
2. Updating the NIP after a period of five years or earlier if the prevailing political situation in the country necessitates this action.
3. Coordination the execution of action plans.
4. Facilitate fund raising for the project proposals in the present NIP.
5. Facilitate information exchange with the General Secretariat of the Convention and the other relevant agencies.
6. Act as a National Focal Point for all information database and dissemination pertinent to POPs.
7. Create linkages with international agencies to gain technical support on any recent advancement in the POPs issues.

### **3.2.5 MONITORING AND EVALUATION**

The Monitoring and Evaluation of the implementation of the NIP will be undertaken by the DOE and the funding agencies (national and/or international), through consensus workshops. The purpose of the monitoring and evaluation process is to measure the impacts of the activities of the proposed action plans to determine the level of achievement that has been reached towards the elimination of POPs.

### **3.2.6 NIP UPDATING AND REPORTING**

The DOE will report to the Stockholm Convention Secretariat on a regular basis or as required by the Secretariat. Updating will be every five years or as the political situation dictates.

### **3.3 SECTORAL STRATEGIES AND ACTION PLANS**

#### **3.3.1 STRENGTHENING OF STOCKHOLM CONVENTION FOCAL POINT (DOE)**

Belize initiated the POPs management issue by appointing the Department of the Environment (DOE) as the National Focal Point to implement the Stockholm Convention and Convention related activities. An enabling activity project was established in the beginning of 2006 which resulted in the creation of the Project Management Unit (PMU). This project made a basic assessment of the POPs issue in Belize as described earlier in chapters 1 and 2 of this report. The project has conducted a preliminary quantification of the POPs chemicals, their location and emissions, and assessed the adverse impacts on the population and the different ecosystems. The project has also created an extensive contact network and identified all major relevant stakeholders regarding further actions. A national as well as an international network of experts and resource persons as well as a data/knowledge base has been created. This initial exercise has been very encouraging and has delivered background information, information on potential solutions, framed the economic and financial context as well as made an estimate of the resource needs. In the future, the POPs related mitigation, management and phase-out activities will gradually turn to sector-specific actions and programs.

As part of the national commitment to meeting its obligations under the Stockholm Convention and ensuring the effective implementation of the National Implementation Plan, there is the need to monitor, coordinate, and provide technical assistance by a unit dedicated solely to achieve these objectives. This implementation unit is also to be in charge of raising public awareness and providing public education. The proposed long-term source of funding is the Environmental Tax through the Annual Budget. Initial funding will be sought through GEF in order to start up the unit in a timely manner as an incremental cost.

It is being recommended that the implementation process remains within one organization, i.e. the DOE, which will not only manage the Convention related formalities but manage the overall POPs issue, coordinate and balance the efforts and monitor the progress. The implementation involves extensive cooperation with the external partners, the funding agencies and other donors. The implementation of the Convention will include specific technical projects and interventions whose implementations will require specific technical and scientific skills as well as introduce new industrial practices.

General public awareness of the POPs issue is important. However, the main awareness-raising efforts will be specific and sectoral. It is also envisaged that the current Environmental Protection Act (2000) and the Pesticide Control Act (2000) will address the POPs issue and any new environmental concern whenever they arise.

The DOE is the best agency to serve as a formal focal point (involving monitoring and reporting) towards the Stockholm Convention. Therefore, it is proposed that the DOE will establish a specific POPs Program to encourage the utilization of the results already achieved and to serve as a watchdog within the government and, as appropriate, within other agencies. This proposed program should last approximately three years to initiate the implementation of POPs related activities. It is estimated that within these three years the POPs management strategies will become routine activities and the activity turns to more sector specific issues. The program should continue to maintain the already established institutional relationship through the Project Steering Committee (PSC), which has proved to be a very good advisory board in regards to the POPs issue. The PSC membership might be restructured in the future to cover other sectors such as industries, businesses and special interests having an increasing role in the further implementation of the SC. It is essential that the roles and responsibilities of the governmental and semi-governmental bodies be instituted, for a period of five years, by the Ministry or by the National Assembly and provides it with the necessary powers and resources. The membership of the PSC and their responsibilities should cover at the minimum the following:

*Department of the Environment*

Overall coordination and monitoring, budgeting and financing.

*Ministry of Health*

Updating and amending of regulatory framework governing waste management, active monitoring and supervision of all waste management related operations, support effort to identify and develop DDT alternatives for malaria control.

*Labor Department*

Enhancement and promotion of cleaner, better practices, and good housekeeping at industries and encourage the application of best available technology and best environmental practices in new and existing establishments. Review and update the occupational safety and health related regulations regarding the exposure of workers to the POPs.

*Attorney General Ministry*

Facilitation to enact new legislation or amend existing legislation.

*Ministry of Agriculture (Pesticide Control Board)*

Updating of the pesticides related regulatory framework to include stricter rules regarding the handling of pesticides, Strong support to transport obsolete pesticide stocks to a central site for final destruction.

*Ministry of Finance (Customs and Excise Department)*

Training of Customs Officers in the import/export regulations and procedures of POPs and other hazardous chemicals. Secure co-financing and feasible finance related procedures.

*Civil Society Groups and NGOs*

Public awareness and advocacy.

*Research Institutions and Universities*

Research on impact of POPs (social and ecological), development of alternatives for POPs, and public awareness.

The program requires one professional to head the unit, one to two persons as support staff, and a part-time national consultant as well as a budget for information exchange/gathering through participation in relevant international seminars and other such functions. The government through the DOE will provide office space and other such facilities.

The main activity of this program is to strengthen DOE's capacity to act as the focal point for the implementation of the Stockholm Convention to include:

- Coordination of sectoral efforts and activities,
- Liase with national, international and regional organizations,
- Seek funding from local, regional and international organizations,
- Insure a smooth and successful NIP implementation.

The proposed budget for running the program for institutional strengthening for DOE is estimated as US\$576,000.00 for the first three years.

### **3.3.2 STRATEGY AND ACTION PLANS TO MANAGE AND ELIMINATE POPS PESTICIDES AND MITIGATE THEIR ADVERSE IMPACTS**

Annex A includes substances generally used as pesticides. The PCBs (also included in Annex A) is handled separately. The quantity of obsolete POPs pesticide stocks is approximately 10 Kilograms. The country has two storage sites containing obsolete POPs chemical stocks. One site contains only DDT (~ 14 tons) while the other site (managed by the Pesticides Control Board) has various unidentified chemicals including the 10 kilograms of POPs pesticide. Both sites present a soil pollution problem, the extent of which depends on several factors like the site location, technical condition of the stores and also on the management practices imposed while handling the pesticides. There is no data on the volume of contaminated soils in the immediate vicinity of the stores.

A more difficult and far reaching problem is the issue of the POPs pesticides residues in the environment. The application of POP pesticides in agriculture and for vector control, the transportation and handling of these chemicals, and through the emission from storage by wind and floods etc. may have its effect on polluting the ecosystems. There have been few studies of POPs residue concentration in environmental samples such as surface water, ground water, fish, animal and human tissues, milk and edibles.

The overall strategy regarding the management of Annex A POPs and their adverse impacts covers the following: Additional local research (data collection, surveys, and analysis) on the current status in order to assess the extent of the problem and the actual extent of the impacts on the ecosystem and the people. Further, the current obsolete stocks should be carefully handled and managed to avoid any further spillage and spreading. The abovementioned improvements can be achieved through regulatory measures, training, improved management practices and making people aware of the immediate risks pertaining to being in contact, directly or indirectly with the current stock and the items stored or contaminated with these substances. Establishing a system of threshold values (adapting international accepted standards) for levels of these chemicals in foodstuffs and environmental media is important.

Based on the above strategy considerations the following four actions (3.3.2.1 – 3.3.2.4.) are proposed:

### **3.3.2.1 Amendment of the Existing Legal Instruments and Strengthening Pesticides Law Enforcement**

The current legal instruments of interest are the Environmental Protection Act (2000), the Public Health Regulations, and the Pesticides Control Act. These three acts were promulgated before the issue of POPs and the international conventions covering them became a national issue. These existing legislations must be reviewed, assessed and amended by the competent authorities to include the management of POPs, improve their effectiveness in eliminating the use of POPS chemicals and to remove any conflicts that may hinder the implementation of the SC.

