Republic of Mauritius

Ministry of Environment & National Development Unit

National Implementation Plan For

The Stockholm Convention On Persistent Organic Pollutants

June 2005

FOREWORD

I would like, first of all, to thank all my colleagues Consultants for their collaboration and cooperation in the rather long process of the drafting of this National Implementation Plan (NIP). It took six months to get the 230 pages of the Draft NIP ready.

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All amounts/sums of money published in the document are systematically in Mauritian Rupees (MUR) and US Dollars (USD) for easiness of both local and international readers. For uniformity purposes, we have used the exchange rate of MUR 29 to USD 1 throughout the document as that was the average exchange rate over the past months.

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ABBREVIATIONS

AOSIS	Alliance of Small Island States
AREU	Agricultural and Research Extension Unit
ARPEGE	*Appui régional pour la promotion de l'éducation à la gestion de l'environnement*
BAT	Best Available Techniques
BEP	Best Environmental Practices
CEB	Central Electricity Board
COMESA	Common Market for Eastern and Southern Africa
CRM	Certified Reference Material
CSO	Central Statistics Office
CWA	Central Water Authority
DCC	Dangerous Chemicals Control (Act)
DDT	Dichlorodiphenyltrichloroethane
EPA	Environment Protection Act (2002)
FAO	Food and Agricultural Organisation
GCMS	Gas Chromatography Mass Spectrometry
GDP	Gross Domestic Product
GEF	Global Environment Facility
GNP	Gross National Product
ICT	Information and Communication Technology
IPP	Independent Power Producers
MACOSS	Mauritius Council of Social Services
MEA	Multilateral Environmental Agreement
MOE	Ministry of Environment
MOH	Ministry of Health
MOLG	Ministry of Local Government
MSIRI	Mauritius Sugar Industry Research Institute
MUR	Mauritian Rupee
NDU	National Development Unit
NEL	National Environmental Laboratory
NGO	Non-governmental Organisation
NIP	National Implementation Plan
PAS	Principal Assistant Secretary
PCBs	Polychlorinated biphenyls

PCDD/Fs	Polychlorinated Dibenzo-p-Dioxins and Furans
POPs	Persistent Organic Pollutants
ppm	Parts Per Million
PSC	Project Steering Committee
SAICM	Strategic Approach to International Chemicals Management
SADC	Southern African Development Community
SIDS	Small Islands Development Summit
TAC	Technical Advisory Committee
TEQ	Toxicity Equivalent
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UPOPS	Unintentional POPs
USD	United States of America Dollar
WHO	World Health Organisation
WMA	Wastewater Management Authority
WTO	World Trade Organisation

EXECUTIVE SUMMARY

The National Implementation Plan (NIP) of the Republic of Mauritius with regard to the Enabling Activities for the Stockholm Convention on Persistent Organic Pollutants is made up of two main sections: assessment of the present legislative and regulatory framework and detailed inventories of POPs in Mauritius and Rodrigues; and the action plans and strategies to manage and eliminate the inventoried POPs and the setting-up of a programme for monitoring POPs in various media.

The three pieces of legislation that are related to POPs in Mauritius are the Environment Protection Act (EPA) 2002, the Dangerous Chemicals Control (DCC) Act 2004 and the Food Act 1998. The EPA 2002 provides for the setting up of POPs limits in different media, especially in water, air, residues and in the disposal of hazardous wastes. The DCC 2004 provides a quite comprehensive legal framework for the control of dangerous chemicals and it does include the 12 POPs. As for the Food Act, there are two Regulations which deal with a few of the POPs chemicals.

The detailed inventory for POPs pesticides shows that the main concern is the existing stockpile of DDT (127.3 tons) though it is used only for malaria vector control. The few other POPs pesticides found are Dieldrin (8 litres), Mirex (64kg) and Aldrin (13 litres). In the case of industrial POPs, an inventory was carried out at the Central Electricity Board (CEB) where it was found and suspected that 77 transformers do contain PCBs at a level greater than 50ppm. These transformers represent a total mass of some 19 tons of oil. Regarding transformers owned by private companies and other organisations, it was found that they have all been manufactured in Europe in the 1990s and are thus PCB-free.

As for the unintentional POPs by-products, results have classified the use of biomass for power/heat production as the number one source of Dioxins and Furans in Mauritius (33.4%) followed by Medical Waste Incineration (20.8%), Uncontrolled Waste Burning (12.2%) and Landfill Leachate (10.6%). The total amount of PCDD/Fs released within the Republic of Mauritius per year was estimated at some 30.4g TEQ. In Rodrigues, however, the major source was found to be the Landfill/Dump fires which release some 80.5% of the total amount of Dioxins and Furans.

On the issue of awareness-raising, a first national campaign was held in April 2005 to sensitize the population about POPs and especially, about domestic waste burning and its alternatives.

The proposed strategy in the National Implementation Plan is to first set up the institutional structure and framework and then carry out the number of activities and projects that have been earmarked in the short, medium and long term for the use, production, management and disposal of existing POPs.

The first recommendation is the setting-up of a Chemical Multilateral Environmental Agreements (MEAs) Desk at the Ministry of Environment in order to co-ordinate all activities and projects under the guidance of the Implementing Agency (Ministry of Health and Quality of Life) and the setting-up of a Technical Advisory Committee so as to advise on the technicalities of the projects and activities. On the regulatory front, a number of amendments will have to be brought to existing pieces of legislations (DCC Act 2004 and Regulations under EPA 2002) so as to be in conformity with the various aspects and implications of the Stockholm Convention.

A few Technical Committees and Task Forces will have to be also set up in order to address specific issues, including the management and disposal of PCBs and DDT. Training will have to be imparted to the CEB personnel, staff of hospitals and clinics, governmental laboratories' employees, etc. in order to meet the required needs and demands. Awareness-raising on different aspects of POPs in Mauritius will have to be on a continuous basis, whether targeting specific audiences or the public at large.

As for the emission of Dioxins and Furans, a number of actions are recommended in order to minimise them. Plans and recommendations for environmentally-friendly solutions to medical waste incineration, bagasse burning, open waste burning, landfill leachate, etc. are proposed both for the islands of Mauritius and Rodrigues. One of the top priorities, however, will be further research on the emission of PCCD/Fs originating from the burning of sugar-cane and bagasse as scientific data on the topic hardly exists.

A POPs Monitoring Programme will have to be rapidly put in place so as to monitor on a permanent basis the amount of POPs in food, animal feed, sediments and so on. In the process of all the activities and projects proposed, capacity building is on top of the agenda, be it on the infrastructure or human resources side.

The sum estimated for the implementation of the NIP is about MUR 635m (USD 22m) including the MUR 290m (USD 10m) which has been earmarked for the construction of a new landfill in Rodrigues.

1. INTRODUCTION

The Stockholm Convention is a global treaty to protect human health and the environment from Persistent Organic Pollutants (POPs). POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife. POPs circulate globally and can cause damage wherever they travel.

In implementing the Convention, Governments are committed to take measures to eliminate or reduce the release of POPs into the environment. The Republic of Mauritius signed the Stockholm Convention on Persistent Organic Pollutants (POPs) on 23 May 2001, ratified it on 13 July 2004 and is committed to comply with its provisions.

A POPs Enabling Activity Project, funded by the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP), is on-going in Mauritius so as to meet the reporting and other obligations under the Convention. The total budget earmarked is USD 420,300 with a funding of USD 356,400 from GEF and the rest, i.e. USD 63,900, from the Government of Mauritius.

The Ministry of Environment and National Development Unit is the Executing Agency of the project, the Ministry of Health and Quality of Life is the Implementing Agency while the Ministry of Finance and Economic Development is the Coordinating one. Moreover, the focal point for the Stockholm Convention in Mauritius is the Permanent Secretary of the Ministry of Environment.

A Project Steering Committee (PSC) has been set up under the chairmanship of Mr. O. Jadoo, the Principal Assistant Secretary (PAS) of the Ministry of Environment, in order to manage the Enabling Activity Project. Seven meetings of the PSC have been held: the first one being in January 2004 and the last one in June 2005.

Mauritius has signed several other Conventions which are related to the POPs issue: the Vienna Convention on the Protection of the Ozone Layer (1985), the

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes (1989), the Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa (1991) and the Rotterdam Convention on the Prior Informed Consent Procedure for certain Hazardous Chemicals and Pesticides in International Trade (1997).

Article 7 of the Stockholm Convention requires that State Parties develop National Implementation Plans (NIP). The Mauritius NIP describes how the country will meet its obligations under the Convention to manage and phase out POPs sources in an environmentally sound manner. The NIP also includes proposals for monitoring activities relevant to the Convention with specific action plans.

The drafting of the NIP has been possible after numerous consultations, discussions and workshops with stakeholders concerned (ministries, para-statal organisations, research institutions, the private sector, the University of Mauritius and NGOs).

The Enabling Activities for the Stockholm Convention on POPs started in December 2003 and the draft NIP was endorsed by all concerned stakeholders at a workshop in June 2005.

Regarding the inventories of POPs inventories carried out throughout the islands of Mauritius and Rodrigues, the following have been noted: the existing DDT stockpile at the Ministry of Health is the main concern regarding POPs pesticides though it is used only for malaria vector control; some 77 transformers are PCB-contaminated or suspected to be at the Central Electricity Board and the main sources of Dioxins and Furans in the island of Mauritius are Bagasse Burning, Medical Waste Incineration, Uncontrolled Waste Burning and Landfill Leachate while for the island of Rodrigues, the landfill at Roche Bon Dieu is the main concern.

Moreover, the International Chemical Analysis Expert of the project has assessed the capacity of local institutions/laboratories for the monitoring and analysis of POPs chemicals. Following his recommendations, some extra capacity, both in logistics and human resources, will have to be built for the

POPs Monitoring Programme but some analyses will still have to be contracted out abroad to foreign laboratories as it is not foreseen to have any high-resolution mass spectrometer in Mauritius in the near future.

On the other hand, the International Coordination Consultant of the project has assessed the scheme for chemical management in Mauritius with particular emphasis on POPs and has made recommendations accordingly.

The strategy for the action plans outlined in the NIP is to first set up the institutional structure and framework and then carry out the number of activities and projects that have been earmarked in the short, medium and long term for the use, production, management and disposal of existing POPs.

Among the recommendations, there are the following:

- Setting-up of a Chemical MEAs Desk at the Ministry of Environment in order to co-ordinate activities and projects under the guidance of the Implementing Agency (Ministry of Health and Quality of Life);
- Setting-up of a Technical Advisory Committee to advise on technicalities of projects and activities;
- Amendments to existing pieces of legislations (DCC Act 2004 and Regulations under EPA 2002) so as to be in conformity with various aspects and implications of the Stockholm Convention;
- Setting-up of a Technical Committee on DDT and a Task Force on PCBs, under the aegis of the Chemical MEAs Desk, in order to undergo further analyses and address management and disposal issues regarding PCBs and DDT;
- Training to be imparted to the personnel of the CEB, staff of hospitals and clinics, governmental laboratories' employees, etc. in order to build up human resource capacity as required by the forthcoming programmes;
- Awareness-raising on different aspects of POPs in Mauritius to be held on a continuous basis;
- Setting up of an Information Exchange Network (IEN) for better dissemination of information on chemicals;

- Environmentally-friendly solutions to medical waste incineration, bagasse burning, open waste burning, landfill leachate, etc. both for the islands of Mauritius and Rodrigues;
- Research on the emission of PCCD/Fs out of the burning of sugar-cane and bagasse as a top priority given that the burning of bagasse has been found as the biggest source of Dioxins and Furans in Mauritius;
- Establishment of a POPs Monitoring Programme so as to monitor on a permanent basis the amount of POPs in food, animal feed, sediments and so on;
- Scheduled evaluation and reporting processes.

The NIP also covers aspects regarding the possible sources of funding as the overall cost estimated for its implementation is about MUR 635m (USD 22m) and that includes MUR 290m (USD 10m) which has been earmarked for the construction of a new landfill in Rodrigues.

2. PROFILE OF THE REPUBLIC OF MAURITIUS

2.1.1 Geography and Population

Source: The Government of Mauritius Web Portal[1]

Mauritius is situated in the south west of the Indian Ocean, slightly over the tropic of Capricorn, in latitude 20° south and longitude 57° east of Greenwich. It is about 2,000 kilometres off the eastern coast of Africa and some 855 kilometres east of Madagascar.

An island of volcanic origin with an area of 1,864 km^2, it is almost entirely surrounded by coral reefs. The land rises from coastal plains to a central plateau where it reaches a height of 670 meters. The plateau is bordered by three mountain ranges and the highest peak, the Piton de la Petite Rivière Noire, rises to 828m. It enjoys a maritime sub-tropical climate.

The Republic of Mauritius is constituted of the mainland Mauritius, the autonomous island of Rodrigues, Agalega, Saint Brandon (also called the

[1] http://www.gov.mu/portal/site/abtmtius/menuitem.9eb76f322dcc02984d57241079b521ca/, June 2005.

Cargados Carajos Archipelago), Tromelin Island[2] and the Chagos Archipelago[3].

Rodrigues has an area of 108 km^2 and is situated 560km to the east north-east of the mainland Mauritius. Agalega consists of two islands and they have a total land area of 26km^2. It is situated some 1,000 km to the north of Mauritius. St. Brandon is an archipelago comprising a number of sand-banks, shoals and islets. It is situated some 430 km to the north-east of Mauritius. Tromelin is a small island of 1km^2 while the Chagos Archipelago, which houses the strategic US military base of Diego Garcia, comprises of 2,300 islands and has a total land area of 60 km^2.

2.1.1.1 The Mauritian Population

The various population movements of the 18th, 19th and early 20th centuries have made Mauritius a unique blend of different races, cultures and religions. People of European, African, Indian and Chinese origins have created a multiracial society where the various cultures and traditions flourish in peace and harmony.

The population started to grow under French rule in the 18th century. In 1735, the population grew to almost 1,000 and reached nearly 20,000 in 1767 (15,000 of them being slaves). When the British abolished slavery in 1835, the population stood at 100,000. It increased rapidly with the coming of Indian labourers. Between 1835 and 1865, some 200,000 labourers were brought in. By the turn of the century, the population grew to 371,000 and in 1944, it stood at 419,000. After the Second World War, the increase was more rapid, particularly because of the baby-boom and the drop in the infant mortality rate.

The rate of natural increase of the population which was about 3% in the 60s has considerably dropped with family planning campaigns and greater awareness due to better education. During the last ten years, the population has

[2] There is a contention with France for the sovereignty of the island.
[3] There is a major issue with the United Kingdom over the sovereignty of the Chagos by the State of Mauritius. The archipelago is indeed a strategic one as it accommodates one of the largest US military bases on the island of Diego Garcia.

grown at an average rate of 1.1% annually. In 2003, the population of the Republic of Mauritius[4] was estimated at 1.22m.

The latest figures of the population of the Republic of Mauritius[5] are as follows:

- Mauritius Mainland 1,191,336
- Island of Rodrigues 36,503
- Agalega 289
- St. Brandon None[6]
- Tromelin Unknown[7]
- Chagos Archipelago Unknown[8]

Regarding languages, English is the administrative language of the country but French is extensively used in the day-to-day activities. Mauritian Creole and/or Bhojpuri are the mother-tongues of nearly the whole population while Hindi, Urdu, Telugu, Marathi, Tamil, Mandarin and Arabic are taught at primary and secondary schools. However, Hindustani is very popular on the radio and television.

Mauritius provides free health services throughout the country to the people. From 1970 to date, life expectancy has increased from 63 years to 72 years and infant mortality fallen from 55 to 14/1000 deaths in the first year of life[9].

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[4] Central Statistics Office, Mauritius in Figures 2003, Population & Vital Statistics (http://statsmauritius.gov.mu/mif03/popula.pdf, January 2005).

[5] Central Statistics Office, Digest of Demographic Statistics 2003, Section 1 – Population, Estimated resident population of Mauritius as at 31st December 2002 & 2003 (http://statsmauritius.gov.mu/report/natacc/demo03/sect1.pdf, January 2005).

[6] According to the Population Census Year 2000, there were 63 men present on the archipelago on the night of the census but they are not permanent residents - http://statsmauritius.gov.mu/report/hpcen00/Demogra/intro.htm, January 2005).

[7] The CIA World Fact Book indicates that the island is uninhabited, except for visits by scientists (http://www.odci.gov/cia/publications/factbook/print/te.html) while the French Ministry of Outer Territories state that the island is inhabited by a few meteorologists and occasionally by scientists (http://www.outre-mer.gouv.fr/outremer/front?id=outremer/decouvrir_outre_mer/les_iles_eparses_1049904806609, January 2005).

[8] There are no indigenous inhabitants (all of them had been sent to Mauritius and to the Seychelles in the late 60s and early 70s) but there were in 2001, according to the CIA, approximately 1,500 UK and US military personnel and some 2,000 civilian contractors living on the island of Diego Garcia (http://www.odci.gov/cia/publications/factbook/print/io.html, January 2005).

[9] Ministry of Environment & National Development Unit, *Mauritius – Staking out the future*, Executive Summary – The Challenges for SIDS, Health, p. 32.

2.1.2 Political and Economic Profile

Mauritius is independent since 12 March 1968 and became a Republic on 12 March 1992. It enjoys a democratic regime and has a Cabinet government. The Prime Minister is the head of government while the President of the Republic is the head of State. General Elections are held every five years and the National Assembly comprises of 70 elected members[10].

There are at present five municipalities and four District Councils for local governance. Mainland Mauritius will soon be fully municipalized with the whole island divided into 12 Municipal Councils. Rodrigues is an autonomous island since March 2002 and it has its own Regional Assembly. Agalega has just been provided with its Island Council but is still administered by the Outer Island Development Corporation (OIDC) while St. Brandon is fully managed by the OIDC.

Mauritius has a multiparty democracy modelled on the British parliamentary system. The separation of the legislative, the executive and the judiciary powers is built in the Constitution. The legal system is a composite of English laws and the French Code Napoleon. The highest Court of Appeal is the British Privy Council.

The Republic of Mauritius is an active member of the Commonwealth of Nations, the *Francophonie* (French-speaking countries), the African Union, the Southern African Development Corporation (SADC), the Common Market of Eastern and Southern Africa (COMESA), the New Partnership for Africa's Development (NEPAD) and the Indian Ocean Commission, among others. Mauritius is also active in various Indian diasporas' activities.

2.1.2.1 An Economic Panorama

From a supported mono-crop economy, predominantly dependent on sugar, Mauritius has successfully diversified its economic activities by carving out special niches in Textile, Tourism and Financial Services. It is now focusing on the emerging Information & Communication Technology (ICT) sector. Over the last five years, from 2000 to 2004, the country has registered an

[10] The only member who may not have been elected is the Attorney General whom the Prime Minister may appoint at her/his discretion if the selection person is a lawyer.

annual average real growth rate of 5.1%, balance of payments surpluses leading to a comfortable external reserves position with single-digit inflation on average. However, the average unemployment rate from 2000 to 2003 has been 9.4%.

With an average per capita income of some USD 5,000 in 2004, Mauritius is now classified as a middle income country and ranks, on the basis of the recent United Nations Human Development Index for 173 countries, 67th globally, 40th among developing countries and second in Africa. Sustaining the growth momentum well into the future is a major challenge because of international pressures such as globalization and liberalization. Reforms are furthermore required domestically to arrest fiscal decline, achieve growth in employment and total factor productivity and address the issues of poverty, social vulnerability and an ageing population.

Diversification of the economy remains a priority. Emphasis is now being laid on the following:

- Developing the Information and Communication Technology (ICT) sector;
- Framing the right policy mix to consolidate public finances;
- Enhancing export competitiveness;
- Modernizing the Welfare State.

Mauritius has embarked on a comprehensive programme of reforms to move to its next phase of development by capitalizing on human resources, Information Technology and higher value-adding activities. This is best achieved by building on its existing strengths of openness, high standards and best practices in the financial sector, an advanced physical and telecommunication infrastructure, an active capital market, competitive communication costs, a relatively reasonable level of human and intellectual capital market and a well-developed social safety network.

An attractive blend of advantages is offered to international investors. These include: political stability, pleasant and peaceful living conditions, efficient telecommunications, pool of qualified professionals conversant in English and

French, Investment Promotion and Protection Agreements, International Stock Exchange, Freeport activities and the absence of exchange control.

2.1.3 Profiles of Economic Sectors

Over the last three decades, the country has experienced stable economic development and growth. It has emerged from a monoculture economy based on sugarcane to a diversified economy resting on four main pillars, namely agriculture (sugar), export processing industries (textile), tourism and financial services. The ICT sector is being developed as a fifth pillar and the seafood industry will most probably be the sixth pillar of the economy.

2.1.3.1 Sugar

Despite the implementation of an agricultural diversification strategy, the sugar industry has remained a key sector of the economy. In terms of revenue, sugar exports represent about 20% of total earnings[11]. The industry contributed an average of 3.9% to the total GDP from 2001 to 2004 and witnessed a 7% growth rate in 2004, which is one of the highest among the different sectors of the economy. The sugar industry has long benefited from guaranteed prices and preferential access to the European markets under the Sugar Protocol of the Lomé Convention (now Cotonou Agreement) which will gradually disappear due to pressures from the World Trade Organisation and expected sharp cut in prices from the European Union itself.

The Government and the private sector have joined forces to enhance the overall competitiveness of the sector. An in-depth restructuring is underway, while on the external front, through equity participation or take-over bids, the sugar industry is exporting its know-how to sugar producing countries of the region such as Mozambique and Tanzania. The sugar producers have also diversified in the production of electricity using 'bagasse' (residue of sugarcane) and coal.

[11] Board of Investment Web Site, Why Mauritius, Strong Economy, Economic Sectors, Agriculture (http://www.boimauritius.com/default.aspx?Guid=8621f156-c2fa-4703-818a-ff0fd87c4d0c&nm=WHYtp://, January 2005).

2.1.3.2 Textile

The manufacturing sector, predominantly textile and garment operations in the Export Processing Zone (EPZ), has been the main engine of growth since the 70s. From 2001 to 2004, the EPZ sector has contributed an average of 8.9% to the GDP (more than twice as sugar) even if it has witnessed an average negative growth of 2.1% over the period. A 3% growth has nevertheless been recorded last year over the previous one, i.e. 2003.

The EPZ continues to attract investment in diverse fields of activities: textile and apparel, light engineering, precision plastics, electronics, jewellery and horology, printing and publishing, toys and ship models, etc. They are all destined for export to Europe, USA, Japan, Australia, South America, Japan, Scandinavia, Africa and the Middle East[12].

The prospects for the EPZ sector, however, do not look too promising as the recent disablement of the Multi-fibre Agreement is a direct threat to the export-led textile industry. However, new opportunities are contained in the vertical integration of garment companies and also in the United States' Africa Growth and Opportunity Act (AGOA) which allow quota-free access for apparel from sub-Saharan Africa (including Mauritius) as well as duty-free access for a number of other items into the US.

A few major textile companies have started their vertical integration by setting up their own spinning mills and quite a few have opened up factories over the last years in Madagascar and Mozambique to outsource production of low-end products. Two major local operators are however opening plants in India and China so as to keep the competitive factor.

2.1.3.3. Tourism

Mauritius is known as a safe holiday destination for up-market and upper-middle market tourism. With a whole array of luxury beach hotels ranked

[12] Board of Investment Web Site, Why Mauritius, Strong Economy, Economic Sectors, Manufacturing (http://www.boimauritius.com/default.aspx?Guid=18afb160-5176-4178-a620-5f0370cfaf02&nm=WHY, January 2005).

among the best in the world, mainland Mauritius distinguishes itself as a quality resort.

In fact, the tourism industry has registered the highest sectoral growth rate and has been the largest foreign exchange earner since the mid-90s, but over the last few years, it has slowed down due to fierce competition on the world market with emerging destinations and the growth has only been of 2.6% in 2004. The number of tourists visiting the country has increased from 374,600 in 1993 to 702,000 in 2003, representing an increase of 87% over the decade. Employment in the Tourism Industry rose from 16,240 in 1999 to 22,260 in 2003, which represents 37% growth.

This industry is poised for further growth with the under-going construction of several new hotels, inland leisure parks and the creation of a variety of tourist attractions in the context of the development of Integrated Resorts. The grant of the "sixth freedom", a new air access policy and the tapping of new markets such as India, the Middle-East and China are among the new measures of government so as to sustain growth in the sector which faces aggressive competition from all over the world.

2.1.3.4 Financial Services

From 1993 to 2003, the business and financial services sector (banking, insurance, capital market, global business and other financial intermediaries) has witnessed annual growth rates averaging 8.4%[13]. The Financial Intermediation Sector has however slowed down in 2004 with a growth of only 2.6%. Its contribution to GDP from 2001 to 2004 has however been of 8.6% average.

Financial services have been substantially liberalized with a view to providing the required impetus to the development of the sector. The number of Global Business Companies (formerly known as Offshore ones) from 1998 to 2004 in

[13] Board of Investment Web Site, Why Mauritius, Strong Economy, Economic Sectors, Financial & Business Services (http://www.boimauritius.com/default.aspx?Guid=18afb160-5176-4178-a620-5f0370cfaf02&nm=WHY, January 2005).

Mauritius has evolved from 7,264 to 23,595, i.e. a percentage growth of 225% over these last six years[14].

The current range of financial services includes payment and credit services, asset accumulation, custodial services and real estate. Corporate finance, risk management and financial data processing are other types of services which are being provided.

Moreover, the range of services provided by financial institutions has also been growing. In the insurance sector, in addition to traditional life and non-life insurance products, companies provide asset accumulation, re-insurance, consultancy services, risk assessment and claim settlement services.

2.1.3.5 Freeport Activities

Established in 1992, the Mauritius Freeport is a duty-free logistics, distribution and marketing hub for the Eastern and Southern African region. Logistics and warehousing facilities are readily available for the transhipment, consolidation, storage and minor processing of goods.

Freeport activities are conducted within well-defined locations in close proximity to the harbour and the international airport. The Freeport offers state-of-the-art infrastructural facilities for logistics and supply chain management, transhipment and warehousing. For the years 2003 and 2004, the average net value of re-exports from the Freeport Zone was MUR 2.5bn (USD 86.2m), while the average value of re-exports for these two years amounted to MUR 7bn (USD 241.3m).

In addition to an attractive package of incentives, the Mauritius Freeport provides international companies with a modern and competitive logistics platform to help them enhance their core business. Space in excess of 105,000 m^2 for dry storage, cold rooms, exhibitions and offices are available for companies seeking modern tailor-made infrastructure and international logistics facilities.

[14] Financial Services Commission Annual Report 2004, Industry Highlights and Analysis of Statistics, Global Business Activities (http://www.fscmauritius.org/indexar.html, January 2005).

2.1.3.6 Information and Communication Technology

With the ambition of the government to transform the island of Mauritius into a Cyber Island, the Government has prioritized the development of the Information and Communications Technology (ICT) Sector to make it the fifth pillar of the economy. A new incentive regime has consequently been introduced. The connection of Mauritius to the SAFE fibre optic network, linking Europe and the Far East via South Africa a few years ago, has placed the island on the information super highway.

The Ebene Cybercity, a new generation of technology parks, provides state-of-the-art infrastructure and facilities for ICT companies and IT-enabled services (ITES) companies. The first Cyber Tower is already in operation and the second one will be ready by end 2005. Moreover, in view of the increasing demand in the sector, two additional Cyber Towers are planned in the North and in the South respectively.

As at September 2004, some 69 companies were operating in the ITES-Business Processing Outsourcing (BPO) sector[15]. Since the beginning of 2003, the industry has experienced dynamic growth in terms of the number of companies which have started operations.

Back-office operations represent the segment which is recording the highest growth, followed by call centres and software development. The ITES-BPO industry is going through a process of diversification with the emergence of sectors like Multimedia, On-Line Education, Website Development and Disaster Recovery.

The industry employed some 2,400 people at November 2004. There is a predominance of French companies in the industry but there are other European companies, as well as American ones, which are settling down.

The unique blend of advantages offered by Mauritius, coupled with its reputation as a very safe location, is attracting several leading players such as Infosys, Accenture and Cendris to set up operations and relocate their Disaster

[15] InvestMauritius *(The Board of Investment Newsletter)*, Issue No. 1, November 2004, p. 8 (http://www.boimauritius.com/Documents/Doc109.pdf, January 2005).

Recovery Centre on the island. On the other hand, Microsoft, IBM and HP have set up their regional base in Mauritius.

2.1.4 An Environmental Overview

With a vision to provide a better environment and quality of life for the present and future generations, the Mauritian authorities are controlling the level of pollution in the country, sensitizing and educating the public in general to be environmentally more conscious, preserving the resources of the country, protecting the local environment and the global environment. Mauritius is also ecologically fragile and vulnerable with high biological diversity.

The Ministry of Environment was created in 1992 following the promulgation of the Environment Protection Act (EPA) in 1991 which has subsequently been replaced by a new EPA in 2002. The Environment Protection Act is the most comprehensive piece of legislation in Mauritius dealing with management and protection of the environment. It lays emphasis on co-ordination of environmental matters through an administrative framework, which includes the National Environment Commission chaired by the Prime Minister.

Before the EPA, a few Acts and Regulations dating as far back as 1954, governed certain environmental issues: inflammable liquids and substances; explosives; pesticides and chemical fertilizers; occupational safety, health and welfare, etc.

2.1.4.1 National Solid Waste Management

The National Solid Waste Management Strategy aims at reducing the generation of waste and the environmental impacts associated with their disposal as well as ensuring that the socio-economic development of the country, the health of its people and the quality of its environmental resources are not affected by an uncontrolled and uncoordinated waste disposal system.

A feasibility study has been commissioned by the Ministry of Local Government and Solid Waste Management in order to determine the most

feasible method for waste disposal. The objective of the study is to achieve a multi-pronged approach to waste disposal through waste minimisation (composting, recycling and new regulations), construction of civic amenity centres for bulky wastes, extension of the Mare Chicose Sanitary Landfill, the possibility of setting up a Waste Complex (Incineration, Landfill, Hazardous), the construction of a landfill in the North West and new transfer stations as well as the upgrading of existing ones and Energy Recovery from the Mare Chicose Landfill.

2.1.4.2 The National Sewerage Master Plan

The National Sewerage Master Plan, prepared in 1994, provides a complete scheme for the development of the Wastewater Sector in Mauritius. It seeks to connect 50% of the population to the public sewerage system by 2010/2012. On the completion of the plan, most of the existing effluent will be disposed of to sewers. Moreover, standards for discharge of industrial effluent into public sewers are in force since November 2004 (Government Notice No 182 of 2004).

2.1.4.3 The Sustainable Management of Oceans and Coasts

The major environmental concerns of Mauritius with regard to its coastal zone are the Coastal Degradation, Beach Erosion and pollution of the lagoons. Progress has been made in the restoration of beaches, banning of sand extraction, protection from anchor damage, controlling of fishing methods, surveillance and protection of marine resources by the National Coast Guard and the Fisheries Protection Service and improvement has been noted in the quality of water in the lagoons.

Through the establishment of the Mauritius Oceanography Institute a few years ago, the following projects are being initiated: Lagoon and Reef Watch Movement; Bio prospecting of the Mauritian Waters; Coral Recruitment and Inventory of the Coral Fauna of Mauritius; study of short period sea level oscillations; and Geo-spatial Information System for the Coastal Vulnerability Mapping of Mauritius.

2.1.4.4 The Ozone Layer

Mauritius has exceeded all expectations in its commitments to preserve and protect the Ozone Layer as required under the Montreal Protocol (more details at Section 2.2.3). This has been further facilitated by the effective use of internationally available resources to transfer non-ODS technologies to our industries and sensitisation of the inhabitants to support the change.

2.1.4.5 Climate Change and Sea-level Rise

A multi-sectoral National Climate Committee, chaired by the Prime Minister, was set up in 1991 to involve all stakeholders in combating climate change. In 1995, a first national inventory of sources and sinks of greenhouse gases was submitted to the Secretariat of the UNFCC. It is since then updated on an annual basis. A National Climate Change Action Plan was prepared in 1998 by the Meteorological Services and a Technology Needs Assessment for Climate Change Issues has been prepared last year (2004).

A list of programmes is on-going with a view to reduce the negative impacts of climate change covering adverse impacts, measures for abatement and enhancing sinks for greenhouse gases, policy options for monitoring systems and for strategies to respond to the impact of climate change, and policy frameworks for implementing adaptation measures and response strategies.

2.1.4.6 National Biodiversity Strategy

Mauritius has produced a draft National Biodiversity Strategy Plan which includes the following thematic sectors: Forest Biodiversity; Terrestrial Biodiversity; Agro Biodiversity; Freshwater, Coastal and Marine Aquatic Biodiversity; Biotechnology and Sustainable Ecotourism. Progress in conservation of native flora has been made with support from NGOs, Government and foreign organisations. An Islets Biodiversity Management Plan has also been endorsed in 2001.

2.1.4.7 The National Oil Spill Contingency Plan

Mauritius has strengthened its institutional and legislative framework to control oil pollution. In line with the provisions of the Environment Protection

Act 2002, Mauritius has prepared a Contingency Plan with the support of the Indian Ocean Commission in order to respond to oil spills. The Plan includes a data directory and a Coastal Sensitivity Atlas of Mauritius.

2.1.4.8 ARPEGE

The ARPEGE *(Appui régional pour l'éducation de la gestion de l'environnement)* is a pilot project has been initiated in 2003 by the Indian Ocean Commission for the promotion of environmental education programmes within Indian Ocean countries. The project concerns the sensitization of school children aged between 8 and 13 on environmental issues.

2.1.5 A View on the Health Sector

Health care is free in Mauritius and it is one of the main assets of the Welfare State. Besides 14 regional public hospitals (two being in Rodrigues), there are 122 Community Health Centres, 27 local Area Health Centres and two 'Mediclinics'[16]. The private health care system is well organised also with 12 private clinics and hundreds of medical and paramedical practitioners exercising on the market.

Mauritius has unfortunately one of the highest rates of diabetics and cardio-vascular patients in the world - 51% of deaths are due to Circulatory System problems[17]. There is one doctor for every 1,043 Mauritians and one dentist for every 7,940 persons. The average life expectancy is 68.6 for the male population and 75.5 for the female one.

Due to the critical issue of cardio-vascular problems, Mauritius has set up state-of-the-art facilities for cardiac surgery and has benefited from assistance of highly reputed foreign cardiac surgeons. One of the main objectives of the Mauritian authorities is now to transform the country into a regional high-tech medicine centre.

[16] Central Statistics Office, Publications, Regular Reports, Mauritius in Figures 2003, Health (http://statsmauritius.gov.mu/mif03/health.pdf, February 2005).
[17] *Ibid*.

2.2. INSTITUTIONAL, POLICY AND REGULATORY FRAMEWORK IN MAURITIUS

This Section gives an overview of the present institutional, policy and legal frameworks that will form the basis for the execution of the National Implementation Plan as required under the Stockholm Convention on POPs.

2.2.1 ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT POLICIES AND GENERAL LEGISLATIVE FRAMEWORK

Mauritius's sustainable development agenda covers an extremely large number of social, environmental and economic issues. Environmental concerns of the Government of Mauritius include preservation and enhancement of the quality of natural environment (air, water, soils, flora and fauna), protection from pollution arising from all kinds of human activities, facilitation of conservation and replenishment of the environment, maintenance of health and welfare of all and the achievement of economic prosperity through environmentally sound and sustainable development.

However, as a small island developing state, Mauritius is both ecologically and economically vulnerable. It is heavily dependent upon its natural resources (soil, lagoons, coral reefs, beaches and fisheries) for sustainable development. Misuse or mismanagement of dangerous chemicals could lead to severe adverse impacts on the environment, health and the economy. The United Nations Commission for Economic Development (UNCED) recognized the specificity and the vulnerability of Small Islands Developing States (SIDS), as highlighted in Chapter 17 of Agenda 21. The International Meeting to review the implementation of the Barbados Programme of Action for Sustainable Development of SIDS (BPOA 1994) was held from 10-14 January 2005 in Mauritius itself.

The most important outcomes of that meeting are:

(i) The adoption of a pro-active strategy for the further implementation of the Programme of Action for the Sustainable Development of SIDS, known as the Mauritius Strategy, and;

(ii) A political declaration, the Mauritius Declaration, which focuses on the full commitment of all stakeholders to support the efforts of SIDS to implement Sustainable Strategies.

The Mauritius Declaration identifies pertinent issues concerning small islands for priority attention. With regard to chemical management, the Mauritius Strategy recognises that SIDS are particularly vulnerable to hazardous chemicals and face constraints both in terms of financial and technical capacity in dealing with hazardous wastes.

The Mauritius Declaration reaffirms the continued validity of the BPOA 1994 and sets the objectives of improving the access of SIDS to appropriate technology and to promote integrated waste management systems. Moreover, it supports the setting up of sub-regional workshops for the implementation of the Stockholm Convention on POPs in order to provide assistance to developing countries in strengthening their national chemicals management programmes with regard to the Stockholm Convention and related instruments. These issues have been included in the Government's agenda and are being addressed. However, much still remain to be accomplished.

2.2.1.1 Environmental and Sustainable Development Policies

The Mauritius policy planning and strategy formulation for environmental protection aims to play a major role in fostering economic development that harmonizes with the natural environment and enhances the quality of life of its population.

The Government of Mauritius is fully committed to the protection of the health of workers and the public and to the protection of the environment from harmful effects of chemicals and hazardous wastes. Policies for sound management of chemicals and hazardous wastes have been adopted by the National Assembly through the promulgation of the following main enactments:

- The Dangerous Chemical Control Act 2004;
- The Environment Protection Act 2002;
- The Occupational Safety, Health and Welfare Act 1999.