The FAO issued the International Code of Conduct on the Distribution and Use of Pesticides which is a global guidance document on pesticide management for all public and private entities engaged in pesticide management and use. This code should be formulated into a statutory instrument within the PCA legal framework.

The following activities are proposed to be included in this action:

- Establishing a legal team comprising a representative from the Solicitor General's Office, as well as experts representing the DOE, MOH, MAF, PCB, University of Belize, and industry to review and assess the existing legislations on hazardous waste and specifically on POPs chemicals.
- Updating the existing legislation and developing proper instruments for pesticides in general and POPs in particular.
- Developing rules (codes of conduct) and regulations (including storage/stocking systems) for the management of pesticides.

### **3.3.2.2 Strengthening the Capacity to Handle POPs Pesticides and Contaminated Sites**

The persons who are actively involved in the management of pesticides and related activities need extensive training and skill development programs. Such programs are very beneficial and can actually introduce better practices at the operational level. The laboratory capabilities need to be upgraded to be able to offer the services needed to analyze for POPs. The pesticide outlet workers as well as formulators need some level of training regarding the handling of POP pesticides. Based on the above considerations the following activities are proposed:

- Training plant protection officers and field extension agents (training of trainers) to equip them to train the farmers and other users including agrochemicals suppliers and sellers.
- Upgrading the laboratory capacities in the relevant institutions (BAHA) and training of laboratory staff in POP pesticide related analysis techniques, methodology and instrument use.

### **3.3.2.3 Raising Awareness of POPs Pesticides**

The POPs pesticides have not been of great concern to the majority of the population of Belize. Pesticides are seen as inherently benign, in the same way that medicines are. Wide-scale information and training is needed to increase the level of caution and gain support for the phasing out or ban of these chemicals.

All the good practices as well as mitigation options when introduced, are not enough to combat the adverse effects including the avoidance of risk if there is no public awareness of the problem. Those directly exposed (farmers, applicators, farm workers as well as people living in the areas where the obsolete stocks and contaminated soil occur) need to be sensitized to avoid risks, both current and future, and to contribute to the environmentally sound management practices.

It is important that the information reaches all groups, including women and children particularly those who are working in agriculture. Training of school teachers and provision of appropriate teaching materials is, therefore, vital.

While the assessment of pesticides did not identify any specific hot spots, there is at least one storage area in the vicinity of a densely populated residential area (Belmopan City), where some concrete awareness activities are obviously beneficial. These actions might include erection of physical barriers, warning signs and advisories to the local people and especially children to avoid contacts with the contaminated substances and equipment.

**Based on the above considerations the following activities are proposed:**

- Preparation of relevant training materials with approved contents and practical aspects of the management of pesticides
- Media campaigns (TV, radio, newspapers)
- Training of trainers in the agricultural sector.

- Training of applicators (farm workers, foremen, local field managers).
- Include pesticide management within the teaching curricula of the Faculty of Agriculture and Natural Resources of UB.

#### **3.3.2.4 Undertaking Ecologically Sound Measures to Eliminate Obsolete POP Pesticides**

The preliminary inventory of the obsolete pesticides needs to be updated to include all details on the quantities of the pesticide substances, volume and condition of containers and the quantities of the contaminated soils (if available) to design a detailed action plan for the effective and efficient management of these stocks. The current conditions of the pesticide stock as well as the containers, present a risk both to the people as well as to the environment. The people handling the substances and equipment must be well trained (and provided with proper protective equipment) in the appropriate methods and practices. Planning for the overall management of these chemicals is necessary to safeguard good results and to avoid the transfer of the problem and potential risks from one place to another.

The Government does not at this time have any project for the final disposal of POPs pesticides (even though there is a GEF-DDT project that will dispose of the obsolete DDT stock). However, this is feasible given that the known volumes of obsolete POPs pesticides are very small (10 Kg).

The following activities are proposed:

- Updating the inventory of obsolete POPs and other pesticides.
- Training on handling of POPs and obsolete pesticides, damaged and empty containers and contaminated soil.
- Repacking of obsolete pesticides and transportation to a final disposal site.



### 3.3.3 STRATEGY AND ACTION PLANS TO MANAGE AND PHASE-OUT PCBs

The Belize Electricity Limited (BEL) is responsible for the generation, transmission and distribution of electricity supply throughout the country, with the exception of the Corozal Free Zone. Generation of electricity is also done by a number of companies however they sell excess electricity to BEL. For the most part, therefore, PCB related activities are derived primarily from the activities of BEL, which is administratively and technically quite competent to manage these activities.

The BEL is a private company which previously was a Statutory Board called the Belize Electricity Board. They have continually been providing electricity to the country of Belize for the last 100 years. The BEL owns most of the transformers in Belize (99%). The majority of these transformers (approximately 5000), are for the distribution of electricity. Technical management of PCBs and PCB related activities is accomplished by a team of BEL personnel. These management activities include:

- Supply of new PCB free transformers.
- The purchase of mineral oils.
- Maintenance of the equipment.
- The removal of mineral oils from obsolete and damaged transformers.
- Phasing out of the apparatus at the end of their lifetime:
- Storage and disposal of equipment.
- Storage and disposal of oil.

BEL has a formal environmental procedure regarding PCB management. Starting in the late 1970's the then BEB implemented a plan to gradually phase out the use of PCB containing transformers. This took the form of buying only PCB free transformers to use in new electrified areas as well as to replace damaged existing transformers. Therefore, the issue of PCB has up to this point only been a concern of BEL. The National POPs Inventory and the subsequent seminars and training have created an awareness of the need for the environmentally sound management of PCBs and PCB containing equipment.

The overall strategy regarding PCB containing and contaminated equipment is to include it as part of the overall environmental management plan of BEL. This plan will be modified as necessary so that it complies with the requirements of the Stockholm Convention and other environmentally sound practices as approved by the DOE.

BEL is charged with the responsibility of supplying electricity to the entire country. With a growing population and increasing demand for electricity, this means that BEL has to be continually expanding the generation, transmission and distribution of electricity to clients, households, and industries. This expansion necessarily involves the adoption of technical and technological improvements and new practices. Environmentally sound management will play an important role in the everyday business and the adoption of these new technologies should not result in an extra burden or cost. It is expected that BEL will continue to implement the PCB management and phase-out policy as an on-going component of its management plan in a manner which will result in the achievement of the relevant goals of the Stockholm Convention earlier than may be required.

BEL policy requires that its customers using privately owned transformers replace these with PCB free transformers when they become inoperable. As part of its management plan BEL will only sell and use PCB free equipment. When PCB containing equipment is found the private owners are informed of the need to replace these equipment. This not a statutory requirement but enabling legislation is expected to be promulgated.

Based on the above strategy considerations the following five actions (3.3.3.1. – 3.3.3.5.) are proposed. The actions elaborated are aimed to support BEL in their PCB management plan. The proposed actions do not include any equipment procurement or activities which would subsidize the basic operations such as electricity generation, transmission and distribution. In consideration of the existing management plans, BEL operations can continue to achieve the objectives of the Stockholm Convention.

The proposed five actions are listed as follows:

#### **3.3.3.1 Develop Legal Instruments and Technical Guidelines for Managing PCBs**

The issue with PCBs is primarily related to the interests to BEL and the DOE. The PCB issues, however, became a national issue with the Country signing the Stockholm Convention in 2002. The various aspects of PCB management particularly import, export, use and restriction, and protection of health in general need to be defined and addressed within an existing legislation such as the EPA.

New laws and regulations may be necessary to address these issues. New enforcement and regulatory mechanisms may also need to be established to formalize the present PCB management plan within the mandate of the DOE.

The following activities are proposed to develop the legislation addressing PCB management:

- Formation of a legal and technical working group including all PCB stakeholders to, among other things, study existing legal instruments related to PCBs management for further development and improvement.
- Development of legal instruments, and formalization and or improvement of guidelines, standards, MOUs as required for the proper and effective management of PCB related issues.

### **3.3.3.2 Inventory of Equipments, Accessories and Articles Consisting of, Containing, or Contaminated with PCBs**

The phasing out program put in place in the late 1970's has resulted in most of the transformers in use today being PCB free. However, most of the older transformers have not been tested. It is suspected that less than 5% of transformers in use today may contain or be contaminated with PCB. Additionally, the greatest effort has been placed in replacing transformers while other equipment and articles have not been thoroughly inspected. As a result a comprehensive inventory is needed. This is essential as a method to safeguard the health and safety of the maintenance workers and the public at large. The purpose of the inventory is to gather information on the equipment contaminated with PCB, countrywide as well as the magnitude and distribution of the problem. All necessary actions to eliminate the use of PCB containing equipments will be dependent on this comprehensive inventory.