2.2.1.1.1. Objectives of the National Environmental, Health and Occupational Safety & Health Policies

The primary objective of the National Environmental Policy is to protect and manage the country's environmental assets such that their capacity to sustain development is unimpaired and to ensure that future generations are able to enjoy the magnificent environmental endowment of Mauritius[18].

The gist of the environmental policies is set out in the National Environmental Action Plan (NEAP2) which figures in the Government's National Environmental Strategies (1999) for over the next ten years. A second key process that shapes the environmental policies is the review of legal and institutional framework for environmental management in Mauritius.

In the 90's, Mauritius revised all its health and sanitary regulations and the country is adopting international standards in all relevant areas. Test certificates issued by standards organisations from originating countries are now recognized. Control of food, drugs and chemicals with potential adverse effects on health is under the purview of the Ministry of Health. Certificates of analysis from recognized foreign institutions are accepted. However, the Health Inspectorate samples imported food to ensure that shipments comply with local food regulations.

The White Paper on Health Sector Development and Reform, published in March 2003, proposes an Action Plan for Health. The aim of the Action Plan is to improve the level of health in Mauritius and the range and quality of health services in order to meet the present and future needs of the people.

The Public Health Service of the Ministry of Health provides basic protection of the public health of the population. This includes public education and the enforcement of laws on public hygiene, protection against environmental hazards, the maintenance of public health standards and the control of environmental pollution.

The Environmental Health Unit also assesses parameters of pollution and has been called upon to advise on technical measures for the abatement of

[18] White Paper on the National Environmental Policy, 1991.

nuisances. Limit of residues with regard to pesticides and other toxic, noxious and harmful substances is provided under the Food Act 1998 and Food Regulations 2000. Over the pasts two years, more than 494 sanitary contraventions have been established by the Division under provisions theses Acts.

Conscious that some workers are exposed to dangerous chemicals at their place of work, the National Occupation Safety and Health Policy aims at improving the work environment and preventing accidents and occupational diseases. The objective of the policy is to encompass all the occupational safety and health issues in all sectors including the public and private sectors that may have direct or indirect, inherent or potential occupational safety and health hazards on the health and safety of employees arising from their workplace.

2.2.1.1.2 Institutional Framework for Environmental Management

The strive for achieving the policy objectives with regard to environmentally sound and sustainable development has engendered the necessary inter-connection and coordination among the various governmental agencies in Mauritius.

The prime institutional responsibility for environmental management as a whole lies with the Ministry of Environment. It provides general response with regard to environmental pollution and ensures the protection and management of the environmental assets of the country.

The following bodies have been established within the Ministry of Environment under the EPA 2002 so as to ensure effective coordination and collaboration among the stakeholders:

(i) The National Environment Commission, a high-level inter-Ministerial Commission chaired by the Prime Minister, where environmental policy decisions are taken;

(ii) The Environment Coordination Committee, comprising high-level officials from various ministries and authorities;

(iii) The Department of Environment, the technical arm of the Ministry, which is administered by a Director with powers to implement policy and enforce environmental laws;

(iv) The *Police de l'Environnement* (seconded Police Officers from the Police Force) which provides assistance to the Director on enforcement of environmental laws.

(v) The National Network for Sustainable Development, a forum for discussion comprising several stakeholders, including NGOs and the Civil Society, and chaired by the Minister of Environment;

(vi) Various Technical Committees and Technical Advisory Committees set up as and when required on matters pertaining to the scientific and technical aspects of environmental protection and management.

The institutional structure upon which the implementation of the environmental strategy is based enables the Ministry of Environment to play its role as stimulator and co-ordinator while the implementation is done by many other agencies - governmental and non-governmental - according to the programmes contained in the National Environment Action Plan.

Figure 1 -
NATIONAL ENVIRONMENTAL
ACTION PLAN PROGRAMMES AND RESPONSIBILITIES

OVERALL ENVIRONMENTAL MANAGEMENT

Ministry of Environment & NDU

Responsibilities

- Department of Environment.
- Environmental Quality.
- Environmental Information and Awareness.

Resource Management

- Land Management – Ministry of Agriculture, Food Technology & Natural Resources (Land Use Division).
- Water Management – Ministry of Public Utilities (Water Resources Unit).
- Air Quality Management – Department of Environment.
- Integrated Coastal Zone Management – Department of Environment.
- Biodiversity – National Parks and Conservation Service (NPCS).

Sector Management

- Integrated Solid Waste Management – Ministry of Local Government and Solid Waste Management.
- Industrial Management – Ministry of Industry, Financial Services & Corporate Affairs.
- Tourism Management – Ministry of Tourism and Leisure.
- Agricultural Management – Ministry of Agriculture, Food Technology and Natural Resources.
- Transport Management – Ministry of Public Infrastructure, Land & Transport.

2.2.1.1.3 Other Ministries, Agencies and Institutes

The EPA 2002 also provides for other relevant ministries to enforce the law in relation to an environmental medium or pollutant for which those ministries already have responsibilities under their respective legislations prior to the enactment of the EPA. The table below summarises the roles of the various enforcing agencies under the EPA.

Table 1 –
ROLES OF THE DIFFERENT ENFORCING AGENCIES

Medium/Pollutant	Enforcing Agency
Noise, quality control of drinking water and odour.	Ministry of Health and Quality of Life.
Inland waters and effluents.	Ministry of Public Utilities.
Solid wastes and hazardous wastes.	Ministry of Local Government and Solid Waste Management.
Pesticide residues.	Ministry of Agriculture, Food Technology & Natural Resources.
Waters in the zone other than waters in the Port.	Ministry of Fisheries and Marine Resources.
Waters in the Port.	Port Master.
Air and any of the above medium or pollutant.	Director of Environment (Ministry of Environment).

2.2.1.1.3 Institutional Arrangements for Chemical Management

The Ministry of Health and Quality of Life plays a major role in the management of chemicals in view of ensuring the protection of the health of workers and the general public and also of the environment from the harmful effects of chemicals. Under the Dangerous Chemicals Control (DCC) Act 2004, different ministries and government departments are assigned the responsibilities for the management of chemicals as enforcing agencies within their respective area of expertise.

For proper coordination and collaboration among the various stakeholders, including the private sector, the DCC Act 2004 provides for the setting up of the following bodies:

- A Dangerous Chemical Advisory Council to advise the Minister on matters relating to dangerous chemicals;
- A Dangerous Chemical Control Board for registration, classification and labelling of dangerous chemicals in accordance with prescribed standards; as a regulatory body, the Board will adopt policies for sound chemical management throughout its life cycle (Refer to Section 2.2.4.2 for details);

- An Enforcing Agencies Co-ordination Committee to coordinate activities amongst the various designated governmental enforcing agencies.

2.2.1.1.4 Legal Framework for Environmental and Chemical Management

The laws of the Republic of Mauritius consist of primary and secondary legislations. The primary legislation comprises enactments passed by the National Assembly whereas secondary legislation, usually in the form of Regulations, is approved by the Cabinet of Ministers.

The EPA, legislated in 2002 (which repealed the previous EPA 1991), provides the main legal framework and the mechanism to protect the natural environment for the environmental management and coordinate inter-relations on environmental issues, and, ensure the proper implementation of government policies and enforcement provisions.

The major provisions set out in the EPA 2002 include the following:

- The concept of environmental stewardship;
- The requirement for environmental impact assessments for major scheduled undertakings;
- The establishment of Standards and Guidelines in respect of air, water, noise, effluent, waste, including hazardous waste and pesticides residues in raw food commodities;
- The protection of natural resources and biodiversity conservation;
- The duty to report to the Director of Environment and to take prompt actions when accidental spills of a pollutant occurs;
- The establishment of liabilities regarding environmental quality rehabilitation;
- The responsibilities of the various enforcing agencies in the enforcement of environmental laws.

The EPA 2002 also provides, under Section 42, for the Minister of Environment to make regulations for the “licensing of waste disposal sites,

wastes management systems and other facilities relating to the disposal of hazardous wastes in an environmentally sound manner." The Environment Protection (Standards for Hazardous Wastes) Regulations promulgated in April 2002 aim at exercising control on the import, export, collection, on-site treatment, transportation and disposal of a hazardous wastes[19].

On the other hand, the Dangerous Chemicals Control Act 2004 makes provisions for the prohibition of the use of certain chemical substances, including POPs, considered to be extremely dangerous as well as criminal sanctions in case of contravention of certain provisions of this Act. It also provides for the licensing of persons who are involved in the import, export, manufacture, sale, distribution, trade, transport and storing of dangerous chemicals (including chemical pesticides).

The DCC Act 2004 also provides for any manufacturer or user of any dangerous chemical to comply with the requirements relating to waste storage and handling as specified in the Seventeenth Schedule of the Act.

[19] More details on the various legislations are found in Section 2.2.4.

2.2.2 ROLES AND RESPONSIBILITIES OF INSTITUTIONS INVOLVED IN POPs LIFE CYCLES

The health and environmental issues associated with POPs are covered mostly under the two main legal frameworks, namely the Dangerous Chemicals Control (DCC) Act 2004 and the Environment Protection Act (EPA) 2002. However, other enactments also cater for certain aspects in the life cycle of the POPs. Details on existing legislation and regulations regarding POPs are covered under Section 2.2.4. This section highlights the roles and responsibilities of the several institutions which are directly or indirectly involved at various stages of the life cycles of the POPs.

2.2.2.1 Role of the Ministry of Health and Quality of Life

The Ministry of Health and Quality of Life (MOH) is the main regulatory body that controls, under the DCC Act 2004, all dangerous and extremely dangerous chemicals - including intentionally produced POPs chemicals - throughout their different stages of life: import, export, transit, production, sale, distribution, transport, storage and disposal. As an enforcing agency under the DCC Act 2004, it is specifically responsible for health effects consequential to accidental, occupational or environmental exposure to dangerous chemicals, medical surveillance and regular medical examinations. The Ministry is also responsible for regular investigation of occupational diseases or work- related diseases following exposure to, or the use of, dangerous chemicals.

The Ministry of Health acts as the main coordinating body with other organisations in the management of dangerous chemicals and provides the secretariat facilities for the functioning of the Dangerous Chemicals Control Board (DCCB) set up under the DCC Act 2004. Through the DCCB, the MOH is responsible for carrying out the following functions:

- Register all importers, manufacturers, distributors and retailers of dangerous chemicals;
- Register all chemicals manufactured, imported and sold in Mauritius;
- Issue licences for the manufacture, import, export, retailing, transport and storage of chemicals;

- Issue of permits for the import of highly dangerous chemicals and pesticides;
- Classify all chemicals according to schedules;
- Ensure compliance with different sections of the legislations especially on labelling and packaging;
- Ensure proper coordination among the different enforcing agencies;
- Prepare guidelines, codes of practice and regulations on dangerous chemicals;
- Disseminate information on chemicals to the public;
- Receive notifications on import of dangerous chemicals;
- Prepare a Register of dangerous chemicals.

The Ministry of Health is also the authority responsible for determining and enforcing the maximum pesticide residue limits, including the POPs' ones, in food under the Food Act

2.2.2.2 Role of the Ministry of Environment and National Development Unit

The Ministry of Environment and National Development Unit (MOE) has the overall responsibility for the protection of the environment. Under the EPA 2002, it regulates, via standards or guidelines, POPs' limits in different media (particularly air and water), and as residues in raw agricultural commodities (fresh or frozen fruits and vegetables in their raw state, grains, nuts, eggs, raw milk, meat and other agricultural produce), food and animal feeds. The Ministry of Environment also regulates the import, export, collection, movement, transportation and disposal of hazardous wastes. Obsolete POPs pesticides, used PCB oils and scrapped PCB-containing equipment are therefore controlled under the relevant Regulations made under the EPA.

The EPA 2002 also enables the MOE to control the release of any pollutant, waste or other noxious substances from or through the atmosphere or by dumping in the maritime zones of the Republic of Mauritius. The Environmental Impact Assessment (EIA) mechanism provided under the same Act allows the Ministry to impose conditions on scheduled activities likely to release POPs (e.g. waste incinerator, power generation) or potentially dealing

with POPs chemicals (e.g. manufacturers of chemical fertilizers, paper, paint, pigment, etc.) .

Under the DCC Act 2004, the Ministry of Environment & NDU is the designated enforcing agency in relation to the adverse effects on the environment likely to be caused by dangerous chemicals. The Ministry is also represented in all the coordinating bodies established under the DCC Act.

2.2.2.3 Role of the Ministry of Labour, Industrial Relations and Employment

The Ministry of Labour, Industrial Relations & Employment enforces occupational safety, health and welfare legislations and regulations as provided under the Occupational Safety, Health and Welfare Act (OSHWA) 1998. That Act specifically requires employers to provide information, instruction, training, supervision and arrangements to ensure safety and absence of risks to health in connection with the use, handling, storage and transport of chemicals at all places of work.

Under the DCC Act 2004, the Ministry of Labour is the designated enforcing agency for the following matters:

- Technical and organizational precautions at workplaces;
- Risk analysis and assessment on loss of containment or explosion of dangerous chemicals;
- Accidents caused by dangerous chemicals;
- Internal audits of dangerous chemicals;
- Storage, handling and internal transport of dangerous chemicals.

Furthermore, the Occupational Safety and Health Inspectorate of the Ministry carries out the following functions:

- Conduct inspections, investigate into complaints and prosecute in cases of non-compliance;
- Investigate into cases of workplace accidents, initiate prosecution and/or advises employers on remedial measures to prevent recurrence;

- Disseminate information on occupational safety and health;
- Organise training; and
- Conduct specialized analyses, audits and surveys.

2.2.2.4 Role of the Ministry of Local Government & Solid Waste Management

The Ministry of Local Government and Solid Waste Management (MOLG) is responsible for the management of household and commercial waste from collection, transportation to disposal. Its mains functions and responsibilities are:

- Coordinator of the local authorities in accordance with the Local Government Act;
- Responsible for the development/review of solid waste management programmes and policies on:
  - Appropriate waste storage, collection and transfer;
  - Provision of additional disposal facilities;
  - Rehabilitation of closed dumps;
  - Effective institutional framework and legislation;
  - Waste minimisation (through composting and recycling).
- Responsible for management of wide variety of environmental issues in relation to:
  - Minimisation of waste;
  - Maximisation of value derived from waste;
  - Promotion of environmental friendly waste treatment and disposal practices;
  - Licensing of waste carriers vehicles.
- Disposal of chemical/dangerous wastes under specific terms and conditions.

The Ministry of Local Government and Solid Waste Management is also the designated enforcing agency in relation to the management of solid wastes and hazardous wastes under the EPA 2002. Under the DCC Act 2004, it is mainly responsible for the inspection, information, guidance and control on the collection, storage, transport, treatment and disposal of chemical wastes.

2.2.2.5 Role of the Ministry of Agriculture, Food Technology & Natural Resources

The Ministry of Agriculture, under the Chemical Fertilisers Control Act 1980 and the DCC Act 2004, is responsible for the inspection, information, guidance and control on the proper and safe use of pesticides as well as the control of pesticides' residues on vegetables, fruits and other agricultural materials such as soil, livestock feed or fodder.

2.2.2.6 The Police Force

The Police Force has responsibilities, under the DCC Act 2004, for the transport on public roads of dangerous chemicals and wastes. It is also responsible for the training of drivers involved in the transportation of dangerous chemicals. The Police is also required to set an emergency planning and preparedness plan relating to accidents that may arise from the use, manipulation or storage of dangerous chemicals. Furthermore, it is its duty to organise rescue activities following an accident relating to the use, manipulation or storage of dangerous chemicals. The Police is also required to contribute in the dissemination of relevant information to the public.

2.2.2.7 The Fire Services

The Fire Services are responsible for issuing fire clearances and the enforcement of fire safety measures in respect of the storage, use and transport of dangerous chemicals. The loss of containment of dangerous chemicals and spillage clean-up following the release of dangerous chemicals in the environment falls under the responsibility of the Fire Services. The latter is also responsible in emergency planning following an explosion, fire or any accident involving dangerous chemicals.

2.2.2.8 The Customs and Excise Department

The Customs and Excise Department, now under the aegis of the newly set up Mauritius Revenue Authority, has the duty to check the nature and amount of dangerous chemicals imported, exported and on transit in the country. It is also

responsible for the exchange of computerised information relating to the importation and exportation of dangerous chemicals.

2.2.2.9 Role of the Ministry of Public Utilities

The main activities of the Ministry of Public Utilities (MPU) are the formulation of policies in the energy, water and wastewater sectors and the introduction of legislation as required to fulfil its mission and goals. The Ministry also ensures that services offered by various organisations falling under its purview are delivered in the best interests of the public.

The objectives of the MPU are to provide a 24-hour water and energy supply while maximizing the use and benefits of renewable local sources of energy. It also aims at extending the wastewater network island wide. The Ministry has under its responsibility the Central Water Authority (CWA), the Central Electricity Board (CEB), the Wastewater Management Authority (WMA), the Water Resources Unit and the Energy Services Division (ESD).

2.2.2.9.1 Wastewater Management Authority

The Wastewater Management Authority, established as a corporate body under the Wastewater Management Authority Act 2001, is responsible for the control of effluents including sewage. It has a general regulatory function concerning wastewater disposal and is an enforcing agency with the power to issue enforcement notices. The WMA operates and maintains all sewerage infrastructure and collects wastewater charges from properties connected to the public sewerage system. Furthermore, the WMA, as per Government Notice No 182 of 2004, also regulates Wastewater Standards for discharge of industrial effluents into the wastewater system.

The Authority can disconnect any user from its system if there is breach of contract or if any offence is committed. The WMA Act 2001 sets up a system of notification calling upon any industrial establishment, factory, workshop or other premises to take appropriate steps within a specified time limit whenever effluent from these places is “liable” to contain any matter which is or may be injurious to the sewerage system or the working of the sewerage system or to public health.

2.2.2.9.2 Central Electricity Board

The Central Electricity Board is a para-statal body established by the RL 1/379 Central Electricity Board Act of 25 January 1964. Under this Act, the CEB is statutorily responsible for the control and development of electricity supply in Mauritius. It is empowered to prepare and carry out development schemes with the general object of promoting, coordinating and improving the generation, transmission, distribution and sale of electricity in Mauritius.

2.2.2.10 Mauritius Sugar Industry Research Institute

To fulfil its research and development programme, the Mauritius Sugar Industry Research Institute (MSIRI) performs a broad range of measurements including analyses on soils, plants, waters, agricultural materials and environmental samples. To this end, it imports a wide range of analytical reagents but none of them falls within the group of POPs. In fact, the only POPs used are the reference standards for POPs analysis, which are imported in microgram quantities only.

The role of the MSIRI with respect to chemical management is therefore restricted to non-POP substances. Moreover, in formulating recommendations for fertilisers and pesticides, particularly herbicides, the MSIRI plays a major role in the judicious use of agro-chemicals both in the sugar cane cultivation and food crop production while minimising their impact on the environment.

The main objectives of the MSIRI with respect to chemical management are:

1. To develop the best management practices for agro-chemical use in sugar-cane and food crop production such that any environmental and health impacts are reduced to a minimum;
2. To ensure a readily available supply of analytical reagents for the purpose of carrying out research work. While achieving this objective, the general rules of proper storage and stock management are observed such as:
    - The location of chemical stores in separate buildings with adequate ventilation and emergency equipment;
    - Authorised access to chemical stores;

- Yearly importation of chemicals so as to avoid old stocks;
- Use of chemicals on a 'first in-first out' principle is strictly adhered to in order to avoid any accident or the use of expired products, among others.

TABLE 2 –

SUMMARY OF RESPONSIBILITIES OF THE DIFFERENT MINISTRIES, AGENCIES AND INSTITUTIONS INVOLVED IN POPs LIFE CYCLES

Stage of life	Importa-tion	Storage	Transport	Distribution/ Marketing	Use/ Handling	Disposa l
Ministry of Health	√	√	√	√	√	√
Ministry of Environment	-	√	√	-	√	√
Ministry of Agriculture	-	√	-	-	√	-
Ministry of Labour	-	√	√	-	√	-
Ministry of Local Government	-	√	√	-	√	√
CEB[20]	√	√	√	-	√	√

[20] With respect to PCBs and PCB-containing transformers.

MSIRI[21]	√	√	-	-	√	-
Customs and Excise Dept.	√	-	-	-	-	-

[21] For research and analytical purposes only.

2.2.3 MAURITIUS' INTERNATIONAL COMMITMENTS AND OBLIGATIONS

Besides the Stockholm Convention which Mauritius signed on 23 May 2001 and ratified on 13 July 2004, the Republic of Mauritius is party to the following waste/chemicals-related Conventions and Protocol:

- The Vienna Convention on the Protection of the Ozone Layer (1985);
- The Montreal Protocol on Substances that Deplete the Ozone Layer (1987);
- The Basel Convention on Transboundary Movements of Hazardous Waste and their Disposal (1989);
- The Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Waste within Africa (1991);
- The Rotterdam Convention for the Prior Informed Consent procedure for Banned or Restricted Chemicals in International Trade (1997).

The table below shows the dates of the signature and ratification of these conventions and protocol by Mauritius and also the achievements so far by the country. A comprehensive list of all Environmental Conventions and Treaties to which Mauritius is a party to is found at Annex 5.

TABLE 3 –

MAURITIUS' POSITION WITH REGARD TO VIENNA, BASEL, ROTTERDAM AND BAMAKO CONVENTIONS

Name of Convention/ Protocol	Signed	Ratified	Accession
VIENNA CONVENTION ON THE PROTECTION OF THE OZONE LAYER - 1985			18 August 1992
Montreal Protocol on Substances that Deplete the Ozone Layer - 1987			18 August 1992
London Amendment June 1990			20 October 1992
Copenhagen Amendment - November 1992		30 November 1993	
Montreal Amendment –			24 March 2003 (Accepted)

September 1995			
Beijing Amendments- 1999			24 March 2003 (Accepted)

Focal Point in Mauritius: Department of Environment.

Achievements:

Since 1992, Mauritius has taken a number of policy decisions aiming at reducing the consumption of CFCs.

With the financial assistance from the Multilateral Fund of the Ozone Secretariat, the Country Programme was prepared and other projects initiated to be implemented.

Forty-eight48 tons of CFC had been phased out in years 1995-2002, representing 69% of the local consumption:

1. Elimination of CFC-11 and CFC-12 in the manufacture of domestic refrigerators and freezers (phased out 7 tons);
2. Elimination of CFC-12 in aerosol conversion project (phased out 41 tons).

Mauritius has thus successfully achieved the baseline figure which was 29.1 tons. 1999 was the freezing year for CFCs and the following actions followed consequently:

1. Amendment of the Consumer Protection (Price Control and Supplies) Act 1999 to include all the Ozone Depleting Substances (ODS) and the banning of equipment containing them.
2. Quota levied on importers of CFCs.
3. Linear reduction of imports annually as from 2000.
4. Mandatory labelling of products and equipment using ODS, 40% Customs Duty on all products containing CFCs and duty reduction on Ozone-friendly products.

In 2001, a Development of Refrigeration Management Plan was elaborated to recover and recycle CFCs.

In 2003, a Terminal Phase-out Management Plan was developed.

Much quicker progress has been achieved with a reduced consumption of CFC by about 92% ahead of the Protocol's target.

Mauritius will be a zero-CFC importing country by the end of this year (2005).

After CFCs, Methyl Bromide is the other ODS which is presently of concern. As a component of the Terminal Phase-out Management Plan, financial incentives are proposed for the shift to an ozone-friendly alternative to Methyl Bromide.

BASEL CONVENTION ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES – 1989		24 November 1992	24 November 1992	

Focal Point in Mauritius: Department of Environment.

Achievements:

The Environment Protection (Standards for Hazardous Wastes) Regulations 2001 came into force on 1 April 2002. The regulations provide mainly for the control of

import, export, collection, on-site treatment, transportation and disposal of hazardous wastes. A National Solid Waste Management Strategy has been devised and is being implemented. A workshop on Medical Waste Management had been organised with the assistance of the Basel Convention Regional Centre of South Africa.				
BAMAKO CONVENTION ON THE BAN OF THE IMPORT INTO AFRICA AND THE CONTROL OF TRANSBOUNDARY MOVEMENT OF HAZARDOUS WASTES WITHIN AFRICA - 1991		29 October 1992		Not yet into force.
Focal Point in Mauritius: Ministry of Environment & NDU.				
ROTTERDAM CONVENTION ON THE PRIOR INFORMED CONSENT PROCEDURE FOR CERTAIN HAZARDOUS CHEMICALS AND PESTICIDES IN INTERNATIONAL TRADE - 1997		In process.		
Focal Point in Mauritius: Ministry of Health and Quality of Life.				
Achievements: All chemicals listed for Prior Informed Consent procedure by the Rotterdam Convention are banned in Mauritius through the Dangerous Chemicals Control Act Bill of 2004.				

2.2.3.1 SYNERGIES AND INTER-LINKAGES

Mauritius participated in a regional project, the Synergies and Inter-linkages of Multilateral Environmental Agreements (MEAs), aiming at harmonizing the implementation of the different conventions and eliminating all possible conflicts and overlapping. The Project concerned seven Sub-Saharan African countries, including two small island developing states (SIDS). Three clusters were proposed: Biodiversity-related Conventions, Marine-related Conventions and Waste/Chemicals-related Conventions.

A first consultative meeting was held on 22 September 2003 whereby the project was explained and discussed. A Mauritian Lead UNEP Consultant was involved in the project, together with representatives of the Ministries of

Agriculture and Environment, UNEP Nairobi Regional Office, the Meteorological Services and the Mauritius Sugar Industry Research Institute (MSIRI). Unfortunately, the project did not proceed any further due to the unavailability of the Lead Consultant.

2.2.4 EXISTING LEGISLATION AND REGULATIONS REGARDING POPs

At present, there are two pieces of legislation which are directly related to the 12 Persistent Organic Pollutants listed in the Stockholm Convention, the main one being the Dangerous Chemicals Control Act 2004 and the other one is the Environment Protection Act 2002. A third one is closely related to the POPs issues: the Food Act 1998.

2.2.4.1 Environment Protection Act (EPA) 2002

The EPA 2002 provides for the setting of POPs limits in different media and especially in water, air, residues and for the disposal of hazardous wastes.

Under the Act, the Minister of Environment is empowered to issue, among others, Standards, Guidelines and Regulations in respect of:

- Water - Different standards for water quality in view of the use and value of water for domestic supply; propagation of fish, flora, fauna and wildlife; recreational, agricultural and industrial purposes and other uses.
- Effluent Limitations - Standards for water and other releases from industrial operations.
- Air - Establishment of standards in order to protect the quality of air resources; prescription of provisions for the control of concentration of substances in the air and the control of atmospheric pollution originating from energy and industrial purposes, etc.
- Waste - Provision of standards for both hazardous and non-hazardous wastes. Regulations may be made for the control of the import, export, collection, movement, transportation and disposal of hazardous wastes and for the licensing of waste disposal sites, waste management systems and other facilities relating to the disposal of hazardous wastes in an environmentally sound manner. Prescription of standards for the collection, transportation, storage, processing, disposal and recycling of non-hazardous wastes is also mentioned.

- Pesticide Residues - Standards may be prescribed for the concentration of pesticide residues in raw agricultural commodities (fresh or frozen fruits and vegetables in their raw state, grains, nuts, eggs, raw milk, meat and other agricultural produce), food and animal feeds. Processed, fabricated or manufactured food or any agricultural produce by the way of cooking, dehydrating, milling or by any other means are not however concerned by the Act.

Section 52 of the EPA Act 2002 prohibits the release of any pollutant, waste or other noxious substance from or through the atmosphere or by dumping in the coastal and maritime zones of Mauritius.

Industries and activities that require an Environment Impact Assessment (EIA) license to operate are also listed in the First Schedule (Part B) of the Act. In this regard, the following POPs-related issues may be of importance:

- Landfills, Waste Incinerators and Transfer Stations for Solid Waste; Sugar Factories or Refineries (possible POPs: Dioxins and Furans);
- Manufacturers of chemical fertilisers, pulp, paper, paint, pigment and varnish (possible POP: PCBs);
- Organisations/persons manufacturing, handling and storing dangerous chemicals and pesticides (possible POPs: Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Mirex and Toxaphene).

2.2.4.1.1 Regulations

The following Guidelines, Standards and Regulations have been published in the Government Gazette in respect of the limit values for POPs in various media:

1. Government Notice No. 188 of 1998 on Guidelines for Inland Surface Water Quality. These guidelines are set to preserve the quality of the inland surface water and to sustain aquatic life. They include maximum permissible limits for POPs chemicals in rivers, watercourses, streams, lakes, ponds, dams and reservoirs. Provisions of the Notice however excludes all ground water, sea water, water in private chambers/tanks or

any other container and water contained in any sewer, sewage disposal works, private drains or private reservoirs used for irrigation purposes.

Adherence to the following parameters of POPs is recommended:

- Chlordane 0.0043 μg/1
- DDT 0.001 μg/1
- Dieldrin 0.0019 μg/1
- Endrin 0.0023 μg/1
- PCBs 0.014 μg/1

2. Government Notice No. 55 of 1996 related to the Drinking Water Standards. Maximum limits for the following POPs are stipulated:

   - Aldrin and Dieldrin 0.03 microgram/l
   - DDT 2 microgram/l
   - HCB 1 microgram/l
   - Heptachlor [and Heptachlor Oxide] 0.03 microgram/l

3. Government Notice No. 157 on Environment Protection (Standards for Hazardous Wastes) Regulations 2001 gives comprehensive descriptions of hazardous wastes and the waste streams. Potential sources of Persistent Organic Pollutants are the following:

Waste Stream	Description of Waste
Manufacture, formulation, supply and use of paint and varnish	Sludge from paint or varnish removal. Waste paints and varnish
Miscellaneous sources	Insulating and heat transmission oils containing PCBs [or PCTs]

4. Government Notice No. 4 of 2005 on Used Oil Regulations. These Regulations provide for the collection, storage, treatment, use and disposal of used oil; and prohibit collection and recycling of used oil containing PCBs or PCT in concentrations above 50 parts per million.

2.2.4.2 The Dangerous Chemicals Control Act (DCC) 2004

The main objective of the DCC Act 2004 was to provide a better legal framework for the control of dangerous chemicals in order to prevent damage to health and to the environment by chemical substances and to provide for better protection of workers, members of the public and the environment. The Act however does not apply to prepared processed or prepared foodstuff and to biological agents other than those used as pesticides. The Pesticides Control Act 1972 was repealed by the DCC Act 2004.

Section 23 of the DCC Act provides that "every person who imports, produces, manufactures or sells any commodity for human or animal consumption shall ensure that the commodity marketed or sold […] presents no danger to the health of consumers by reason of toxic residues contained in or on such commodity through the use of pesticides or other dangerous chemicals on crops or otherwise […]". But some caution need to be taken as, according to Section 27(2) of the Act, anyone may freely import, manufacture, use or possess a prohibited chemical if it is for research purposes, experiments or as a reference sample or exhibit.

The Act divides chemicals into several groups according to the level of risk they pose:

1. Non-dangerous chemicals for which export, import, sales, distribution and manufacturing is not restricted.
2. Dangerous chemicals for which export, import, sales, distribution and manufacturing require a general licence.
3. Pesticides and extremely dangerous chemicals, a category of highly risky dangerous chemicals and pesticides that require a permit on a chemical-by-chemical basis.
4. Prohibited chemicals which are not be subject to export, import, sales, distribution or manufacturing.

Among the 422 dangerous chemicals listed in the Act (First Schedule, Section 2), there are two Persistent Organic Pollutants: PCBs and Toxaphene. In the list of the restricted extremely dangerous chemicals (Second Schedule, Section

2, Part I), we again find PCBs and another POP which is Hexachlorobenzene (HCB).

This may give the impression that POPs could be authorised in Mauritius. However, in the list of the prohibited chemicals (Eighteenth Schedule, Section 27, Parts I and II), the 12 POPs of the Stockholm Convention are found: Dioxins, Furans and PCBs for the Industrial Chemicals; Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, HCB, Mirex and Toxaphene for the Agricultural Chemicals.

The Dangerous Chemicals Control Act also requires, in Paragraph 19, to substitute a dangerous chemical with a less dangerous alternative if available. This would facilitate the withdrawal of risky chemicals from the market and replace those with safer products. Such provisions may be of importance if and when new POPs chemicals are identified.

2.2.4.3 The Food Act 1998

A few Regulations of the Food Act 1998 do also mention POPs. In the Tenth Schedule (Regulation 62 (2) (d)) entitled Maximum Pesticide Residues in Food, there are maximum residue limits for the POP Heptachlor that read as follows:

- 0.2 mg/kg for carrots and carcass meat (in fat);
- 0.02 mg/kg for raw cereal and tomatoes;
- 0.05 mg/kg for vegetables.

In the 64th Schedule of the same Act (Regulation 421), Guidelines Values for Bottled Water, standards are set for the following pesticides:

- Aldrin and Dieldrin 0.03 microgram/l
- DDT 1 microgram/l
- HCB 1 microgram/l
- Heptachlor
  [and Heptachlor Oxide] 0.03 microgram/l

There are also a few other pieces of legislation that are not directly related to POPs but do embrace other types of chemicals, fertilizers, etc. A few

examples are The Chemical Fertilizers Control Act 1980, The Agricultural Chemists Act 1979 and the Chemical Analyses Act 1898.

2.2.5 KEY APPROACHES AND PROCEDURES FOR POPs CHEMICAL AND PESTICIDE MANAGEMENT

As noted in the previous section, the importation of all the POPs chemicals is banned in Mauritius. Existing stock of DDT is used only by public health officials for malaria vector control and is not authorised for other uses. PCBs have been prohibited since long, however no systematic investigation have been conducted before 2004 and therefore no specific management and control approaches have been developed.

2.2.5.1 Administrative Approaches and Procedures

Until very recently, the administrative and enforcement of pesticides and industrial chemicals were controlled through the Pesticides Control Act 1972 and the Consumer Protection Act 1991. The legal basis has recently been revised and transferred to the Dangerous Chemicals Control Act of 2004. The enactment of the Dangerous Chemicals Control (DCC) Act is an important step in rationalizing the chemical management schemes in Mauritius. The approach of bringing most, if not all, chemicals-related authorisations and control issues, independent of their use, under a common framework should facilitate the sound management of chemicals and make best use of the available resources. This is of utmost importance especially as chemicals' production and use, as well as human and financial resources for their control, is on a modest level in the country.

Both the former and current legislation rely on an inter-ministerial/stakeholder Board to put forward applications of chemicals to be registered or restricted. The DCC Board has made its decisions based on international assessments (WHO, FAO, etc.) and on some domestic experience - Approach very understandable and the only possible way due to the scarcity of resources both when it comes to professional capacity and to budgeted funding. However, this approach is a reactive rather than proactive and preventive way of chemicals' management.

Considerable time passes between final decisions on individual chemicals and actions at international level. Furthermore, the conditions of use may not always correspond to the local context. Therefore, there is a need to enhance

the knowledge and experience of chemicals' hazards and risk assessments in the governmental structure, particularly at the Ministry of Health but also at Ministries of Environment, Labour and Agriculture.

The case-by-case approach may further distort the chemicals/pesticides market as chemicals are assessed individually without criteria of accepted/unaccepted properties. This could result in unfair treatment of suppliers of chemicals. This may particularly be the case when a decision for banning and restriction of a chemical is done based on local experiences. Such decisions may even be in infringement of the international free trade obligations if some chemicals are banned and chemicals with similar properties are allowed to remain on the market.

The undertaking of a Chemical Inventory is planned. This would be a first step in order to have a proper overview of the situation and could be implemented alongside with the development of the criteria for acceptable chemical substances in each area of use: agriculture, industrial and domestic.

The Chemical Inventory will be the first step in a chemicals classification schemes as foreseen by the DCC Act 2004. In classification of chemicals, they are assessed according to their intrinsic characteristics, i.e. the hazards. The aim is to classify the chemicals on the market and by doing so, the most hazardous substances may be identified. Once the classification exercise is completed, selected and prioritized chemicals may be put forward for a more comprehensive assessment of the risks.

Detailed assessments of risks by individual chemicals are foreseen in the Dangerous Chemicals Control Acts 2004. By virtue of the Act, there is now a Dangerous Chemicals Control Board that may further discuss and assess – by ways of committees and working groups - the risks and possible risk mitigation measures or restriction.

In summary, the DCC Act provides for a clear approach and structure for identifying and listing of chemicals in the market, a screening of these through the classification schemes and verifying that their use does not pose unacceptable risks to humans or the environment.

Implementing the provisions of the DCC Act will verify whether the approach will lead to clear risks reduction in form of fewer poisoning cases, less cases chemicals-originated chronic diseases and pollution. The full implementation of the Act will nevertheless require substantial resources.

For further emphasizing the POPs concerns and in order to ensure that new POPs are not imported in Mauritius, the DCC Act 2004 should be amended to contain provisions for making it impossible to authorise use or manufacture of substances that show persistence and bioaccumulation exceeding the cut-off criteria in the Stockholm Convention, especially for substances with health or environmental concerns.

2.2.5.2 Monitoring and Enforcement

The enforcement of the laws on pesticides, including distribution, lies with the Ministry of Health. The Health Inspectors make routine controls with the pesticide importers, distributors and sales points for ensuring that non-authorized pesticides, hence also POPs pesticides, are not available on the market. This is done by visual control but the inspectors may use the Government Analyst Lab in uncertain cases.