The following activities are proposed as part of the inventory:

- (i) Review of previous inventory reports (if available).
- (ii) Training the people needed for conducting the inventory.
- (iii) Make available inventory equipments (GPS, sampling equipment, protective items).
- (iv) Conduct Inventory.

### **3.3.3.3 ESM for in use Equipment**

The ongoing PCB management plan has resulted in virtually all the transformers in use today being PCB free. Several privately owned transformers have however been identified as containing PCBs. It is also possible that some of the BEL owned transformers may also contain PCBs. These would more than likely be those older transformers installed before 1980. BEL has also taken the policy to not repair PCB containing transformers. However the handling, storage and disposal of PCB containing equipments needs to be done in an environmentally sound manner that will protect the health and safety of the worker as well as result in a minimization of any contamination.

The application of all technical requirements related to ESM and the Stockholm Convention is required for these PCB containing equipments. These will include the use of a retention tank for the storage of dielectric fluids, remove from use broken transformers or transformers with high corrosion, and analysis of dielectric fluids for absence of PCB before repairing.

Detailed activities include:

- Apply ESM at selected sites (based on previous inventory).
- Develop the practice of replacing transformers highly contaminated with PCB.
- Undertake initial assessment of electrical equipment and articles containing and/or contaminated with PCBs.

### **3.3.3.4 Environmentally Sound Management (ESM) of Obsolete Equipment**

Belize has limited capacity to manage obsolete electric equipment and articles containing or contaminated with PCBs. This is compounded by a lack of knowledge among potential risk groups. The major risk groups would be those involved in recycling metal scrap and the dielectric oil from unknown PCB contaminated obsolete equipment. The sale of equipment to scrap metal operators should be prohibited unless they are PCB free.

The following activities are proposed:

- Identify and train stakeholders on ESM of the obsolete equipment (handling, transportation, storage, dismantling, pre-treatment, shipment of used PCBs abroad for disposal).
- Develop a strategy for the destruction and disposal of the obsolete electrical equipment, articles and wastes containing and/or contaminated with PCBs in compliance with ESM requirements (handling, transportation, storage, dismantling, pre-treatment and final disposal).

### **3.3.3.5 Capacity Building for Public Awareness**

Most of the population is unaware of the potential hazard to human health and safety posed by the use of PCBs. This is compounded by the fact that Belize does not have the legislation to regulate the use of PCBs. The technical staff of BEL working with PCB containing/contaminated equipment as well as other workers may be exposed to unsafe working conditions. Under the SC reporting requirements Belize will have to provide periodic updated quantities of PCB in use, decommissioned and disposed of. In order to comply with this regular reporting to the SC, it is necessary to conduct a comprehensive identification and inventory of the number of transformers until 2025. Since BEL is in charge of the entire electrical distribution network, the management staff must be trained for this specific purpose. Beside this, the general population of Belize and especially the electrical equipment repair personnel are lacking the adequate information about PCB risk and their mitigation measures.

The following activities are proposed:

- Identify the relevant information and awareness needs related to PCBs to be disseminated to the stakeholders.
- Develop media material on PCB issues.

### **3.3.4 STRATEGY AND ACTION PLANS TO ELIMINATE DDT USE IN VECTOR CONTROL**

Belize has not applied DDT in the control of malaria since 1997 but has instead relied on integrated vector control, careful monitoring of the malaria transmission parameters, public awareness in areas of high incidence, and international cooperation and information exchange, mainly with the WHO and GEF.

Belize is cooperating at the regional level with the other Central American Countries and Mexico in using a regional approach to combat the incidence of Malaria. Various factors affect the rate of malaria incidence in Belize including migration patterns, weather conditions, creation of new communities in areas with high mosquito populations (such as marshlands) and the lack or refusal for prophylactic application of insecticides. Knowledge of these requirements stated above is fundamental to the development of integrated vector management, which bases itself on an ecosystems approach. Strategies aimed at reducing disease transmission while maintaining or restoring ecosystem integrity is therefore needed.

Belize will maintain DDT in the Registry (Art. 4, Register of specific exemptions) to enable the exemption from the restriction of use of DDT as stipulated in Annex B, Part I. However, this requested exemption will be a precautionary measure to enable Belize to introduce DDT in case other malaria combating measures are deemed ineffective. Any future uses of DDT will follow the stipulations mentioned in Annex B, Part II.

Belize has regulations in force as well as a mechanism (regulated by the Ministry of Health (National Malaria Service) and the Ministry of Agriculture (Pesticides Control Board), which ensures that DDT, if re-introduced, will be used for disease vector control only.

Belize is applying, in cooperation with the WHO and the GEF/DDT Central American Project, the Integrated Vector Management (IVM) concept, which involves routine insecticide resistance monitoring, regularly conducted exercise using WHO Susceptibility Test Kit and Methods. Environmental management as a component of IVM must receive great attention and concern.

A significant portion of the malaria control budget is spent on the purchase of anti-malarial drugs. With an IVM program in place this money could best be utilized to sustain a long term multi-pronged preventive program instead of the curative one.

## **COMPONENTS OF THE ACTION PLAN**

### **3.3.4.1 Country Needs Assessment**

WHO in its efforts to find alternatives to DDT in the Central American Region has initiated a project to support these countries in discontinuing the use of DDT and the introduction of IVM as an alternative to DDT. This project includes a country needs assessment, the packaging and disposal of obsolete DDT stockpiles and the development of an action plan to strengthen IVM capacity in selected hot spots. This project is being funded by GEF and also has the participation of Mexico and Panama.

### **3.3.4.2 Institutional Operational Research**

Primary research is essential to the development of integrated pest and vector management strategies (IPM/IVM). Joint agriculture (FAO) and public health (WHO) initiatives should be developed, including research on alternatives to pesticides and pesticide resistance management.

The activities of this phase are as follows:

- The potential and operational implications of environmental management for malaria reduction in urban and rural areas.
- Evaluate integrated vector management schemes. Compare their cost effectiveness and sustainability with single method approaches.

### **3.3.4.3 Monitoring and Evaluation of DDT Alternatives**

There is a need to ensure that the discontinuation in the use of DDT is not causing adverse impacts on the health status of the population. In addition the efficacy and appropriateness of alternatives to DDT, including integrated vector management (IVM), must be verified and validated.

The activities of this phase are as follows:

- Revise, update, and standardize protocols for analysis and data reporting
- Monitor efficacy and appropriateness of alternatives to DDT, including IVM.
- Collect information on the cost increment of alternatives (i.e. the cost margin over and above the cost of DDT), for purposes

of subsidizing the cost increment through a financial mechanism.

#### **3.3.4.4 Public Awareness and Community Participation**

The Stockholm Convention is a global treaty to protect human health and the environment from the harmful impact of POPs. Community awareness and involvement in this respect is indispensable.

**The activities of this phase are as follows:**

1. Preparation of suitable and practical training material on malaria control
2. Disseminate appropriate educational material on the impact of DDT on the environment and human health, and DDT alternatives for disease prevention and control, including IVM.

#### **3.3.5 STRATEGY AND ACTION PLANS TO REDUCE AND ELIMINATE RELEASES FROM UNINTENTIONAL PRODUCTION OF DIOXINS AND FURANS (UPOPS).**

Article 5 of the Stockholm Convention pertains to the measures to reduce and eliminate releases from unintentional production of POPs. This article states that Each Party shall at a minimum take measures to reduce the total releases derived from anthropogenic sources of each of the chemicals listed in Annex C of the SC, with the goal of their continuing minimization and, where feasible, ultimate elimination.

The inventory revealed that for the year 2006, approximately 88 gTEQ of dioxins and furans were produced. These were classified according to the recommended classification system. In Belize dioxins and furans are produced as unintentional by-products from various sources including waste incineration, uncontrolled combustion, vehicle emissions, wood burning, and lime production. The sectors that account for much of the unintentional release of these products are, waste incineration (48 gTEQ/A) and uncontrolled combustion processes (38 gTEQ/A).

The bulk of dioxins and furans were released to the air (63gTEQ/A) and land (24gTEQ/A) with a smaller percentage being deposited as residue (0.25gTEQ/A) (Figure 2.2, 2.3, 2.4).

The preliminary inventory shows that the following sources contributed less than 1% to the total production of dioxins and furans: occasional forest fires, open water dumping of wastes, and occasional landfill fires. The strategy to tackle UPOPs should be based on actions which are more source-specific and make the releases from sources more accurate.



Partially this requires new surveys and field measurements. However, all source categories are generally covered by existing Best Available Technology (BAT) and Best Environmental Practices (BEP) references, which can be successfully applied also to the Belize conditions.

Since Belize at the moment lacks the necessary regulatory framework to manage dioxin and furan releases in general, and further has limited information and knowledge base to manage the operation of these source categories; the proposed strategy consists of general actions to strengthen the regulatory framework and institutional capacity.

Secondly, several source categories are run as industrial or commercial activities on which the established BAT and BEP guidelines and recommendations can be applied. Several of the industrial and similar sources can certainly benefit from the cleaner production concepts, the application of which doesn't necessarily present cost increases but savings (in form of reduced raw material and energy inputs and reduced and/or effectively re-used waste) in a rather short time.

Medical waste incineration and the open burning of waste accounts for the largest part (86%) of dioxin and furan releases in Belize. Waste management and proper waste treatment is the key to the reduction of dioxin and furan releases in Belize.

Based on the abovementioned general considerations; the following eight actions (3.3.5.1. – 3.3.5.8) are proposed. The actions elaborated are aimed to principally support the Government in its regulatory, advisory and monitoring role, but also the owners and operators of these source categories.

#### **3.3.5.1 Policy and Legal Framework for the Management of Unintentionally Produced POPs (UPOPs) and other hazardous waste**

Belize has ratified the Stockholm Convention, made inventories and preliminary assessments of the issue of the unintentional production of dioxins and furans. However, there is neither a policy nor a legal framework to manage, regulate or take other measures to control the UPOPs. The current regulatory framework consists of overall guidelines in the EPA and the Public Health Act (PHA), which at the moment have no enforcement capacity.

In order to develop a consistent policy and a legal framework to govern the key aspects of production, a long term management and phase-out strategy for UPOPs is needed.

In formulating this section on POPs the following issues should be clearly highlighted.

The open burning of waste:

- In principle, open burning should simply be prohibited; however, there are practical considerations that speak to the wisdom of defining guidance for open burning with the provision that it should be minimized and eliminated as soon as, and wherever feasible. Those considerations include lack of alternative disposal or recovery methods due to nonexistent or inaccessible infrastructure. In addition, sporadic open burning may be necessary for sanitary disposal of unusual material, to control pathogens or pests, or in the cases of imminent disasters or emergencies.

- The support for the establishment and implementation of a proper waste management system is a major task and should be a critical component in the action plan of the Stockholm Convention NIP for reduction of UPOPs in Belize. The Government at all level should work diligently to establish and implement sound practices including resource use reduction, reuse, recycling, composting, modern sanitary landfills, and BAT incineration. Convention implementation efforts and the Convention financial mechanism could be used to support the establishment of model waste management systems as alternatives to open burning.

- The industrial sources of dioxin and furan releases (BSI and medical waste incineration) are associated with production of flue gas, fly ash, bottom ash, dust and particulate matter emission. Therefore, all regulations, which address these mentioned emissions, but not necessarily the emissions of dioxins and furans, most likely affect these latter emissions, too, i.e. overall reduction of industrial waste will certainly reduce the volume of UPOPs.

The following activities are proposed:

1. Situational analysis of the existing related regulatory mechanisms and the capacities of the concerned institutions.
2. Identification of gaps and requirements for sound management of UPOPs
3. Amendment of the existing regulations and/or formulate new ones based on the report findings.
4. Conduct workshops and seminars with participation of all stakeholders to endorse and disseminate the amended and the new regulations related to the sound management of UPOPs.
5. Produce and disseminate guidelines for all stakeholders and conduct training for the appropriate personnel.

These actions will result in new regulations and enforcement strategies to make decisions on mandatory reduction of open burning practices of municipal wastes, for establishing a national body for continuous monitoring and reporting on UPOPs releases (under the NSWMA), and to introduce health and safety protection and technical measures for existing installations.

### **3.3.5.2 Capacity Building and Technical Support**

Since the UPOPs issue is a relatively new issue for most institutions and organizations, which technically can control the production of UPOPs, more extensive technical background is necessary to handle the UPOPs issues to guarantee that the regulatory measures as well as BAT and BEP considerations are based on sound knowledge. To achieve this, the following activities are proposed:

- (1) Assessment of the related needs in the different institutions and relevant sectors.
- (2) Establishment of efficient means to exchange information and technology with relevant institutions abroad.
- (3) Encourage training/research, both locally and abroad, on environmental engineering, waste management, environmental policy, emission monitoring, waste water management and infrastructure planning.
- (4) Build up a comprehensive monitoring programme which should include:
  - Type of emission to be covered by monitoring.
  - Sampling equipment to be employed in order to cover a wide range of emission with minimum effort.
  - Training of local technical staff in sampling methodologies.

- Establishment of a continuous data reporting and management system in the field of UPOPs.

### **3.3.5.3 Municipal and Hazardous Waste Management**

Waste management and waste treatment are key issues in the UPOPs production in Belize. The open burning of waste accounts for some 38% of the total UPOPs production. Addressing this issue requires a combination of some regulatory interventions mainly in the field of personal behavior and technical development. This is against the background that the increase of the waste volumes is unavoidable as well as the increase of hazardous waste.

Good practices in municipal waste management were initiated in all the District towns as well as in Belize and Belmopan City. At the moment this takes the form of having a garbage collection system in place.

The following activities are proposed:

- (i) Establishment of a technical team for the sound management of municipal waste (as part of the NSWA).
- (ii) Study of municipal waste composition in Belize (a preliminary study regarding the composition of the solid waste in Belize has been carried out, but a more in depth study is required).
- (iii) Promotion of municipal solid waste separation and collection.
- (iv) Evaluation of possibilities of reuse, reduce or recycle.
- (v) Assessment of the present practice of landfill or dumping of municipal waste.
- (vi) Development of landfill programs.
- (viii) Conduct training courses on landfill management of hazardous waste for all municipalities.
- (ix) Establish a technical team to identify and evaluate sources of hazardous waste.
- (x) Establish a collection system of hazardous waste (under the NSWA).
- (xi) Evaluate the possibilities of recycling and reuse of hazardous waste.

### **3.3.5.4 Public Awareness and Technical Networking**

Several of the tasks related to the application of Best Available Technologies and Best Environmental Practices (BAT/BEP) can be supported through a public awareness program. In addition to raising awareness, specific issues such as waste management issues and open burning of waste should be addressed. In addition, a specific public awareness process should be initiated for decision makers and for the

industry. This awareness raising program should be integrated into existing environmental education projects for the public (schools, television, flyers) and should not be conceived as a separate program specific only to POPs.

The following activities are proposed:

- Select a technical team from various stakeholders concerned in UPOPs to develop a public awareness program.
- Preparation of information and training materials.
- Organize and conduct training courses and seminars for target groups (decision makers, workers, managerial staffs, professionals and public in general) on UPOPs issues.
- Prepare publications, pamphlets and posters on topics requiring much public involvement, such as open burning.
- Establish a network for scientific and technical information on UPOPs.
- Establish focal points for public awareness at the municipal level.

### **3.3.5.5 Landfills and Hazardous Waste Co-incineration**

The present regulations are inadequate to prohibit disposal of hazardous, industrial and infectious wastes in the normal waste stream. At the moment all waste is handled in the same manner and the dumpsites are not equipped to separate waste.

The following activities are proposed:

- Develop a technical team from government officials, industry and NGOs.
- Evaluate the commitment of the facilities for their interest to use these waste fractions as secondary fuels (if applicable).
- Evaluate the options for separation from waste stream and collection methods.

### **3.3.5.6 Inventory of Unintentionally Produced POPs**

The inventory of the unintentionally produced POPs carried out for the NIP was a very preliminary one based on secondary data, estimates and calculations. It is necessary to plan and implement a more detailed inventory based on site assessment and interviews. This will result in concrete actions being developed including updating the inventory and creation of an operational database.