The Customs Department, on their side, controls the entry of chemicals into the country and are obliged to stop any shipment of nationally-banned chemicals whether they are industrial or agricultural chemicals.

The Environment Protection (collection, storage, treatment, use and disposal of used oil) Regulations 2005 (Government Notice No.4 of 2005) will come into force on 1 October 2005. These Regulations put obligations on both the used oil generators and the authorised oil recyclers in respect of the type of used oil that should be collected and stored, specifications for storage containers and general precautionary measures to be taken. The Regulations do not provide, however, for thermal oil and used oil containing PCBs or PCTs in excess of 50ppm.

2.3 ASSESSMENT OF THE POPs ISSUE IN MAURITIUS

2.3.1 ASSESSMENT OF POPS PESTICIDES (STOCKPILES, CONTAMINATED SITES AND WASTES)

According to information gathered from various authorities, no POP pesticide has been used in agriculture since the early 80s. DDT has been the only exception as it has been used solely under strict supervision of the Health authorities for malaria vector control at the airport, seaport and occasionally in a few malaria prone areas. The annual use level of DDT is between 500 and 1,000 kg.

A national inventory[22] of Persistent Organic Pollutants (POPs) Pesticides was undertaken by the Inspectorate of the Ministry of Health from March to July 2004 as a part of the POPs Enabling Activities Project.

The data for the inventory were compiled through questionnaires and site inspections. One hundred and five inventory forms based on the FAO Inventory Form model were sent to some 105 firms, organisations and individuals, including all importers and distributors of pesticides, sale point operators, sugar estates and small producers. Members of the inventory team had made 36 site visits to stores and sale points.

2.3.1.1 Results of the Inventory

Out of 101 duly filled forms received, representing a high response rate of 96%, 91 forms showed nil returns indicating an absence of both POPs pesticides and non-POPs banned pesticides. The 4% that did not respond in writing verbally informed of the absence of POPs pesticides and non-POPs banned pesticides in their respective stores.

No unlabelled obsolete pesticide was found during the inventory exercise, which also revealed that no POP or any non-POP banned pesticide is used for the treatment of wood or for the control of ectoparasites on domestic and farm animals.

[22] Details of the report are at Annex 4.

The compiled inventory showed the presence of four POPs pesticides: Aldrin, DDT, Dieldrin and Mirex.

TABLE 4 –

DETAILED INVENTORY OF POPs PESTICIDES IN MAURITIUS

Store/Site	Pesticide (POP)	Stock	Type of container	Condition of container	No. of containers	Year manufactured and country of origin
Ministry of Health	DDT	127.3 tons	Jute Bags/Tins	From satisfactory to not satisfactory	Not available	Received as donation in 1982
Mauritius Sugar Industry Research Institute (MSIRI)	Dieldrin	8 litres	Metal	Rusty	1	1977
Roger Fayd`herbe (private company)	Mirex	64kg	Carton Bags	Good	2	1985 - France
Deep River Beau Champ Sugar Estate	Aldrin	13 litres	Jerry Can	Not Good	1	Unknown

The inventory also revealed the presence of eight non-POPs banned pesticides amounting to 586kg: Azinphos-Methyl, Dimethoate, Endosulphan, Methamidophos, Methomyl 90%, Monocrotophos, Omethoate and Paraquat.

The stockpile of some 127.3 tons of DDT was stored, at the time of the inventory, at the following locations but it has all been repacked and centralized in Pamplemousses in January 2005, as conditions of storage at Fort George and Mahebourg were not satisfactory.

TABLE 5 –
LOCATION OF DDT STOCK AT THE TIME OF INVENTORY

STORE/SITE	QUANTITY (TONS)
Fort George	64.4
Powder Mill, Pamplemousses	61.2
Mahebourg Community Hospital	1.7

The former storage premises at Fort George are highly contaminated with DDT. Three rooms with floor surface of six times ten metres and wall height of four metres are in need of decontamination. The interior of the former storage building at Mahebourg has not been inspected. The extent of soil contamination from the DDT storage sites are discussed in the following sub-section.

The other POPs pesticides (Aldrin, Dieldrin and Mirex) have been properly packed and soundly kept in their respective stores. Owners of these stores are awaiting instructions from the authorities for safe disposal of the pesticides.

Regarding the DDT stockpile, tests have been carried out and the results show that the concentration of active DDT in the flakes is 79.23% and in the powder, it is 56.19%. However, they are still effective for vector control according to bio-assay tests performed by the Ministry of Health.

2.3.1.2 Soil Sampling

Six soil samples (one being from Rodrigues) and two water samples were taken from suspected contaminated sites and sent to the Mauritius Sugar Industry Research Institute (MSIRI) for analysis. No Aldrin, Dieldrin and Mirex were detected in the soil and water samples whereas details for DDT's presence, at the time of inventory, are found in following table.

TABLE 6 –
DDT SOIL SAMPLING

SAMPLE	SITE	DDT (mg/kg)
S1	Ex DDT Store (Ministry of Health), Brisee Verdiere	0.3
S2	Powder Mill, Pamplemousses (Ministry of Health)	274.2
S3	DDT Store, Fort George (Ministry of Health) - ~5 m from store	12.6
S3a	DDT Store, Fort George (Ministry of Health) - ~100 m from store	1.1
S4	DDT Store (Ministry of Health), Mahebourg	1,146.8
R1	Port Sud Est, Rodrigues Island	Not Detected
W1	Mare aux Vacoas Reservoir	Not Detected
W2	River Seche	Not Detected

Results show that the soils next to the DDT stores of the Ministry of Health range from fairly highly to very highly contaminated with DDT. Countries which have established soil quality limit values for DDT, have themselves set the limit for acceptable contamination in soil considerably under 0.1mg/kg and the limit for mandatory risk mitigation in form of soil remediation or reduction of exposure to man and environment at 1-4mg/kg. No DDT contamination was however found in the water samples and in the soil sample from Rodrigues.

Further investigations were done with ten additional soil samples in March/April 2005 and the results are shown in Table 7.

TABLE 7 –

FURTHER INVESTIGATIONS ON DDT SOIL CONTAMINATION

STORE	LOCATION	RESULTS (ppm)
Pamplemousses	Near Store - 50/60cm deep soil	145.6
	10 metres away from store - top soil	3.8
	10 metres away from store - 50/60cm deep soil	1.31
	15 metres away from store - top soil	1.18
	15 metres away from store - 40/50 cm deep soil	1.53
Fort George	30 metres away from store - 20cm deep soil	1.08
	100 metres away from store - 25/30cm deep soil	0.19
Mahebourg	Near store door - 20cm deep soil	761.54
	10m away from store door - Top soil	49.49
	10m away from store door - 40/45cm deep soil	4.1
	Back of store -Top soil	3.74
	Back of store - 30cm deep soil	0.27

2.3.1.3 Rodrigues Island

The inventory exercise on the autonomous island of Rodrigues was conducted in July 2004. A workshop was held with the major stakeholders concerned and site visits were made at the Public Health Office in the capital, Port Mathurin, at the central store/sale point of pesticides in Citronelle and at the five other local sale points. A soil sample was taken in a cultivated field at Port Sud-Est for analysis.

According to information received and confirmed by the results of analyses, no POP and non-POP banned pesticide was found to be present. The main suppliers of pesticides (Agricultural Marketing Cooperative Federation and Roger Fayd`herbe Ltd) also confirmed not having sold any POP pesticide to

the Cooperatives in Rodrigues. From information gathered, growers tend to make minimum use of pesticides on the island.

2.3.1.4 POPs Pesticides in Mauritius

In total, according to the national inventory of POPs pesticides effected from March to July 2004, the quantity of POPs pesticides available in Mauritius is about 127 tons of DDT and some 85kg of Aldrin, Dieldrin and Mirex.

2.3.2 ASSESSMENT OF PCBs (STOCKPILES, CONTAMINATED SITES AND WASTES)

The first ever inventory of Polychlorinated Biphenyls (PCBs) and PCB-containing equipment in Mauritius was carried out from May to September 2004 by the POPs Enabling Activities Project Task Manager with the help of officers of the Ministry of Environment and National Development Unit.

For the identification of PCB-containing equipment, focus was mainly on transformers and capacitors (power factor correctors). These equipment would, in principle, contain the most significant amounts of PCBs or PCB-contaminated oils. Information was gathered through a questionnaire-based approach for point sources followed by site visits to confirm data and collect oil samples for chemical analysis. For the island of Rodrigues, information was collected during a three-day visit to the island.

Results obtained indicate that only a small proportion (less than 2%) of transformers in use in Mauritius are likely to be PCB-contaminated whereas all transformers in operation in Rodrigues seem to be PCB-free. In the case of capacitors, they were all found to be PCB-free on both islands.

No PCB-containing waste was identified though it is possible that PCB-contaminated transformer oils have been incinerated together with mineral oils.

2.3.2.1 Identification and Inventory of Equipment Containing PCBs

To help in the identification of PCB-containing equipment, the team used an initial list of PCB-containing capacitors and transformers from UNEP and another list of trade names and synonyms of PCB oils[23]. In the case of transformers, whenever the trade name of the oil was not mentioned either on the plate of the transformer or in the technical document accompanying the equipment, a first screening was carried out by performing a PCB quick test (Clor-N-Oil, Dexil Corp.) on an oil sample of the transformer. For samples giving positive results, further analyses by GC-MS were carried out at the

[23] UNEP Chemicals (1999), Guidelines for the identification of PCBs and materials containing PCBs. First Issue, August 1999.

MSIRI in order to confirm the presence or absence of PCBs since these kits test for the presence of chlorinated chemicals and are not specific for PCBs.

For capacitors, as they are sealed equipment, no analysis was carried out. It would be a PCB-containing equipment if its make is one of those listed in the UNEP list or if the equipment label and technical specifications would indicate any PCB content.

An equipment was considered PCB-contaminated if it contained more than 50ppm of PCBs. In any other case, the equipment was considered PCB-free.

2.3.2.2 Transformers and Related Contaminated Sites

Most electrical transformers in operation in the Republic of Mauritius are either owned and/or serviced by the Central Electricity Board (CEB). However, all transformers, whether owned by the CEB or by private companies, were considered in the survey. In view of the relatively large number of transformers in operation in Mauritius, it was proposed that PCB investigation would concern only transformers manufactured before 1986 which is considered as the cut-off year for finding PCBs in power transformers. The following systematic procedure was used for the identification of PCB-containing transformers:

- Check country of origin, year of manufacture and nature of oil (trade name).
- If manufacture date is prior to 1986 and trade name of oil not specified (or PCB content not given), then perform PCB test kit (Clor-N-Oil).
- If sample is positive to PCB test, then analyse by Gas Chromatography-Mass Spectrometry (GC-MS) for confirmation. A positive result (>50ppm) would mean a PCB-contaminated transformer and it would be labelled accordingly; otherwise, for a negative result (<50ppm), the transformer would be labelled PCB-free.

The approach for the identification and location of transformers containing PCBs was different depending on whether the transformer was owned by the CEB or was the property of other companies. The two cases are discussed in the sections below.

2.3.2.2.1 CEB-owned Transformers

In the CEB electrical network, there are about 4,000 power transformers in operation in Mauritius and Rodrigues. Out of these 4,000 transformers properly coded and inventoried in a database (make, year of manufacture, location and mass of oil), only 875 were manufactured before 1986, i.e. some 22%. These transformers had been purchased by batch.

For the initial inventory, only one transformer of each make, manufactured at the earliest year on the list, have been investigated as it can be expected that the same manufacturer would not change the oil from PCB-free to PCB-containing in a similar transformer of a later manufacturing date. However, if the age gap in the manufacture years for a given make was too big, then more than one transformer in the make were investigated. It was thus decided that, for every batch, the result for the sampled transformer would be the result for the whole batch.

The collection of oil samples from transformers was carried out with the collaboration of CEB Engineers and Technicians. Some samples were collected from transformers on repair or decommissioned found at the CEB Transformer Workshop at St. Louis, Pailles. The rest of the samples were collected from transformers in operation located at different places over the island of Mauritius. However, not all the makes of transformers manufactured before 1986 were covered during the PCB screening exercise because of practical reasons (need for power cut and consequent notices needed to be given to the public, etc.).

During the inventory, 20 out of 28 makes, representing 819 transformers, have been screened for PCBs. Transformers from the eight batches that have not been tested represent only 6.4% of the total (56 out 875 transformers).

According to the results obtained, only two transformers of the NGEF make and manufactured in 1981 do contain PCBs at a level greater than 50ppm (53.14ppm and 143.74ppm respectively). It was then considered that all transformers of the make NGEF and manufactured in 1981 were considered PCB-contaminated. The other transformers, of the same make but from a different year of manufacture, were considered as being potentially PCB-

contaminated. In total, there are 77 NGEF transformers out of 875 that are either considered as PCB-contaminated or as suspected to be PCB-contaminated. These 77 transformers represent a total mass of about 50 tons (19 tons of oil).

2.3.2.2.1.1 Cross-contamination Issue

According to CEB Engineers, cross-contamination of PCB-free transformers during repair or servicing at the Transformer Workshop is unlikely to happen. The reason is that only mineral oil (Diala B purchased from Shell) has been used for topping up or as replacement oil in transformers since 1965. Moreover, used oil is normally stored in drums and these used oils are afterwards burnt in an incinerator located at the St. Louis Power Station and Transformer Workshop site.

In the case of a transformer being repaired and/or serviced, if the oil is still of good quality, it is reused in the same transformer. No oil coming from a transformer is ever used in another transformer. Finally, there is no common container for keeping transformers' oil during repair and/or servicing. Instead, empty drums that contained the purchased mineral oil (Diala B) are employed for this purpose. For these reasons, it can be expected than cross-contamination is unlikely to happen.

Even if some residual oil from a PCB-contaminated transformer would be present in drums/pumps or piping at the workshop, it would not result in high levels of contamination as no pure PCB-containing equipment has been found in Mauritius.

2.3.2.2.1.2 Possible PCB-contaminated Sites

During the inspection visits to the different sites of the CEB, two possible contaminated sites were identified. Both sites are located at the St. Louis Power Station and Transformer Workshop.

The first one concerns the immediate surrounding of the incinerator where visible signs of spillage are observed. An oil sample has been taken from this site and tested for PCBs and the result was negative.

The other area at risk is the Transformer Workshop where transformers are taken for repair and/or servicing. Generally, all the oil accumulated in the drain canal is collected in drums and disposed of by incineration. The drain canal is also washed on a regular basis and the wastewaters generally discharged in the Grand River North West (GRNW) found nearby. An oil sample from this drain canal was collected on 20 July 2004 and found positive by the PCB test kit. However, further analysis of this oil sample by GC-MS indicated that it was PCB-free. In order to keep this drain canal PCB non-contaminated, it is strongly recommended to adopt the management system proposed at Section 3.3.3.

Otherwise, no visible signs of oil spillage were seen near the transformers that were inspected during the assessment. This however does not preclude the possible soil contamination near PCB-containing transformers. It should be pointed out that a soil sample collected at the St. Louis CEB Site was found to be free of PCB. It is however recommended to undertake further PCB analyses in soil samples collected at selected sites.

2.3.2.2.2 Transformers Owned by Other Companies

The questionnaire-based approach was used to gather information on transformers owned by private companies other than CEB. In order to include all companies likely to be in possession of transformers, the hundred biggest consumers of electricity were considered for this assessment. PCB questionnaires were sent to all these companies but the response was again low.

Analysis of the returned questionnaires indicated that transformers in the premises of most companies are the property of the CEB. However, about 15 private companies have their own transformers and according to the questionnaires, all these transformers were manufactured after 1994. It can therefore be expected that these transformers are PCB-free as all of them originate from countries where PCBs have been banned well before 1994. In fact, most of these transformers were manufactured in France, South Africa and Italy and they had been purchased from 1999 onwards.

2.3.2.3 Capacitors

Capacitors are generally used as power factor correctors. The companies likely to possess equipment of this type are the big consumers of electricity. For investigating the presence of PCBs in capacitors, the same approach as for transformers was applied.

2.3.2.3.1 Capacitors Owned by CEB

According to information obtained from CEB Officers, all capacitors in operation on the CEB network are of the same make (GEC Alsthom) and were manufactured in France. They are all PCB-free as indicated on their equipment plate. As for the previously in-service capacitors, they were all dry ones.

2.3.2.3.2 Capacitors Owned by Other Companies

A PCB questionnaire was sent to more than a thousand big consumers of electricity susceptible to own a capacitor. As for transformers, the response rate was unfortunately very low: less than 20%. From the returned filled questionnaires, the trend is that most of these capacitors are dry ones and all of them have been manufactured after 1990. From these results, it can be reasonably concluded that capacitors are unlikely to be sources of PCB in Mauritius.

2.3.2.4 Rodrigues

The inventory for Rodrigues was carried through a three-day visit (14-16 July 2004) to the island. All electrical equipment (transformers and capacitors) existing in Rodrigues are the property of the CEB of Rodrigues. No other company owns such equipment. All electrical equipment in use in Rodrigues are purchased by CEB Mauritius and then transported to Rodrigues. It can be expected that no equipment make would be specific to Rodrigues. Therefore, any transformer or capacitor make existing in Rodrigues should also exist in Mauritius.

2.3.2.4.1 Transformers

From information gathered during the visit at the Rodrigues CEB Headquarters, all transformers in operation in Rodrigues have been manufactured after 1983. In fact, most of these transformers were manufactured in the 1990s. The findings of the Mauritian inventory showed that the few transformers identified to be PCB-contaminated were all manufactured before 1981. Taking these into consideration, it can reasonably be assumed that all the transformers in Rodrigues are PCB-free.

2.3.2.4.2 Capacitors

As it was the case for Mauritius, all capacitors in Rodrigues are PCB-free.

2.3.3 ASSESSMENT OF RELEASES FROM UNINTENTIONAL POPs BY-PRODUCTS PRODUCTION

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), also known as Dioxins and Furans, are unintentional by-products (POPs) formed during certain processes and activities. For the estimation of unintentional POPs' releases in Mauritius and Rodrigues, the methodology and emission factors recommended in the UNEP Toolkit Document (UNEP, 2003) have been used. This section is a summary of a detailed account of the unintentional POPs releases in Mauritius. The detailed data by activity sector can be found at Annex A4.

For 2003, an estimated amount of about 26.5g TEQ[24] PCDD/Fs had been produced and emitted in the environment on the island of Mauritius with bagasse burning for power generation and medical waste incineration responsible for about 50% of the total release. For Rodrigues, with an estimated annual emission of 3.7g TEQ, the dumpsite at Roche Bon Dieu is the major problem as it is responsible for 80% of the PCDD/Fs' release. For the islands of Mauritius and Rodrigues, a total of 30.2g TEQ of PCDD/Fs have thus been estimated.