The following activities are proposed:

- Organize a team to conduct the inventory and review existing reports.
- Conduct the inventory on a regular basis (every 5 years).
- Generate database on unintentionally produced POPs.
- Evaluate the reduction or elimination of unintentionally produced POPs.
- Disseminate the results of evaluation to the concerned parties.

### **3.3.5.7 Medical Wastes Management**

The incineration of hospital waste has to be evaluated carefully since hospital waste normally contain high concentrations of PVC (high chlorine and heavy metal content) and are located in sensitive areas (near the hospital and inside residential areas). In hospitals, waste management incineration should be given preference over chemical disinfection for reasons of efficiency and environmental considerations. However, when incineration of hospital waste is considered, a program needs to be developed to include:

- Use of a centralized incinerator.
- Implementation of a BAT/BEP operation policy.
- Reduction/minimization of PVC.

The KMH already has an incinerator in place. Other medical providers either use this incinerator or transport their medical waste to the municipal dumpsites. Construction of a medical waste incinerator at the landfill will allow for all medical waste to be transported to one site. In the districts smaller incinerators can be employed.

The key to hospital waste treatment is an organized hospital wastes management system and the separation of waste fractions so that finally only minimized waste streams fall into the classification of hazardous

hospital waste. To this extent waste treated by autoclaving or incineration need further evaluation.

The following activities are proposed:

- Recruit a technical team from affected parties.
- Evaluate the present medical waste management system.
- Consider using the guidelines in the publication “Technical guidelines on the environmental sound management of biomedical and healthcare wastes” of the Basel Convention Secretariat and determine those guidelines suitable for Belize.
- Develop a strategy to implement a National Action Plan on Medical Waste Management.
- Conduct country-wide training on medical wastes management involving local authorities.
- Implement project on medical waste management.

#### **3.3.5.8 Green Harvesting of Sugarcane**

Approximately 65,000 acres of land are presently under sugarcane production. BSI has initiated a green harvesting of sugarcane project in the 3,000 acres of sugarcane that it owns. The economic benefits resulting from this current harvest are fairly negligible. However, positive financial benefits will result from the fact that the sugarcane will last longer before it spoils and will have higher sugar content than the burnt cane.

This change from harvesting burnt cane to harvesting green cane requires a change in harvesting technique. There is a need for the preparation of the fields with long rows, more stalks per unit area such as planting double row on beds, slightly raised and uniformly leveled beds, debris free fields, and so on. All this has to do with the efficiency of the harvest.

The following activities are proposed

- Form a working group from relevant stakeholders.
- Pilot project on green harvesting.
- Conduct awareness training among cane farmers.

### **3.3.6 ASSESSMENT AND MITIGATION OF RELEASES FROM STOCKPILES AND WASTES**

The stockpiles of obsolete pesticides and the mitigation of possible releases are assessed above in section 3.3.2. The DDT stockpile is slated to be repacked and to be transported out of the country for final destruction. It is expected that the 10 Kilograms of POPs pesticides will also be included thereby getting rid of all POPs stockpiles.

### **3.3.7 IDENTIFICATION AND MANAGEMENT OF CONTAMINATED SITES**

The preliminary inventory did not identify any specific contaminated sites (contaminated soil) except those used for storing pesticides, which have previously been discussed and the Belize City dumpsite. Some industrial sources of the unintentionally produced POPs can obviously be regarded as contaminated sites, but further and detailed inventory and measures are necessary to identify these sites and the degree of contamination. The issue is discussed in section 3.3.5.

### **3.3.8 STRATEGY FOR INFORMATION EXCHANGE**

Belize will actively participate and make use of opportunities available for the exchange of information provided by the Stockholm Convention. A crucial and instrumental information exchange forum is the WHO. It is envisioned that parts of the NIP will be implemented through the UNDP and UNIDO; therefore, Belize is actively liaising with these agencies regarding the financial and technological opportunities to combine the POPs related mitigation and management activities with other (e.g. cleaner production) on-going and forthcoming activities.

Regional cooperation with SICA calls for exchanging relevant information on disease vector control between countries.

### **3.3.9 PUBLIC AWARENESS, INFORMATION AND TRAINING**

Public awareness in general is discussed above in section 3.3.1 when presenting the sectoral and source specific implementation strategies. It is generally recognized that the public awareness as well as the availability of and access to the information will be very crucial in mitigating the adverse effects of the POPs. The main source categories of the unintentionally produced POPs, uncontrolled burning of waste and using wood and charcoal for domestic cooking, can be approached only



through public awareness and information campaigns as indicated in the concerned sections above.

Training is also recognized as a key issue, especially at this early stage of the implementation, when there is need for monitoring, technical information collection and other basic information on POPs. Training components are included in the action plans covering pesticides, PCB and unintentional production of POPs.

### **3.3.10 MONITORING**

The actual monitoring of releases (and potential releases) from all POPs sources (pesticides, PCB, unintentional production) is a key condition for the effective implementation of concrete management and elimination actions. However, Belize is not aiming to establish any comprehensive monitoring program at this time, but instead will enhance the technical capacity and training of the technical staff to be able to carry out the monitoring as indicated in the sectoral project proposals. Due to financial constraints the monitoring capacity to be developed will reflect the national priorities; uncontrolled combustion and waste incineration are to be monitored in the first instance.

### **3.3.11 REPORTING**

The reporting and compilation of the national reports/information for use by the stakeholders will be regularized. It is expected that Belize will compile annual reviews/monitoring reports to be discussed with relevant stakeholders. These reports will also make the basis for the regulatory report as referred to in Article 15.1 of the Stockholm Convention (“Each Party shall report to the Conference of Parties on the measures taken to implement...”).

Regarding the possible statistics to be provided to the Secretariat (Article 15.2) on the production, import and export of POPs, such reporting need is not foreseen (except in a very rare case that DDT should be imported for malaria/vector control). In case said occurrences happen the government will naturally provide the Secretariat with the appropriate information. In case the obsolete POPs pesticides and PCB are exported for final destruction the appropriate regulations of the Basel Convention will be followed i.e. any control actions or other activities will be notified to the Rotterdam Conventions as required.

### **3.3.12 STRATEGY FOR RESEARCH AND DEVELOPMENT**

The active implementation of the Stockholm Convention provides more applied research in Belize. The research is closely related to the improvement of the monitoring capacity. As mentioned above in section 3.3.10 the monitoring capacity and the inadequate analytical equipment present one of the most serious obstacles.

### **3.4 CAPACITY BUILDING AND PRIORITIES**

The proposed actions are based on clearly expressed priorities as described in section 3.2 above. The most urgent capacity building needs are related to the strengthening of the focal point and a public awareness campaign to sensitize the general public about POPs generally.

In regards to the human and environmental impacts the tackling of the UPOPs production contributes the most immediate and direct positive results.

### **3.5 TIME SCHEDULE OF IMPLEMENTATION AND FOLLOW-UP**

The majority of the actual implementation activities and interventions are planned for the time period of 5-7 years from present to 2015. During this period most of the regulatory and other legal issues should be addressed. Also the active POPs management and phase-out in the industry and businesses should be on-going for a few years.

The issue of the obsolete POPs pesticides should be fully assessed and planned within the coming five years including a firm plan for the final disposal of these substances. The awareness activities, mainly addressed to the people in direct contact with the obsolete stocks and their remains, should have been effectively implemented and resulted in such awareness and behavior that helped these persons to avoid the risks being impacted by the POPs.

Waste management, including managed landfills and proper treatment of industrial and hazardous waste should have been initiated. The PCB issue, including the replacement of the PCB containing transformers as well as the environmentally sound management of the in-use and out-of use transformers should be in place.

It is expected that the proposed institutional strengthening and capacity building project within the DOE will develop performance indicators and milestones for the NIP Implementation. The performance indicators to be developed are to observe the development of the impacts of the projects (including the amended regulatory framework) on the POPs releases and the observed exposure risks. Initially these indicators will be general in nature such as the number of trained people, collected waste volumes, number and spread of dioxin/furan sources etc. Milestones to be developed should serve as a time-wise measure of the project implementation.

The development of the technical project documents for the proposed programs should include clear measurable and observable, quantitative

performance indicators as well as time wise milestones clearly showing when such activities and other interventions are supposed to be accomplished.

The DOE (or other selected Focal Point) will continue its overall monitoring activities by arranging sessions/seminars at least annually reviewing both the implementation of the projects and the performance; i.e., the impact of the actions on the humans and environment and ecology. The DOE is also obliged to review the general POPs related policy and especially the development of regulatory framework and implementation of the subsequent legislation by the concerned governmental bodies. Furthermore, the DOE is supposed to review the priority order of POPs management and phase-out activities and to discuss and propose appropriate adjustments to it based on the actual development.

### 3.6 RESOURCE REQUIREMENTS

Total costs of the proposed actions and the related projects are summarized in table 3.16.

Table 3.16. represents the estimated costs of the proposed projects in the five action areas related to POPs.

The cost of the DDT elimination is through the DDT/GEF Central American Project. Most of the estimated costs are capital costs plus incremental costs. However, the following considerations can be made regarding certain sectoral cost items:

**Pesticides.** The small amount of POPs pesticide present does not justify infrastructure improvement of the storage facility of the Pesticides Control Board. However, if the FAO guidelines are regulated then this would require all establishments formulating, selling, or storing pesticides to upgrade their buildings.

**PCBs.** All the PCB related actions are run by the Belize Electricity Limited. Managing PCBs has been a normal part of their operation. The establishment of a PCB phase-out program in the 1970s means that any incremental cost at this time will be negligible. The possible non-incremental elements of the costs should be assessed in details when the concerned project proposals and documents are being prepared.

**UPOPs.** Unintentional production of POPs in the industrial sector can be often tackled by measures and investments, which increase efficiency and pay back very quickly. The budget estimates of the proposed projects presents capital costs as well as incremental cost of the activities related to the industries and it should be reviewed when the concerned project documents are prepared.

Belize understands that the Global Environmental Facility has opportunities to finance the majority of the incremental costs of the proposed projects. For industry related projects and their costs Belize will seek funding opportunities, (through UNDP, FAO, UNIDO), aiming to run cleaner production programs. Bilateral funding will be sought as appropriate. It is obvious that the opportunity to involve bilateral donors will increase.

Table 3.1: Preliminary Schedule and Cost Estimates for NIP Implementation

**STRATEGY: Strengthening Of Stockholm Convention Focal Point**

Activity	Lead/ other Agencies	Completion Date	Success Indicators	Source Management and Long Term Output Indicators	Cost Estimate US\$
<i>Action Plan: Implementation of Coordinating Body</i>					
Establishment of POPs Unit within the DOE	DOE	December 2011	Personnel hired	POPs Unit functioning	576,000

**STRATEGY: Manage and Eliminate Pops Pesticides and Mitigate their Adverse Impacts**

Activities	Lead/ other Agencies	Completion Date	Success Indicators	Source management and long term output indicators	Cost estimate US\$
<i>Action Plan: Amendment of the Existing Legal Instruments and Strengthening Pesticides Law Enforcement</i>					
Updating the existing legislation and developing proper instruments for pesticides	PCB, Sol Gen	December 2009	Legislation reviewed & enacted	Proposals presented to government for acceptance	20,000
Developing rules and regulations for the management of pesticides.	PCB, DOE	December 2009	Guidelines developed & approved	Rules and regulations adopted	10,000

<i>Action Plan: Strengthening the Capacity to Handle POPs Pesticides and Contaminated Sites</i>					
Training plant protection officers and field extension agents.	MOA, PCB, UB, CARDI	September 2009	Training of trainers workshop held	Trainers conduct training for farmers	50,000
Upgrading the laboratory capacities in the relevant institutions (BAHA) and training of laboratory staff in POP pesticide related analysis techniques, methodology and instrument use.	BAHA	December 2010	Assessment of laboratory capacity	Purchase of supplies Analysis performed	50,000
<i>Action Plan: Raising Awareness of POPs Pesticides with Particular Reference to Waste and Contaminated Sites</i>					
Preparation of training materials with approved contents and practical aspects of the management of POPs pesticides.	PCB, MAF, MOE	June 2009	Training material developed & approved	Training manual distributed	15,000
Media campaigns (TV, radio, newspapers).	PCB,	September 2009	Ads developed & approved	Ads aired on the various media	50,000
Training of trainers in the agricultural sector.	PCB, MAF	March 2010	Trainers identified	Training conducted	25,000
Training of applicators (farm workers, foremen, local field managers).	PCB, MAF	March 2010	Target group identified	Training conducted	25,000

Include pesticide management within the teaching curricula of the Faculty of Agriculture and Natural Resources of UB.	UB, Galen University	September 2011	Teaching module developed	Teaching module incorporated into curricula	To be determined
<i>Action Plan: Undertaking Ecologically Sound Measures to Eliminate Obsolete POP Pesticides</i>					
Updating the inventory of obsolete POPs and other pesticides.	PCB	December 2011	Methodology developed	Inventory completed	7,500
Training on handling of POPs and obsolete pesticides, damaged and empty containers and contaminated soil.	PCB	May 2012	Training developed	Training completed	10,000
Repacking of obsolete pesticides and transportation to a final disposal site.	PCB, MOH, DOE	December 2011	Disposal site identified	Obsolete pesticides transported to disposal site	350,000 – 500,000

**STRATEGY: Manage and phase-out PCBs**

<b>Activities</b>	<b>Lead/ other Agencies</b>	<b>Completion date</b>	<b>Success Indicator</b>	<b>Long Term indicator</b>	<b>Cost estimate US\$</b>
<i>Action Plan: Develop Legal Instruments and Technical Guidelines for managing PCBs</i>					



Development of legal instruments, guidelines, standards, MOUs	BEL, DOE, PUC	September 2009	Legal instruments developed/Guidelines developed for PCB Management	PCB management guidelines approved by DOE  Regulatory process initiated	30,000
<i>Action Plan: Inventory of Equipments, Accessories and Articles Consisting of, Containing, or Contaminated with PCBs</i>					
Review of previous inventory reports (if available)	BEL, DOE	May 2009	Previous reports made available	Gaps identified	5,000
Training the people needed for conducting the inventory.	BEL, DOE	October 2009	Persons identified	BEL and DOE staff trained in PCB Management	5,000
Make available inventory equipments (GPS, sampling equipment, protective items).  Conduct Inventory	BEL, DOE	September 2010	Inventory equipment identified	Results of inventory distributed to stakeholders	40,000
<i>Action Plan: ESM for in use equipment</i>					
Apply ESM at selected sites (based on previous inventory).	BEL	February 2010	Sites identified	Sites properly managed	To be determined
Develop the practice of replacing transformers highly contaminated with	BEL	December 2009	Contaminated transformers identified	Number of transformers replaced	To be determined

PCB.					
Undertake initial assessment of electrical equipment and articles containing and/or contaminated with PCBs.	BEL, DOE	January 2009	Contaminated equipment identified	Contaminated equipment collected	10,000
<i>Action Plan: Environmentally Sound Management (ESM) for obsolete Equipment</i>					
Identify and train stakeholders on ESM of obsolete PCB equipment	DOE, BEL	January 2011	Scrap metal operators identified	Scrap metal operators trained and certified by the DOE	10,000
Develop a strategy for the destruction and disposal of the obsolete electrical equipment	BEL	January 2011	Disposal site identified	Obsolete electrical equipment transported to disposal site	15,000
<i>Action Plan: Capacity Building for Public Awareness</i>					
Identify the relevant information and awareness needs related to PCBs	DOE, BEL, PUC	June 2009	Stakeholder workshop on PCB awareness	Formation of working group	7,500
Develop media material on PCB issues.	DOE, MOE, BEL	December 2009	Needs identified at workshop	Printed material distributed to schools, etc.	15,000