According to the analyses carried out in 15 environmental samples (ash, sediment and soil), PCDD/Fs contamination do not seem to be a major problem in Mauritius. However, further analyses in other sample type (biota, food, etc.) should be undertaken in order to have a better evaluation of the PCDD/Fs situation in Mauritius.

For investigating unintentional POPs emissions from industrial point sources, a first step has been taken by performing analysis of ash samples from bagasse burning. It should be pointed out that no internationally peer-reviewed data or emission factors for bagasse burning has been found and that the work carried out is believed to be first of its kind. A few ash samples have however been sent abroad for analysis purposes but the results were not available at the time of the drafting of the NIP.

[24] TEQ: Toxicity Equivalent.

2.3.3.1 Ranking of Source Categories

In Table 8, each activity has been ranked according to its total annual estimated PCDD/Fs' release. The activity emitting the highest amount of PCDD/Fs has been ranked first and the one releasing the lowest amount has been ranked last.

As it can be seen from the table, about 26.5g TEQ of PCDD/Fs was released to the environment in 2003 in Mauritius as compared to 1.4g for Samoa Islands[25], 77g for Jordan and 80g for Lebanon (UNEP, 2003). Bagasse burning for power generation (33.4%), medical waste incineration (20.8%), uncontrolled waste burning (12.2%) and landfill leachate (10.6%) appear to be responsible for more than 75% of the total release. However, much care has to be taken in analyzing these figures as very rough estimates have been used for calculating these releases.

The emission factors used for the estimation of PCDD/Fs' release during bagasse burning for power production have been derived from results of four ash analyses only: two ash samples collected before wet-scrubbing and two after wet-scrubbing (Table 9). Moreover, if instead of taking an average value (130pg/g) for PCDD/Fs' level in ash before wet-scrubbing, the actual values, i.e. 220 and 39pg/g (Table 9) were taken for estimating the emission factors, the PCDD/Fs' release from bagasse burning would have been in the range 2.6–14.9g TEQ. In view of these considerations, there is need for further research studies/analyses on PCDD/Fs' levels in ash coming from bagasse burning in order to obtain more accurate values.

TABLE 8

RANKING OF ACTIVITIES ACCORDING TO THEIR ANNUAL PCDD/Fs' (mg TEQ) RELEASE

[25] *Samoa's National Implementation Plan for POPs*, POPs Assessment, Production, Import and Use, Unintentional Introduction: Dioxin and Furans, p. 12.

ACTIVITY - SOURCE CATEGORY	AIR	WATER	LAND	PRODUCT	RESIDUE	TOTAL	%
Power/heat Production - Biomass	6,860.6	1,920.7	NA	NA	68.93	**8,850.23**	**33.4**
Medical Waste Incineration	5,473.21	NA	NA	NA	36.28	**5,509.49**	**20.8**
Uncontrolled Waste Burning	1,080	NA	NA	NA	2,160	**3,240**	**12.2**
Landfill Leachate	NA	2,819.51	NA	NA	NA	**2,819.51**	**10.6**
Accidental Fires	905	NA	NA	NA	901	**1,806**	**6.8**
Incinerators owned by CEB*	13.3-1,330	NA	NA	NA	NA	**1,330**	**5.02**
Steel Production	179.93	NA	NA	NA	672.83	**852.76**	**3.2**
Uncontrolled Biomass Burning	93.19	NA	319.83	NA	14	**427.02**	**1.6**
Textile Industry*	NA	NA	NA	0.4 -376	NA	**376**	**1.4**
Crematoria	357.6	NA	NA	NA	1.27	**358.87**	**1.35**
Power/heat Production - Fossil Fuel	33.39	86.07	NA	NA	131.36	**250.82**	**0.94**
Open Water Dumping	NA	235	NA	NA	NA	**235**	**0.9**
Incinerators at Airport	64.75	NA	NA	NA	95.38	**160.13**	**0.6**
Leather Goods*	NA	NA	NA	1.26-126	NA	**126**	**0.5**
Transport - 2&4-Stroke, Diesel Engines	45.47	NA	NA	NA	NA	**45.47**	**0.17**
Household Cooking/ Heating - Biomass	23.89	NA	NA	NA	11.26	**35.15**	**0.1**
Sewage/Sewage Sludge	NA	19	NA	NA	FNA	**19**	**0.07**
Asphalt-mixing	1.72	NA	NA	NA	7.27	**8.99**	**0.03**
Household Cooking/ Heating - Fossil Fuel	7.09	NA	NA	NA	11.26	**7.09**	**0.03**
Landfill Gas Flaring	1.17	NA	NA	NA	NA	**1.17**	**0.004**
Incineration of Animal Carcasses	0.63	NA	NA	NA	NA	**0.63**	**0.002**
Lime Production	0.35	NA	NA	NA	NA	**0.35**	**0.0**
Tobacco Smoking	0.11	NA	NA	NA	NA	**0.11**	**0.0**
Dry-cleaning Residues	NA	NA	NA	NA	0.03	**0.03**	**0.0**
TOTAL						**26,509.82**	

* For CEB incinerators, textile and leather goods, the lower and upper limits have been reported.

2.3.3.2 Environmental Levels

As mentioned earlier, only one study about PCDD/Fs' levels in environmental samples has been reported in Mauritius. In that study, undertaken by Soobadar *et al.* (2003; MSIRI, 2001) on sewage samples using the Low Resolution Gas Chromatography-Low Resolution Mass Spectrometry (LRGC-LRMS) technique, no PCDD/F were detected. For further investigating the situation, it was decided to determine PCDD/Fs' levels in selected environmental samples collected at potentially contaminated sites.

Sugar-cane burning, which is a common practice in Mauritius, and the textile industry are among the activities that might have potentially released large amounts of PCDD/Fs to the environment in Mauritius (Tyrkko, 2004). For these reasons, soil samples coming from sugar-cane fields that have been burnt for several consecutive years and sediment samples resulting from textile industry effluents were collected for PCDD/Fs' analysis (Table 9). Fly ash samples coming from bagasse burning for power generation were also included for this analysis. The reason behind is that, to date, no published data for PCDD/Fs' emissions from this activity exists.

In the absence of laboratory capacity (High Resolution GC/High Resolution MS) to analyse dioxins in Mauritius, the environmental samples were sent, after a tender exercise, to Ecochem Laboratory, Czech Republic, for analysis. The results from Table 9 indicate that, in general, the levels of PCDD/Fs are low except for fly ash not wet-scrubbed. However, further analyses in other sample types (biota, human tissue, foodstuff, etc.) have to be performed in order to really establish the level of contamination with regards to PCDD/Fs in Mauritius.

TABLE 9

PCDD/Fs' LEVELS IN ENVIRONMENTAL SAMPLES COLLECTED IN MAURITIUS

Sample Site	Sample Type	PCDD/Fs' level pg TEQ/g Dry Mass
Sugar Estate (West)	Bagasse – Fly ash after wet-scrubbing	1.9
IPP (North)	Bagasse - Fly ash (ESP)[26]	220
Sugar Estate (East)	Bagasse - Fly ash after wet-scrubbing	0.13
IPP (South-east)	Bagasse - Fly ash (ESP)	39
Medine: Sugarcane field burning – fifteen consecutive years	Top soil	1.4
Medine: Sugarcane field burning - fifteen consecutive years	10-cm deep soil	1.5
Flacq: Sugarcane field burning - five consecutive years	Top soil	2.2
Flacq: Sugarcane field burning - five consecutive years	Top soil	0.83
Deep River Beau Champ: Sugarcane field burning – five consecutive years	Top soil	2.0
Deep River Beau Champ: Sugarcane field burning - seven consecutive years	Top soil	4.0
St. Louis River Mouth	Sediment	0.0014
Mare Piram, Solitude	Sediment	4.8
Ile d'Ambre: Novel Textile - Inside Yard	Sludge	0.87
Ile d'Ambre: Novel Textile - Sedimentation Pond	Sludge/sediment	0.31
Ile d'Ambre: Novel Textile - Near Beach	Sediment	0.15

2.3.3.3 Rodrigues Island

2.3.3.3.1 Overall PCDD/Fs' Release in Rodrigues

As expected, the overall release of PCDD/Fs was much lower in Rodrigues than in Mauritius. For Mauritius, the overall release of PCDD/Fs amounted to 26.5g TEQ (Table 8) whereas it was only 3.7g TEQ for Rodrigues (Table 10).

[26] ESP: Electrostatic Precipitator.

From that Table, it can be seen that waste burning (landfill/dump fires and uncontrolled waste burning) contribute to 90% of the total amount of PCDD/Fs released in Rodrigues. Except for open water dumping, the contribution of other listed activities in the table is negligible.

TABLE 10

ESTIMATED PCDD/Fs' RELEASE IN RODRIGUES FOR 2003

ACTIVITY/SUB-CATEGORY	AMOUNT OF PCDD/Fs RELEASED (mg TEQ)	%
Landfill/Dump Fires	2,950.00	80.50
Open Water Dumping	328.50	9.00
Uncontrolled Waste Burning	297.00	8.10
Waste Incineration	54.38	1.50
Accidental Fires	32.24	0.90
Transport	1.30	0.04
Cooking and Heating	1.26	0.03
Power Generation and Heating	0.48	0.01
Bush/Grass Fires	0.45	0.01
Tobacco	0.00	0.00
TOTAL	**3,665.61**	

2.3.3.4 OVERALL ASSESSMENT FOR THE ISLANDS OF MAURITIUS AND RODRIGUES

For the islands of Mauritius and Rodrigues, some 30g TEQ of PCDD/Fs have been estimated to have been released in the environment in 2003 with Power Generation and Heating (9.15g TEQ, 30%), Waste Incineration (7.3g TEQ, 24%) and Uncontrolled Combustion Processes (8.76g TEQ, 29%) contributing to more than 80% of the releases (Table 11).

It should be pointed out, however, that PCDD/Fs' emission factors for bagasse burning, a subcategory of the Power Generation and Heating Source Category, have been obtained from very limited analyses. In fact, for this activity, the release could vary between 2.6 and 14.9g TEQ. Further analyses and research are needed in order to get more accurate values.

TABLE 11

ANNUAL RELEASE OF PCDD/Fs PER SOURCE CATEGORIES FOR THE ISLANDS OF MAURITIUS AND RODRIGUES IN 2003

SOURCE CATEGORIES	ANNUAL RELEASES (g TEQ/a)				
	Air	**Water**	**Land**	**Products**	**Residue**
Waste Incineration	6.91	NA	NA	NA	0.39
Ferrous and Non-Ferrous Metal Production	0.20	NA	NA	NA	0.67
Power Generation and Heating	6.92	2.01	NA	NA	0.22
Production of Mineral Products	0.00	NA	NA	NA	0.01
Transportation	0.05	NA	NA	NA	NA
Uncontrolled Combustion Processes	5.15	NA	0.32	NA	3.29
Production of Chemicals and Consumer Goods	NA	NA	NA	0.50	NA
Miscellaneous	0.36	NA	NA	NA	0.00
Disposal/Landfill	NA	3.40	NA	NA	NA
Identification of Potential Hot-Spots	NA	NA	NA	NA	NA
TOTAL	**19.59**	**5.41**	**0.32**	**0.50**	**4.58**
GRAND TOTAL (SUM OF ALL RELEASE VECTORS)	**30.4**				

2.3.4 SUMMARY OF FUTURE PRODUCTION, USE AND RELEASES OF POPs

2.3.4.1 Production

No POP chemical is intentionally produced in Mauritius for use or exportation. Furthermore, as seen during the inventory phase, there are no activities such as paper or chemical (Chlorophenols, Cl_2 production, Halogenated organics, etc.) industries likely to produce PCDD/Fs as by-products in Mauritius. This will probably remain as such for years as no investment in these areas is scheduled in the near future in Mauritius.

2.3.4.2 Uses

As reported in Section 2.3.1, out of the 12 POPs, DDT is the only one which is being used in Mauritius and it is mainly for malaria vector control at the airport, seaport and occasionally in some malaria prone areas. The annual use is between 500 to 1,000kg annually. Mauritius has registered an exemption with the Stockholm Convention Secretariat for the continued use of DDT in 2004. This exemption is valid for an annual amount of 1,500 kg over three years. However, the authorities may gradually shift to alternatives in the coming years and thus progressively phase out the use of DDT for malaria vector control.

From the findings of the inventory carried out on PCBs, it is very unlikely that the existing amount of PCB-contaminated oils or PCB-contaminated equipment would be further increased from importation of new equipment or oils. Both types of goods are imported from France, South Africa and Italy where PCBs have been banned or have not been produced since the early 80s. Moreover, PCBs are strictly regulated in these countries.

PCB oils, as an integral part of imported second-hand equipment, present a potential route for additional PCB-contaminated oils entering the country. This aspect may require strengthening of awareness and capacity of control by the Customs.

2.3.4.3 POPs Releases

The release of POP chemicals to the environment concerns mostly, if not exclusively, PCDD/Fs as the other POP chemicals are either banned or not used in Mauritius. The inventory carried out in the early phases of the POPs project in Mauritius revealed that power production from bagasse burning and medical waste incineration are the two major activities that contribute the most to the emission of PCDD/Fs. They are responsible for about 53% of the total PCDD/Fs emission in Mauritius.

The problem concern is that the burning of bagasse for power production represents 40% of the total electrical power produced in Mauritius as the rest is produced from the burning of fossil fuel (heavy fuel oil, coal, diesel, etc.) or hydro-electricity. The present status is that all bagasse produced in Mauritius is already being burnt for power or heat production, which then means that the activity is at its maximum release rate.

Due to globalisation and fierce competition with Asian countries like China, Mauritius is currently experiencing a difficult economic transition with the closing down of many manufacturing plants, mostly in the textile industry. At the same time, with the creation of the Cyber City and the Cyber Island drive, many companies in the field of Information Technology and IT-enabled Services (ITES) have been created. However, the need for electrical power for these two industries is not of the same order of magnitude.

The textile industry is a much bigger consumer of electricity than the ICT industry. In view of the above, it is most unlikely that there will be a significant rise in the need of electrical power in Mauritius in the coming years. It is therefore expected that PCDD/Fs' release coming from power production (including bagasse burning) will be at the same level as that found in the inventory carried out. Furthermore, the closing down of textile manufacturing plants will contribute to further reduction in demand of electricity from industry.

Simultaneously, with increasing income, the population is using more and more electricity in their everyday life. Electrical home appliances are getting

more and more common. Especially air-conditioning of commercial and residential buildings will increase the demand for electricity.

It may therefore be concluded that electricity demand will not suffer a steep increase in the coming years. However, in a no action scenario, the PCDD/Fs' releases to the environment in Mauritius[27] would continue to increase.

A factor that could contribute to the reduction of PCDD/Fs' release in the future, although marginally, is the compulsory use of catalytic exhausts in new petrol-driven motor vehicles (other than motorcycles and auto cycles) purchased in Mauritius since July 2004 and the compliance, since September 2003, for second-hand imported vehicles (other than motorcycles and auto cycles) to European or Japanese standards for exhaust emissions[28]. Regarding in-use motor vehicles, new and imported diesel-driven vehicles, motorcycles and auto cycles, opacity limits and exhaust emission limits are specified in the Road Traffic (Control of Emissions) Regulations 2002 and are in force since September 2003.

Moreover, it is in the plans of the Ministry of Local Government and Solid Waste Management, which is responsible for waste management in Mauritius, to implement a Hazardous Waste Incinerator, which will be part of a Waste Complex, by 2010. However, as Mauritius has ratified the Stockholm Convention, the incinerator will have to be equipped with a BAT one. If properly operated by following Best Environmental Practices, it would produce only very small amounts of PCDD/Fs.

[27] Main Category 7 of the Standardized Toolkit UNEP document, 2003.
[28] Road Traffic (Control of Vehicular Emissions) (Amendment) Regulations 2003.

2.3.5 EXISTING PROGRAMMES FOR MONITORING RELEASES AND IMPACTS

There is no existing programme for monitoring releases and impacts of POPs in Mauritius. Before the inventories and assessments made in 2004 as part of the Enabling Activities for the Stockholm Convention, there were not even data available on the different POPs in Mauritius - the only exception being the stock of DDT at the Ministry of Health.

Against this background, it is highly understandable that no systematic monitoring has been undertaken. However, the only thing that exists is the routine Food Monitoring Programme being conducted by the Government Analyst Laboratory at the Ministry of Health.

The capacity of performing POPs sampling and analysis is given in Section 2.3.10 and the planned activities in this regard are described in Section 3.3.12.

2.3.6 INFORMATION, COMMUNICATION, AWARENESS AND EDUCATION

The issue of Persistent Organic Pollutants (POPs) is new in Mauritius and it has been prompted on the chemical agenda quite recently. Few people seem to know much about POPs and the risks they pose.

The results from a survey questionnaire sent in October/November 2004 to some 15 organisations from the public, private and NGO sectors confirm this assessment: the current level of awareness of POPs among stakeholders is low and very few publications/documents are available on the subject. The challenges they pose both to the environment and health are unknown.

This knowledge gap, particularly with regard to the health impacts of POPs, is expected to be even more acute among risk groups and the general public. It is in this context that the need for awareness raising activities is deeply felt. The gap has to be adequately filled with general information on POPs and the promotion of practices that would help people to safeguard themselves against these pollutants.

In 1999, when Dioxins in Belgian eggs and chickens was found, local newspapers reported quite extensively on the crisis. The issue of imported food safety for the local population was raised both in the local media and at the National Assembly. Actions and safeguards taken at the national level to protect health of consumers against the risks of Dioxins were reported in the media. The crisis was named “The Dioxin Affair” but the concept of POPs has never been used in press reports.

2.3.6.1 POPs Knowledge Transfer

Since the first workshops carried out in the context of the POPs Enabling Activities in April 2004, knowledge about POPs’ chemicals has been steadily growing. The workshops were attended by government officials and professionals and information on the domestic significance of POPs, the risks that they can pose as well as the relevant literatures have been provided.

2.3.6.2 Awareness Campaign on POPs and Dioxins

Based on the findings outlined in Section 2.3.3 (Assessment of releases from unintentional POPs by-products production), there is a need to control and/or reduce Dioxin emissions in Mauritius.

In this respect, the public can play an important role to prevent contamination by Dioxins of the environment and human health. It is out of ignorance that people resort to domestic waste burning, ignoring that Dioxins released during the process can put themselves and their families at risk and contribute to the overall amount of release of Dioxins in the country. Safer and practical alternatives to domestic waste burning have thus to be promoted.

In this context, a mass awareness campaign has been carried out in April 2005 in order to:

1. Educate and sensitize the public on the role it should play to prevent releases of Dioxins into the environment;
2. Enlighten people on the risks of Dioxins and alternatives (proper disposal of waste, composting, re-use, recycle) that exist;
3. Address questions arising out of the awareness activities and manage concerns thereof. This role could hopefully mean behavioural/attitude changes in terms of prevention of incinerations, uncontrolled waste burning and accidental fires.