**STRATEGY: Eliminate DDT Use in Malaria/Vector Control**

<b>Activity</b>	<b>Lead/ other Agencies</b>	<b>Completion Date</b>	<b>Success Indicators</b>	<b>Source Management and Long Term Output Indicators</b>	<b>Cost estimate US\$</b>
<i>Action Plan: Country Needs Assessment</i>					
Needs Assessment	MOH, PAHO, DOE, PCB	December 2010	Malaria hot spots updated	Data on annual malaria cases	5,000
<i>Action Plan: Institutional Operational Research</i>					
The potential and operational implications of environmental management for malaria reduction in urban and rural areas.	MOH, PHB, PAHO, DOE	June 2011	Pilot project on environmental management	Result of pilot project incorporated into IVM	30,000
Evaluate integrated vector management schemes. Compare their cost effectiveness and sustainability with single method approaches.	MOH, PHB	October 2011	Training on IVM	IVM adopted	20,000
<i>Action Plan: Monitoring and Evaluation of DDT Alternatives</i>					
Revise, update, and standardize protocols for analysis and data	MOH, PHB	May 2010	Protocols developed	Data produced	10,000

reporting.					
Monitor efficacy and appropriateness of alternatives to DDT, including IVM.	MOH	November 2010	Monitoring program developed	Monitoring program in routine use	40,000
Collect information on the cost increment of alternatives	MOH	July 2011	Cost of program evaluated	Funding identified	10,000
<i>Action Plan: Public Awareness and Community Participation</i>					
Preparation of suitable and practical training material on malaria control	MOH, MOE	September 2009	Training booklet developed & approved	Training conducted	25,000
Conduct appropriate educational material on the impact of DDT on the environment and human health, and DDT alternatives for disease prevention and control, including IVM.	MOH, DOE	November 2009	Educational material printed	Material distributed to schools	25,000

**STRATEGY: Reduce and Eliminate Releases from Unintentional Production of Dioxins and Furans (UPOPs)**

Activity	Lead/ other Agencies	Completion Date	Success Indicators	Source Management and Long Term Output Indicators	Cost Estimate US\$
<i>Action Plan: Policy and Legal Framework for the Management of Unintentionally Produced POPs (UPOPs) and other hazardous waste</i>					
Situational analysis of the existing related regulatory mechanisms and the capacities of the concerned institutions.	MOH, NSWMA, DOE, PAHO	October 2009	Formation of working group	Compilation of existing legislation	10,000
Identification of gaps and requirements for sound management of UPOPs.	DOE, NSWMA, MOH	February 2010	Sources of UPOPs identified	Quantification of UPOPs produced	10,000
Amendment of the existing regulations and/ or formulate new ones based on the report findings.	Sol Gen, MOH	June 2011	New regulations developed	Regulations adopted	15,000
Conduct workshops and seminars with participation of all stakeholders to endorse and disseminate the amended and the new regulations related to the sound management of UPOPs.	MOH	September 2011	Identify stakeholders		7,500

Produce and disseminate guidelines for all stakeholders and Conduct training for the appropriate personnel.	MOH	September 2012	Conduct workshop	Number of personnel involved in solid waste management trained	12,500
<i>Action Plan: Capacity Building and Technical Support</i>					
Assessment of the related needs in the different institutions and Relevant sectors.	MOH	September 2011	Relevant sectors contacted	Report produced	7,500
Establishment of efficient means to exchange information and Technology with the relevant institutions abroad.	MOH, DOE	September 2011	Network established	Data produced and distributed	10,000
Encourage training/research, both locally and abroad, on environmental engineering, waste management, environmental policy, emission monitoring, waste water management and Infrastructure planning.	DOE, MOH, UB, PAHO	March 2012	Training programs identified	Staff of NSWMA trained in various areas	
Build up a comprehensive	MOH	November	Development of	Monitoring unit established	40,000

monitoring programmed		2012	monitoring program		
<i>Action Plan: Municipal and Hazardous Waste Management</i>					
Study of municipal waste composition in Belize.	NSWMA, DOE	September 2010	Survey conducted	Changes to management of dumpsite based on composition	20,000
Promotion of municipal solid waste separation and collection.	Municipalities, DOE, MOH, PAHO, NSWMA	September 2010	Training of Town Council staff	Radio ads promoting separation	25,000
Evaluation of possibilities of reuse, reduce or recycle	NSWMA	January 2014	Survey conducted	Report produced	15,000
Assessment of the present practice of landfill or dumping of Municipal waste.	NSWMA	August 2012	Assessment of dumpsites	Better management of dumpsites	10,000
Development of landfill programs.	NSWMA	December 2014	Landfill constructed	Better management of landfill	To be determined
<i>Action Plan: Public Awareness and Technical Networking</i>					
Preparation of information and training materials.	MOH, MOE, UB	September 2010	Pamphlets produced	Pamphlets distributed to schools	100,000
Organize and conduct training courses and seminars for target groups on UPOPs issues.	MOH	September 2011	Courses developed & implemented	Courses made part of natural resource curricula at UB	40,000
Prepare publications,	MOH,	September	Ads produced	Consumers begin to separate	45,000

pamphlets and posters on topics requiring much public involvement, such as open burning.	MOE	2012		trash	
Establish a network for scientific and technical information on UPOPs	MOH, DOE, Focal point	November 2012	Local network established	Data on solid waste is available online	10,000
Establish focal points for public awareness at the municipal level.	Town Councils, City Councils, Village Councils	November 2009	Each municipality has a focal point	Improvement in garbage collection and disposal at the municipal level	5,000
<i>Action Plan: Landfills and Hazardous Waste Co-incineration</i>					
Evaluate the commitment of the facilities for their interest to use waste fractions as secondary fuels	NSWMA	December 2014	Hazardous waste separated at landfill		To be determined
Evaluate the options for separation from waste stream and collection methods.	NSWMA	December 2014	Hazardous waste separated	Hazardous waste regulation adopted	To be determined
<i>Action Plan: Inventory of Unintentionally Produced POPs</i>					
Conduct the inventory on regular bases (each 5 years).	MOH	September 2010	Inventory conducted	Results of inventory published	25,000



Generate database on unintentionally produced POPs.	MOH	June 2011	Database developed	Database available online	10,000
<i>Action Plan: Medical Wastes Management</i>					
Evaluate the present medical waste management system.	MOH, PAHO	June 2013	Assessment of incineration at hospitals	# of incinerators functioning	12,500
Develop a strategy to implement a National Action Plan on Medical Waste Management	MOH, PAHO	November 2013	Workgroup established	National Action Plan developed	20,000
Conduct country-wide training on medical wastes management involving local authorities	MOH	June 2014	workshops	Number of hospital personnel trained on medical waste management	20,000
Implement project on medical waste management.	MOH, PAHO	November 2014	Medical waste management initiated	Reduction of amount of medical waste	50,000
<i>Action Plan: Green Harvesting of Sugarcane</i>					
Pilot project on green harvesting	BSI, MAF, Cane Farmers Association	July 2012	Preparation of cane fields	Percentage of cane fields harvested through green harvesting	200,000
Conduct awareness training among cane farmers	BSI, MAF	October 2012	Green harvesting promoted among cane farmers	Acres of sugarcane harvested by green harvesting methods	40,000

### Belize Financing Implementation Plan

ACTIVITY/YEAR	2008	2009	2010	2011	2012	2013	2014
1. POPs Implementation Unit		\$192	\$192	\$192			
2. Capacity to Handle POPs Pesticides		\$100					
3. Legal Guidelines for Managing PCBs		\$30					
4. POPs Public Awareness	\$40	\$200	\$200	\$160			
5. Solid Waste Management		\$4,000	\$6,000	\$500	\$540	\$580	\$620
6. Medical Waste Incinerator		\$600	\$600	\$100	\$100	\$100	\$100
7. Green Harvest of Sugar Cane		\$1000	\$1000				
8. DDT packaging and disposal	500						
<b>Totals</b>	<b>540</b>	<b>6,122</b>	<b>7,992</b>	<b>952</b>	<b>832</b>	<b>872</b>	<b>912</b>

Note: Costs are in Thousands of US Dollars (US\$1,000s).

## ANNEX 1

Project No. 1: POPS Implementation and Monitoring Unit	
1. Implementing Agency	Department of the Environment (DOE)
2. Responsible Institutions	Ministry of Natural Resources and the Environment (MNRE) of the Government of Belize (GOB). Inter agency mechanism for effective implementation of NIP.
3. Duration	36 months initially, then ongoing as an established unit.
4. Location	Belmopan, Belize
5. Background	The Department of the Environment is responsible for the implementation of the POPs results but lacks the resources to do so. This unit is integral to implementation and needs external financing for 36 months then should be an established unit of DOE. Long term mechanism for interagency cooperation and implementation needs to be developed.
6. Project Justification	The unit supports effective implementation of the plan.
7. Project Goal	Establish an operating and effective unit capable of long-term implementation and monitoring of the NIP. Begin the process of chemicals management.
8. Objectives	Upgrade the capacity of the DOE to implement and monitor the NIP for POPs. Development of a mechanism for the linkages and effective inter-agency cooperation and implementation of the NIP.
9. Beneficiaries	The Belizean people in general and those exposed to any level of POPs specifically. The DOE.
10. Activities	<ol style="list-style-type: none"> <li>1. Training of relevant public and private sector involved with general POPs issues.</li> <li>2. Development of long-term mechanism for NIP.</li> <li>3. Upgrading of the Department of the Environment to carry out monitoring and long term implementation of Chemical and POPs Management</li> <li>4. Procurement of field testing equipment</li> <li>5. Procurement of vehicle for nationwide use</li> <li>6. Maintenance level public awareness</li> </ol>
11. Estimated Cost	US \$576,000.00
12. Donors	GEF. After 36 months GOB assumes responsibility.

Project No. 2: Strengthening the Capacity to Handle POPs Pesticides, Containers and Contaminated Soil and Obsolete Storage Sites	
1. Implementing Agency	Department of the Environment
2. Responsible Institutions	Ministry of Natural Resources, Ministry of Agriculture, Pesticides Control Board, BAHA, M of /Health
3. Duration	12 months
4. Location	Belmopan
5. Background	The capacity to handle the pesticides, containers, etc. of POPs is not up to an adequate standard. The upgrading of skills is mandatory for effective implementation.
6. Project Justification	This action supports effective law enforcement and capacity building in the handling of POPs.
7. Project Goal	To eliminate POPs pesticides in Belize.
8. Objectives	Enhance and upgrade the skills of people who manage or come into contact with possible POPs.
9. Beneficiaries	Belize's population at large, farmers, customs officers, etc.
10. Activities	1. Training of chemical personnel, customs officers, farmers, public health officials, quarantine staff, etc. 2. Upgrading of laboratory equipment and training of staff in its use 3. Procurement of laboratory equipment
11. Estimated Cost	US\$100,000.00
12. Donors	GEF, FAO

Project No. 3: Develop Legal Instruments and/or Legal Guidelines for Managing PCBs	
1. Implementing Agency	Belize Electricity Ltd., Ministry of Public Utilities
2. Responsible Institutions	MNRE, Ministry of Health, BEL
3. Duration	12 months
4. Location	Belmopan
5. Background	PCB containing transformers are not imported. A few very old models may need to be tested and the management of scrap cables investigated.
6. Project Justification	The scrap metal workshops may have exposed workers as well as those that are exposed to transformer oil. These persons could be protected by specific legislations or if unneeded, by clear technical guidelines for the regulation and verification of the proper treatment of any possible PCB remains.
7. Project Goal	The safe environmental management until the end of the lifetime of all possible equipment containing PCBs.
8. Objectives	Drafting and implementation of specific PCB regulations. The regulation and verification of in-use and out-of-use electrical equipment and articles that contain PCBs.
9. Beneficiaries	Workers and employees of transformers, people in their vicinity, scrap metal workers.
10. Activities	<ol style="list-style-type: none"> <li>1. Forming a legal and technical working group involving all PCB stakeholders, MNRE and BEL.</li> <li>2. Study of existing legal instruments related to PCB management for further development if needed</li> <li>3. Develop any required legal instruments and technical standards necessary for PCB management.</li> </ol>
11. Estimated Cost	US\$30,000.00
12. Donors	BEL, GOB

Project No. 4: Raising Awareness on POPs and the NIP Goals and Objectives	
1. Implementing Agency	Ministry of Natural Resources and the Environment
2. Responsible Institutions	Municipalities, farmers associations, universities, NGOs, women's associations, health and quarantine authorities.
3. Duration	36 months
4. Location	Entire country of Belize
5. Background	Groups vulnerable to POPs may be unaware of the risks. This includes farm workers and their children, residents of municipalities where solid waste and medical waste are incinerated, etc. The information on POPs needs to be made available on an intensive and comprehensive basis to both urban and rural populations.
6. Project Justification	Public campaigns are the most cost effective means of protecting the public from POPs risks.
7. Project Goal	To eliminate POPs in Belize and mitigate their adverse effects through public awareness and education.
8. Objectives	Protect the general public, farmers and workers from the adverse impacts of POPs.
9. Beneficiaries	General public in urban and rural areas including farms.
10. Activities	<ol style="list-style-type: none"> <li>1. Preparation of training materials with popular content showing the effects of POPs</li> <li>2. Media campaigns (TV, radio, newspapers)</li> <li>3. Training of agricultural extension staff</li> <li>4. Training of farmers, farm workers field staff in alternatives to POPs</li> <li>5. Introducing pesticide and other POPs issues in the relevant curricula of schools and universities</li> </ol>
11. Estimated Cost	US\$600,000.00
12. Donors	FAO, EU, GEF

Project No. 5: Solid Waste Management Project (Municipal and Related Wastes)	
1. Implementing Agency	Solid Waste Management Authority (SWMA), DOE
2. Responsible Institutions	Ministry of Finance, M/Economic Development, MNRE
3. Duration	24 months
4. Location	Mile 22 Western Highway
5. Background	The SWMA has been legislated but municipal and other waste is still disposed of at municipal landfills and incinerated. There is a need for a proper solid waste managed facility to serve the main population centers.
6. Project Justification	Solid waste continues to be disposed of and incinerated near municipalities causing a health and environmental hazard to the population. Minimize unintended POPs release.
7. Project Goal	Stop the disposal and incineration of solid waste near population centers. Improve human and environmental health. Implement existing SWMA plans.
8. Objectives	Improve the health of the population by removing hazardous waste and its incineration from their vicinity.
9. Beneficiaries	The population living in the main cities and town on Belize. Later improvements will extend this to the other towns and rural areas.
10. Activities	<ol style="list-style-type: none"> <li>1. Make the SWMA operational</li> <li>2. Operate a sanitary landfill and solid waste management facility</li> <li>3. Serve as a site for the medical waste incinerator.</li> </ol>
11. Estimated Cost	US\$10,000,000.00 estimated capital costs US\$500,000.00 estimated recurrent costs
12. Donors	IDB, GOB.

Project No. 6: Medical/Hazardous Waste Management	
1. Implementing Agency	Ministry of Health
2. Responsible Institutions	MNRE, M/Finance, SWMA
3. Duration	24 months
4. Location	Mile 22 Western Highway
5. Background	Medical waste is not segregated or treated and is either incinerated at the hospital sites or disposed of at current municipal landfills where it is also incinerated.
6. Project Justification	Compliance with the Stockholm Convention on unintended POPs by-product release minimization.
7. Project Goal	Reduce and/or eliminate the release of unintentionally produced POPs.
8. Objectives	Implement the proper treatment of hospital waste. Minimize release of dioxins and furans from inefficient burning of medical wastes.
9. Beneficiaries	Health sector, hospital staff, general public.
10. Activities	<ol style="list-style-type: none"> <li>1. Improve legal framework for medical waste mgmt.</li> <li>2. Develop a detailed management plan</li> <li>3. Extend the medical waste management throughout the country</li> <li>4. Segregation of wastes</li> <li>5. Installation of a high temperature incinerator.</li> </ol>
11. Estimated Cost	US\$1,200,000.00 Capital US\$100,000.00 estimated recurrent cost.
12. Donors	PAHO, EU, GEF, GOB



Project No. 7: Green harvesting of Sugar Cane	
1. Implementing Agency	Belize Sugar Industry (BSI), Cane Farmers Associations
2. Responsible Institutions	M/Agriculture, MNRE, DOE
3. Duration	24 months
4. Location	Orange Walk and Corozal Districts
5. Background	Sugar cane is currently harvested using burning of cane fields. This produces much air pollution and reduces the quality of the cane harvest.
6. Project Justification	Burning of the cane fields produces furans and dioxins that affect the health of the population.
7. Project Goal	Reduce the unintentionally produced furans and dioxins. Improve the quality of the cane harvest. Demonstrate the positive impacts of green methods of harvesting.
8. Objectives	Develop the concept of green harvesting by including the cane farmers in this BSI pioneer concept for Belize.
9. Beneficiaries	The population of the northern districts, cane farmers.
10. Activities	<ol style="list-style-type: none"> <li>1. Educate the cane farmers in green harvest techniques and benefits</li> <li>2. Raise public awareness of green techniques</li> <li>3. Prepare fields for this new method</li> <li>4. Extension services</li> <li>5. Purchase two harvesters</li> </ol>
11. Estimated Cost	US\$2,000,000.00
12. Donors	EU, GEF, Cane Farmers Association, BSI

## **ANNEX (2)**

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