At least 20 activities have been identified as releasing Dioxins. These include, among others, industrial sources such as power production/biomass, medical waste incineration, uncontrolled biomass burning, incinerators owned by the Central Electricity Board and non industrial sources such as uncontrolled waste burning and accidental fires.

For the campaign, it was decided that, in the first instance, a one-off campaign on domestic waste burning would be run so as to target the general public and to inform on the risks that Dioxins present to the environment and to human health and to promote safer alternatives.

In this respect, a national awareness campaign on POPs was carried out through the media namely, through the publication of a full-page advertorial in

nine newspapers, a one-week message on the national TV and through the publishing and distribution of posters and brochures to relevant stakeholders, public offices and schools.

The objectives of this one-off campaign were:

1. To bring to public attention issues of the Stockholm Convention on POPs/Dioxins and the actions set by Mauritius.
2. To inform and sensitise people on safer and practical alternatives to domestic waste burning. The campaign slogan in Creole could be read as follows: "*Bril saleté enn mauvais solution*" (Waste burning is the wrong answer) and it targeted households.

The launching of the campaign was made during a press conference hosted by the Ministry of Environment and National Development Unit in presence of the UNDP Resident Co-ordinator.

2.3.6.2.1 Technical Publications

In the run-up to the mass public awareness campaign, a publication programme was designed and executed through linkages and editorial co-operation with existing magazines of governmental organisations and NGOs. Articles on POPs and the implementation of the POPs project in Mauritius were published in order to familiarise specific audiences such as government officials, the NGO community and planters to POPs and of the underlying stakes.

Articles were placed in the following publications: NEL News, a newsletter of the National Environment Laboratory; MACOSS Info, a publication of the Mauritius Council of Social Service (MACOSS) which targets non-governmental organisations of Mauritius; and Farming News, a publication of the Agricultural Research Extension Unit (AREU) which primarily targets planters in Mauritius.

Furthermore, in the context of the International Meeting for the 10-year Review of the Barbados Programme of Action for the Sustainable Development of Small Island Developing States (SIDS), an article presenting

the status of the POPs Project in Mauritius was placed in a GEF-UNDP magazine. The articles and relevant materials can be found at Annex 3.

Prior to that, a website on POPs and their domestic relevance was launched as an awareness raising tool. The site is part of the Ministry of Environment's website and can be accessed at the following address: http://environment.gov.mu/stockholm.htm. It provides a comprehensive view on POPs, the inventory results and the implementation of the project in Mauritius. The website has been advertised in most of the awareness campaign materials and it is reasonably expected that more than 500 people had visited the site.

2.3.6.2.2 National Campaign

The launching of the campaign was placed in the wake of other national initiatives undertaken by the Ministry of Environment to improve the quality of air, namely the introduction of unleaded petrol and diesel with less sulphur.

It is within the framework of sustainable development, sound waste management policy and improvement of the quality of air by getting rid of POPs and the preparation of its National Implementation Plan that Mauritius was implementing the Stockholm Convention. It is also in this context that the issue of domestic waste burning was singled out as a sensible source of Dioxins and of air pollution and where alternatives to waste burning were recommended.

The press gave good coverage on POPs, the characteristics of the chemicals, the preparation of the National Implementation Plan and the hazards of domestic waste burning[29].

Domestic waste burning was featured as the wrong answer for the disposal of waste in the campaign. People were asked to use the waste bin distributed free of charge instead of burning their wastes as the latter produces Dioxins. In the medium and long term, people have been encouraged to shift to cost-effective and eco-efficient alternatives such as waste prevention at source, re-using and recycling.

[29] See Annex 3 for the press reports.

Waste prevention brought people to reflect on their buying and consumption habits. It encouraged consumers to consider sustainable consumption and to seek products with less packaging and to buy products that are durable and long lasting. In this way, they could help prevent the generation of waste by delaying or avoiding the item's entry in the waste collection and disposal system.

Through the campaign, people were also encouraged to resort to sound recycling operations like composting which can divert green and domestic waste from landfills, reduce or eliminate the need for chemical fertilizers and promote higher yields of agricultural crops.

2.3.6.2.3 Effectiveness of the Campaign

The campaign has met its overall objectives of raising public understanding of POPs and by encouraging people to shift to safer practices instead of burning wastes. It has also brought to their attention their ability to produce less waste by purchasing smart, by recycling and reducing the amount of waste they discard through composting. The ground has been laid for the promotion of alternatives to domestic waste burning and for waste prevention.

However, to achieve its full scope, the campaign has to be conducted on a permanent basis, taking into account that people are ready to embark into recycling and waste prevention programmes.

2.3.7 RELEVANT ACTIVITIES OF NON-GOVERNMENTAL STAKEHOLDERS

Up to now, no activity has been carried out by any organisation to inform about the challenges that POPs represent. The awareness raising activity on POPs being implemented by the Ministry of Environment and the UNDP is certainly the first of its kind to be launched in the country. However, the Mauritius Council of Social Services (MACOSS), the umbrella organisation of NGOs operating in Mauritius, has proposed to organise an awareness session for its members.

2.3.7.1 Partnership Development

As part of the awareness programme, working partnerships with government agencies, funding agencies, agro-chemical industries and NGOs have been established. These third-party alliances partnerships have enabled the Executing Agency – mostly through linkages to their in-house programmes - to extend concerns about POPs to their respective audiences in regards to POPs. Among the partners were government ministries, the United Nations Development Programme, the Agricultural Research and Extension Units (AREU), the National Environment Laboratory (NEL), the Central Electricity Board (CEB) and the Mauritius Council of Social Service (MACOSS), the umbrella organisation of NGOs operating in Mauritius.

It may also be noted that Croplife Mauritius, a federation of private agro-chemical companies, has been launched with the objectives of promoting sustainable agriculture, chemical safety and development.

2.3.8 OVERVIEW OF THE TECHNICAL INFRASTRUCTURE FOR ASSESSMENT OF POPs

Ten laboratories run by ministries and governmental organisations and one private one have been assessed for their suitability to analyse POPs chemicals. The conclusion is that there is adequate capability in the country for implementing a POPs Monitoring Programme, although additional supporting materials such as glassware, chemicals and standards will be required. Some analyses will however need to be contracted out to specialist laboratories overseas, namely regarding the highly specific measurements required for Dioxins and Furans.

There are presently some limitations at the human resources level for carrying out POPs' analysis. This should be addressed through the recruitment of additional staff. In addition, a co-ordination mechanism needs to be developed to allow the optimum use of existing analytical facilities, especially gas chromatography-mass spectrometry.

Some laboratory personnel already have a limited amount of experience in carrying out POPs' analysis. However, this has not covered the breadth of sample types and the full range of POPs chemicals as envisaged for the monitoring programme. Some initial overseas training will have to be provided for two selected staff, followed by local training of additional personnel. Details about the complete report can be found at Annex 4.

2.3.8.1 Assessment of the Laboratories for POPs Analysis

The laboratory capacity was assessed through questionnaires sent in advance and inspection visits. The matters covered in the questionnaire ranged from organisation and staffing, accommodation and infrastructure, quality assurance, equipment for sample collection, storage and handling, sample processing and the specific requirements for POPs analysis.

The assessment revealed that most of the facilities are adequately designed and constructed for operation as analytical chemistry laboratories. Facilities for sample storage and processing are generally quite adequate. An assessment

of the suitability of each of the laboratories for POPs analysis is presented in summary form in Table 12 and discussed further below.

TABLE 12

SUMMARY OF THE ASSESSMENT OF LABORATORIES FOR POPs ANALYSIS

	Agricultural Chemistry Lab. (Ministry of Agriculture)	Central Water Authority Lab.	Fisheries Lab.	Forensic Lab. (Prime Minister's Office)	Government Analyst Lab. (Ministry of Health)	Mauritius Standards Bureau	MSIRI	NEL (Ministry of Environment)	SGS (private company)	University of Mauritius	Wastewater Lab.
Sample processing	Y	P	P	Y	Y	Y	Y	P	Y	Y	Y
GC with ECD	N	N	N	N	N	N	Y	N	N	N	N
GC with LRMS	N	MUR	N	Y	Y	N	Y	N	MUR	N	Y
GC with HRMS	N	N	N	N	N	N	N	N	N	N	N
POPs analysis experience	P	N	P	N	N	N	Y	P	N	N	N
Staff numbers	N	N	-	P	N	N	P	N	N	N	N
Space for additional work/ samples	Y	Y	-	Y	Y	Y	Y	Y	Y	Y	N

The entries within the inner boxes refer to the adequacy or availability of the facilities, according to the following code: Y = Yes, N = No, and P = Partial (i.e. not quite adequate but could be developed). A "MUR" symbol indicates the equipment is budgeted for but not yet available. The positive entries (Y) in the table have been highlighted to facilitate the interpretation of this table.

Most of the laboratories have adequate supplies of the glassware and other associated equipment required for sample processing, although in the case of NEL and two others, this would need to be increased by additional purchases. Moreover, none of the laboratories participating in the POPs Monitoring Programme would need to invest in some of the more specialised glassware, such as Kuderna-Danish evaporators, which would be required for the processing of particular samples. Consideration should also be given to the

purchase and use of semi-automated extraction equipment and solid-phase extraction units.

The only laboratory with an operational GC/ECD is the one at the MSIRI. However, there are four laboratories with LRGC-LRMS (Low Resolution GC-Low Resolution Mass Spectrometry) systems which offer significant additional advantages over the use of GC/ECD. There are two other laboratories which have the intention of purchasing a GC-MS, which suggests that Mauritius will shortly be more than adequately supplied with this particular analytical facility.

There are no high-resolution mass spectrometers in Mauritius which is quite understandable given that the cost of these is between 15 and 30 million rupees (USD 517,000 to 1m). In addition, it would be difficult to justify this level of expenditure in support of the POPs Monitoring Programme alone. The most likely approach would be to send samples to a suitable overseas laboratory as it has been done for part of the inventories and analyses.

There are members of the staff in most of the laboratories with experience related to POPs analyses, although MSIRI is the only one with any significant directly relevant experience. But even there, this is still limited in terms of the range of samples processed, the extent of sample extraction and clean-up, and the overall sensitivity (detection levels) achieved.

With one or two exceptions, the staff capacity in most laboratories appears to be adequate for their current workloads, although most of the managers indicate that they are under-staffed. Additional personnel will certainly be needed for any significant increases in the number of samples associated with a new programme.

Most laboratories also appear to have adequate bench space and support facilities to accommodate increases in equipment and sampling, although this may not be the case if a more stringent approach was adopted to some of the safety issues noted below.

2.3.8.1.1 Overall Assessment

The MSIRI has the only laboratory which could readily take on a significant new workload for POPs' monitoring and analyses, with some relatively minor expenditure in terms of laboratory glassware and processing equipment, specific standards and reagents. There may also be a need for some additional technical staff to carry out the sample processing and work-up.

Other laboratories, and particularly NEL, have the capability and capacity to undertake additional sample collection, processing and work-up, but they lack the necessary instrumental equipment such as GC-MS. On the other hand, those laboratories that already have this equipment (GC-MS) are either lacking in the capacity for sample processing (the Government Analyst and Wastewater Labs) or are constrained by the particular demands of their current roles (Forensic Lab).

2.3.8.1.2 Quality Assurance and Laboratory Accreditation

Most of the senior laboratory staff demonstrate a reasonable awareness of the basic requirements for quality assurance procedures in their work. However, with the exception of SGS, most still have a lot of work to do before these principles are put fully into practice. In particular, there is a need for all of the laboratories to develop and implement a quality management system in accordance with international standards, such as ISO 17025, and be accredited with MAURITAS[30].

In the case of POPs analyses, the laboratories should equip themselves with an appropriate range of chemical standards and utilise these as both internal and external controls in the analytical methods. There are also several Certified Reference Materials (CRMs) available which should be purchased and used for overall checks on analytical performance. Efforts should also be made to identify and take part in any inter-laboratory programmes that might be operating at the time the work is started. One of the most likely avenues for this is the European Union which is developing some significant programmes for POPs' monitoring in food and animal feeds.

[30] Mauritius Accreditation Service (Ministry of Industry).

2.3.9 SOCIO-ECONOMIC CONSIDERATIONS OF POPs USE IN MAURITIUS

2.3.9.1 Identification of Impacted Populations and Environments

Persistent Organic Pollutants have harmful health effects on human beings who are directly or/and indirectly at risk through occupation, diet, the environment and accidents. On the other hand, POPs are associated with activities that generate essential services and confer economic benefits on to the society as a whole. Economic agents and policy makers have therefore to give up certain benefits in an attempt to reduce these pollutants and their harmful effects.

In the context of Mauritius, seven major sources of POPs have been identified; namely, DDT, biomass burning, medical waste incineration, landfill leachate, accidental fires, domestic waste burning and power production. The effects of each one of these are considered and treated separately depending on how they are spread in the environment, whether through air, water or soil.

2.3.9.1.1 Application of DDT

For malaria vector control, DDT is spread in Mauritius regularly at the seaport and airport areas and on one-shot case-to-case basis in areas where indigenous malaria has been reported. Mauritius has been declared as a malaria-free zone since 1973 but there are traces which sometimes occur due to flooding or after the passage of a cyclone when isolated endemic cases become prevalent. However, reported cases of malaria, in recent years, are mostly imported ones: either by Mauritians who have visited malaria-prone areas or foreigners coming from such areas and visiting the country. This is why DDT is sprayed regularly at the ports of entry which are the Sir Seewoosagur Ramgoolam Airport at Plaisance and the seaport in Port Louis.

Since 1998, cases of malaria reported have been only imported and not indigenous. In 2004, there were five cases detected in the district of Port Louis, namely at Vallee Pitot, Tranquebar and Vallee des Pretres, but these were again secondary cases introduced by foreign contacts. The reduction in the number of cases of indigenous malaria reported in recent years has led to a

significant decline in the amount of DDT applied per annum: from five tons a year in the 80s to some 500kgs in 2005! The current stock of DDT stands at 127.3 tons and is kept under highly questionable conditions.

Exposure to DDT may have serious health effects on human beings and the environment itself. It has been found that the stock of DDT is high and that it is dated as far as the early 80s. Hence, it could be a major threat to workers who run the risk of being contaminated whenever they need to have access to the stores where the DDT stockpile is kept and whenever they have to spray the pollutant.

Unawareness may increase their vulnerability as well as for those who may be in contact with the proliferation of DDT, either as sprayers or bystanders (for example, local inhabitants), by way of transportation through the medium of air. To cite an example, local inhabitants might not always be kept informed of the spraying of DDT in and around canals or rivers where malaria is suspected. Since the regions at risk are the airport and the seaport, this implies that several individuals, besides workers, do run the risk of coming into contact with DDT.

It is also important to note that non-target species and complete ecosystems could easily be at risk with the spraying of DDT. Through air transportation, birds and plants could be seriously affected, especially at the airport's vicinities, which is an agricultural area. At the seaport, the runoffs into the sea would constitute a potential threat to the marine environment. Constant spraying may have serious implications for marine life. The Ministry of Health views that DDT is one of the most effective chemicals for malaria vector control.

Even if there is practically no malaria in the country, control at the ports remains a major task. Foreign pests and diseases may penetrate the country through aircrafts and ships that and this is why spraying is required to safeguard the Mauritian natural environment. One major reason that would explain the frequent use of DDT is because the current stock was obtained at no cost and was large enough to serve as vector control for several years. DDT has therefore played a major role to ensure the socio-economic progress of the

country. Now that malaria has considerably decreased, it makes little sense to maintain such a high stock of contaminated DDT for vector control.

However, alternatives to DDT could be introduced, for instance, by synthetic pyrethroids and by the use of bed nets treated with alternative chemicals in order, to reduce the health risks involved and potential damages to the environment as a whole. If no action is taken with regard to DDT, then we could then expect, among the major cases of exposure, an increase in food contamination, dermatological and respiratory problems and, worse, should pregnant women be exposed, there would be complications such as foetal growth disorders.

Stakeholders, which are directly or indirectly concerned with DDT, are indicated in Table 13. Identification of stakeholders is important whenever policy implications are involved.

TABLE 13

STAKEHOLDERS INVOLVED IN DDT USE

ACTIVITY	STAKEHOLDER(S)
Distribution and Storage	Government of Mauritius (Ministry of Health and Quality of Life) and Workers.
Source of Production	Donated: Imported.
Externality Effect	Civil Society, particularly in marshy areas.
Particular Spraying Areas	Airport Authorities and Seaport Authorities, Ministry of Environment & NDU.

In the above table (Table 13), the externality effect refers to the second-round effect following the action of spraying which may affect any individual in contact with the spraying of DDT and who would require medical treatment. Moreover, in the inventory performed on POPs pesticides (Section 2.3.1), it was also found -, though of a relatively much lower degree of concern - that, the storage conditions of some POPs' pesticides were inappropriate.

The Ministry of Health and Quality of Life has since centralised all the stock of DDT to Pamplemousses (Powder Mill) but the fencing need be reinforced so as to prevent people from having access to the site. Furthermore, it was found that the soil around the stores where DDT is kept is quite contaminated.

Needless to say, this could be easily carried away during heavy rains that which would further spread the pollutant to other compounds, constituting thus a threat to agriculture.

TABLE 14

NON-DDT POPs PESTICIDES

ACTIVITY	PESTICIDE	STAKEHOLDER
Storage	Dieldrin	MSIRI.
	Mirex	Roger Fayd'herbe.
	Aldrin	Deep River Beau Champ Sugar Estate.
Consumption (and externality effect)		Farmers Service Corporation, Civil Society, Ministry of Environment & NDU, Ministry of Health and Quality of Life, Ministry of Agriculture, Importers/Distributors of Pesticides, Chamber of Agriculture, Mauritius Sugar Producers ' Association, Mauritius Cooperative Agricultural Federation Ltd. and AREU.

2.3.9.1.2 Bagasse or Biomass Production

In recent years, it has become customary in Mauritius to use bagasse as an important cost-effective means of to producing electricity. Actually, it has been found that Dioxins and Furans (PCDD/Fs) are produced from biomass burning and especially, from the burning of bagasse which is more and more used in the production of electricity. Given the location of sugar factories and the topography of the island, runoffs of PCDD/Fs in rivers and rivulets passing within the vicinity or compounds of factories may carry these forms of pollutants far away and thus increase the probability of exposure. The same applies to releases carried away by air currents to long distances.

There could be then various impacts on the environment and individuals could be several.

The immediate people at risk would be field workers exposed directly to the process of burning bagasse burning and families living very close or in the vicinity of sugar factories as they who may be affected by the fumes and Dioxins deposited on particles carried away from the incinerator. People, especially women, involved in laundering clothes in nearby rivers may also be

affected. In bigger rivers, in which amateur fishing is practiced as a hobby, there is still danger of consuming fish which has been contaminated by the pollutant. Swimming in and playing by the side of the concerned rivers could also prove to be hazardous for such children who run the risk of getting exposed to Dioxin-related chronic effects.

As regards the costs involved in using bagasse to produce electricity, this means of production has several benefits for the industry and for the economy as it is much cheaper than diesel, for example, and does not contribute to climate change as the net emissions of CO_2 to the atmosphere do not increase. With the phasing out of the Sugar Protocol and the ultimate removal of trade protection, Mauritius will find it hard to compete internationally with countries producing sugar at more competitive prices.

Hence, one important method of safeguarding the economy would be instead to use sugar-cane/bagasse instead for the production of electricity. In this way, the Mauritius could save on its foreign exchange by reducing the imports of coal, diesel and fuel oil, as inputs, combined for the production of electricity. Altogether, Earnings and employment generated by factories involved in the production of electricity would also be secured in that way.

On the other hand, we could have threatening health risks involved in using profusely bagasse for energy production. Increasing production would simply worsen the situation by increasing exposure risks. Unless some Best Available Technology (BAT) or Best Environmental Practices (BEP) is applied, it would be rather difficult to encourage a greater use of bagasse. In the absence of any remedial action, such policies could be encouraging to more health hazards and damages to the natural environment should there be an increase in biomass burning.

To come up with solutions and policy implications, it is wise to look at the various stakeholders involved in the production of bagasse as a source of electricity generation. From the production side, we have the sugar estates which are scattered all over the island of Mauritius; the consumer side being represented by the Central Electricity Board (CEB); and for negative externality effects, we have the Civil Society.

2.3.9.1.3 Medical Waste Incineration

Medical waste incineration has been classified as the second most important source of Dioxins and Furans after bagasse burning (Section 2.3.3). Both public and private hospitals are found to release Dioxins and Furans during the incineration of medical waste with public hospitals accounting for 97.5% of all medical wastes burnt per annum and this would amount to 1,734.85 tons. Of this amount, 52.6% come from the SSR National Hospital at Pamplemousses.

As any other source contributing to high Dioxin emissions, medical waste is of no exception and is equally harmful to the living environment and people at large. People more at risk would primarily consist of workers handling and operating the incinerators and those who are responsible for waste burning at the spotted sites. The population living in the vicinity of hospitals and clinics equipped with incinerators is also at risk. The risks of affected populations would vary depending on the wind direction and to the time span over which waste incineration takes place. Needless to add, constant exposure would simply make matters worse. Should these incinerators be located close to the habitats of animals, birds or plants, these living elements would also be threatened.

Medical incineration was originally and is still looked upon as an important activity in reducing the danger of contamination and propagation of infectious diseases in the environment, particularly through the transport and disposal of medical wastes to any landfill. Either through transport or closeness to landfill sites, there would be the very high probability of more people getting in contact with the contagious wastes. It is also unethical for many to dump medical waste along with household or industrial wastes.

Medical waste incineration is thus a quick method available at the moment to get rid of contagious wastes and is ethically environmentally sound too. In this respect, it acts as an appropriate sound substitute for other means of disposing off medical wastes. Simply through BAT and BET methods, the State could regulate the releases of Dioxins and Furans to render medical waste incineration more reliable, safe and environmentally-friendly. Should there be

no action taken, one would expect the undesirable consequences on the Civil Society.

At present, there are 15 medical incinerators in operation, nine of which are owned by state/public hospitals and health centres while the remaining six are operated by private clinics. In the following table, we indicate the various stakeholders involved in the operation of medical incinerators across over the island.

TABLE 15

MEDICAL INCINERATORS AND STAKEHOLDERS

USER GROUP (Owner or Operator)	**STAKEHOLDERS**
State	Ministry of Health (Jeetoo Hospital, Poudre d'Or Hospital, Victoria Hospital, J. Nehru Hospital, SSR Hospital, Mahebourg Hospital, Flacq Hospital, Souillac Hospital and Dialysis Centre).
Private	Bon Pasteur Clinic, Darne Clinic (Ferriere and De Lorette), Med-Point Clinic, Clinique Mauricienne, City Clinic and Clinique du Nord.
Distributor	Imported Materials
Externality Effect	Civil Society

2.3.9.1.4 Uncontrolled Waste Burning

Uncontrolled waste burning is ranked third in emitting Dioxins and Furans in Mauritius (Section 2.3.3). Households tend to burn their wastes as and when the latter accumulates to get rid of them in their own compounds and sometimes in open areas. In the process, several unused wares, clothes, broken equipment, plastics, papers and other wrapping materials, are burnt.

Being unconscious of the danger which such burning could represent, family members, neighbours and children in the neighbourhood/locality, in particular, are at risk while being in contact with the toxic smokes released and carried away by the wind. The worst thing is that, in one area and on the same day, there may be different a number of people involved in such burning thereby which finally leads to the increase of the level of exposure to this form of

POP. This form of 'self-scavenging' would have the same dangerous effects on health and the environment as would any other POP.

There is actually no benefit to society in resorting to uncontrolled waste burning. Municipal and District Councils do play an important role in waste collection and they have specific safe disposal sites to prevent the living environment and the population to be in contact with it. The physical environment would be however more exposed when burnt materials are carried away through rivers into the sea. The current means of scavenging, if believed to be defective, should be improved and people should be more conscious of the health dangers they may run with waste burning. Such measures would largely attenuate the health risks for households.

Firms and commercial companies also have their share in uncontrolled waste burning. They may try to keep the costs of operation low by avoiding the transport of wastes to a proper landfill site. Given that companies may not dispose of their hazardous wastes, they would often be involved in destroying waste materials, equipment, batteries, used oil and fuel, wrapping and packaging stuffs or unused papers. Their quantum of wastes would be much greater than that of the households. Furthermore, as many enterprises are located near rivers and canals, burnt objects and leftovers are often found to have been dumped into rivers.

The stakeholders involved in uncontrolled waste burning are the Civil Society, the Ministry of Local Government and Solid Waste Management and the Ministry of Environment and National Development Unit.

2.3.9.1.5 Landfill Leachate

Another source of PCDD/Fs is landfill leachate emanating from the Mare Chicose Landfill. The average volume of wastes dumped is very high and this process is about to continue until a new landfill is constructed. In 2002, the amount of wastes collected and disposed off at the Mare Chicose landfill was 363,913 tons[31]. The leachate is removed, transported and disposed of in the

[31] Central Statistics Office, Mauritius in Figures 2003, Government of Mauritius, 2004.

high seas after some elementary treatment. Though its toxicity is reduced, one should not preclude the health hazards associated with it.

The stakeholders involved in the release of this POPs are the Ministries of Environment, Local Government, Public Utilities and Fisheries as well as the Civil Society. They would play an important role in investigating how the leachate is cautiously transported and properly treated before being dumped off into the Mauritian seas.

2.3.9.1.6 PCB-containing Equipment

The transformers owned by the CEB have been playing a major role in the production and distribution of electricity in the country. However, according to the inventory on PCBs, some transformers of the CEB have been classified as being the source of that POP in Mauritius.

The health hazards that pertain to PCBs relate basically to the used oils of the transformers. Exposure to the contaminated oil would mainly occur while replacing the used oils or whenever there are repairs and maintenance to be effected. Also, soil and food items are also potential routes for exposure to PCBs exposure. It is to be noted that the CEB destroys the used oils originating from the transformers through incineration. PCB-contaminated oils release large amounts of Dioxins and Furans during combustion and it thus transposes the PCB problem to another POPs problem due to unsustainable disposal. In the event the CEB fails to take proper action to handle the potentially contaminated oils, workers - those at the workshop site particularly -, would be exposed to several health hazards as enumerated already in the case of other POPs.

In this particular case, the stakeholders concerned are the Ministry of Labour and Industrial Relations and the Ministry of Public Utilities (the parent ministry of the CEB). The Ministry of Labour's role is important as it may intervene to ensure health and safety conditions for the workers.

2.3.9.2 Cost-Benefit Analysis of POPs

The potential benefits and costs associated with each form of POP surveyed in Mauritius are hereunder summarized. These relate to the direct and indirect

channels through which POPs could affect the socio-economic life of individuals and institutions. The externality effects are also tracked in terms of health hazards and damages to the physical environment by POPs. These details are here based on the immediate environments, individuals and institutions which may be impacted. Furthermore, the benefits and costs may be in both monetary and non-monetary terms.

TABLE 16

DETAILED COST-BENEFIT ANALYSIS OF POPs AND THE NO ACTION SCENARIO

POLLUTANT	BENEFITS	COSTS [1,2]
DDT	• Malaria under control and financial resources for curative care significantly reduced/saved): 1 out of 100,000 people affected (Human Development Index). • Reduced absenteeism at work. • Increase in life expectancy (life Expectancy at birth is 71.9 years today as compared to 1970-75 at 62.9 years when malaria was highly prevalent). • Reduced absenteeism at schools (adult literacy rate is 84.3%). • More productive labour • Sustained economic progress due to reliable human development (5.5%) in 2005.	• Health Hazards: workers and Civil Society where spraying is done (an estimated range of MUR 5,250-13,125 has been calculated[32] for treatment for of five affected individuals). • For 14 working days lost by workers, the employing organisation loses[33] MUR 16,600-26,200 with respect to five individuals. • Ecosystem at risk (animals, insects, birds and plants).
Biomass Burning	• Additional revenue for the sugar industry (MUR 1,388m[34]; equivalent to 16.5% of sugar exports earnings). • Own production of electricity by sugar factories, hence a cost-saving device. Bagasse represented 30.1% of fuel input for CEB in 2003 and this would constitute roughly MUR 315m (USD 10,860) of foreign	• Health Hazards: workers and Civil Society (an estimation[35] of MUR 16, 800-42, 000 for 16 individuals). • Loss to the employing organisation would range[36] between MUR 106,300-170,000 for a period of 14

[32] USD 181-453.
[33] USD 572-903.
[34] USD 47.9m.
[35] USD 579-1,448.
[36] USD 3,666-5,862.

	exchange saved. • Reduction in imports of fuel for electricity production: saving of foreign exchange. • Directly or indirectly support and would sustain employment of the sugar industry, which stood at 19,900 in 2003.	days for 16 individuals. • Greater risk of propagation through rivers and air. • Ecosystem at risk (animals and plants).
Medical Incineration	• Ethical way to rid of wastes.	• Health Hazards: workers and Civil Society (people in the vicinity of hospital/clinic compounds): estimated cost of treatment[37] for 10 individuals is MUR 10,500-26,250. • Loss to the organisation would range[38] between MUR 103,000-185,000. • Physical Environment at risk (animals, insects, birds and plants) depending on the direction of the wind.
Uncontrolled Waste Burning and Accidental Fires	• Amount of money saved instead of using an alternative to burning[3] (MUR 21,500-Rs 215,000)[39].	• Injuries: an estimate of treatment cost for 9 nine individuals would be between[40] MUR 9,450-23,625. • Loss ranging between MUR 56,500-97,000 estimated[41]. • Health Problems (Civil Society and Firemen).
Landfill Leachate	• Reduction in exposure and lower rate of contamination when disposed of in high seas. • Lower capital expenditure cost for the public sector since there would be no need to incinerate the waste.	• Exposed marine environment (coral reefs, sea weeds and fisheries). • Humans indirectly through contaminated fish.

[37] USD 362-905.
[38] USD 3,552-6,379.
[39] USD 741-7,414.
[40] USD 326-815.
[41] USD 1,948-3,345.

PCBs	• Contributes towards electricity generation.	• Workers at risk and treatment cost averaging[42] MUR 2,100-5,250 for two individuals • Employing organisation may lose between[43] MUR 31,000-39,000.

(Notes: 1.Computation of the health hazards has been based on a risk-calculated approach using a Bayesian methodology, from which the potential number of people at risk was calculated. The formula is as follows: N = [R*D]*P*E, where N is the number of people at risk for a given POP, R is the coefficient of correlation between POPs' S emissions and POPs-related diseases, D is the total of POPs-related diseases in Mauritius, P is the probability of contracting POPs-related diseases and E is the relative contribution of the POP with respect to other POPs' emissions. Cost of treatment was based on the per capita health expenditure for the overall population and that of in and out-patients in 2003. We assume that public health care constitutes the primary source of curative care and applied it as a 'numeraire' in the above study. Moreover, POPs diseases could be long-lasting but in this exercise we apply a gestation period of 14 days to give an indication of benchmark costs. 2. Loss to the employing organization includes the value of work days lost, wages and salaries and value added by the worker to the production process, was computed for a fortnight and using average monthly earnings from different category of workers and by sector (i.e. agriculture, manufacturing and services) available in Mauritius in Figures (CSO, 2004) and Digest of Employment and Earnings Statistics (2003). 3. The computed range was based on complaints made to the Department of Environment of the Ministry of Environment. 4. There is consideration to incinerate the waste at Mare Chicose to produce electricity. This would be an alternative to disposing of leachate.)

2.3.9.3 Health Impacts of POPs

2.3.9.3.1 Annual Releases of Dioxins and Furans by District

The different POPs have been classified with respect to the nine districts of the island of Mauritius. The computation involves DDT, uncontrolled waste burning and accidental fires, PCBs, medical waste incineration and biomass burning. Table 17 below indicates this classification.

[42] USD 72-181.
[43] USD 1,069-1,345.

TABLE 17

RELEASES OF DIOXINS, FURANS AND PCBs PER DISTRICT IN mg

DISTRICT	VALUE	PERCENTAGE BELOW OR ABOVE AVERAGE
Port -Louis	1,777	13.23% below
Plaines Wilhems	1,303	36.4% below
Moka	834	59.3% below
Black River	699	65.9% below
Riviere du Rempart	1,031	49.7% below
Pamplemousses	6,208	203% above
Flacq	3,506	71.2% above
Grand Port	1,977	3.5% below
Savanne	1,105	46% below
TOTAL	**18,440**	

Source: Computed.

The spread of dioxins and furans has been computed district-wise using data on population level for uncontrolled waste burning, the location of sugar factories and plant-capacity generation for bagasse and the location of hospitals (private and public) for allocating pollutants from medical incinerators.

2.3.9.4 Conditions of POPs-related Diseases and Deaths in Mauritius

In relation to the established wisdom on the health hazards caused by POPs, surveyed data pertaining to deaths by district caused by POPs-related diseases has been conducted. These are stillbirths (deaths of newly born after a gestation period of 28 weeks), neonatal deaths (deaths of babies below four weeks), endocrine and metabolic diseases, diseases of the respiratory system and diseases of the circulatory system. However, it should be noted that cancer has not been included in the analysis, given that its data are as no data is not available, more so because further medical tests and analyses are required to confirm deaths by cancer cause. The table below shows the number of deaths associated with POPs-prone diseases by district.

TABLE 18

POPs-PRONE DISEASES AND DEATHS BY DISTRICT[44]

DISEASE	DISTRICT								
	Port Louis	Plaines Wilhems	Moka	Black River	Riviere du Rempart	Pample-mousses	Flacq	Grand-Port	Savanne
Stillbirths	27	59	12	14	13	17	28	19	8
Neonatal	27	46	9	11	24	16	20	28	16
Endocrine	79	150	33	20	35	39	42	48	21
Respiratory	14	29	9	5	6	11	13	6	7
Circulatory	87	229	45	36	42	57	81	62	31
TOTAL	**234**	**513**	**108**	**86**	**120**	**140**	**184**	**163**	**83**

The above table (Table 18) clearly shows that in the most developed districts, where the population density also tends to be high, namely Port -Louis and the Plaines Wilhems, the total number of cases of deaths is much higher. The lowest number comes from the Black River district. To have more precision of the degree of association between POPs-related diseases' deaths and the level of emissions, the following correlation matrix has been computed.

TABLE 19

CORRELATION MATRIX BETWEEN POPs EMISSIONS AND POPs-RELATED DISEASES DEATHS

DISEASE	CORRELATION VALUE
Respiratory	0.079
Still Births	0.02
Endocrine	-0.062
Neonatal	-0.083
Circulatory	-0.022

Source: Computed.

[44] Selected from the Health Statistics of the Ministry of Health and Quality of Life (2002).

From the above table, it can be clearly observed that there is very weak correlation between POPs and POPs-related diseases or deaths. For only two of the five cases, namely, Respiratory and Still Births, it is seen that there is a positive but low degree of association, suggesting that these diseases might be having other more prominent causes. It should also be noted that in the case of Respiratory diseases, the correlation figure is much higher than in the latter case.

As for the other three suspect diseases - Endocrine, Neonatal and Circulatory - the degree of relationship is negative, implying that there is no association between POPs and such diseases. The overall correlation coefficient turns out to be less than 20% between all POPs and POPs-related diseases.

Hence, in the case of Mauritius, there is very weak evidence of POPs having any significant impact on the diseases for which such pollutants have been blamed or responsible for in other countries. However, this could be attributed to the very low level of emissions in Mauritius, but nevertheless one should not undermine their potential effects, especially if in the future, greater uses of POPs is anticipated.

2.3.9.5 Implications of a No Action Scenario for POPs

Should there be no action taken to remedy to the current status of POPs in Mauritius, we would be bound to face problems will have to be faced at different levels. It has been assumed that the no action scenario would consist of reluctance to apply either the BAT or the BEP recommendations with other things remaining constant. We explain below the significance of this extreme case.

2.3.9.5.1 Deterrence Factor and the Generational Implications

Action(s) taken today will definitely act as a deterrent element to future increases in the uses and applications of POPs. Awareness campaigns will urge people to become more conscious of the health hazards that such pollutants may trigger. On the other hand, enactment of laws on the regulated uses of POPs would compel concerned enterprises to consider seriously the damages which such pollutants could cause. In this respect, the society at large

would opt for the possibility of reducing emissions of PCDD/Fs through proper methods as advocated by BAT and BEP.

No action today would not only cause a threat to present generations but as well as future generations because if the deterrence element is eliminated and concerned enterprises are not bound by the law to reduce POPs, there may be potential ground for greater emissions of such pollutants, particularly because of their associated private benefits (beyond their socially desirable amount). Since POPs do not degrade fast on one hand and there is a potential for greater emission of POPs on the other hand, it would be unfortunate that the future generations would have to bear the very heavy costs of this no action policy.

2.3.9.5.2 Morally Unsound and Violation of Human Rights

POPs have been found to cause stillbirths and high neonatal deaths in several cross-country case studies. In Mauritius, such problems do exist but the exact causes have not been sorted out clearly and POPs may not be blamed exclusively for their occurrences.

Further medical tests would be required to establish such a relationship. However, we cannot preclude or undermine risks of POPs-related diseases in potentially explaining such deaths. Therefore, it would be absurdly immoral to avoid taking any action towards preventing pregnant women from being exposed to POPs. Many such women may be exposed to these pollutants due to their occupation and may not be aware of the dangers that lurk upon them. Moreover, it is very important to inform all categories of workers about the dangers of POPs. Health and safety enforcement at work should be able to ensure minimum risks of exposure. The no action scenario would be classified as a breach of any convention stipulating workers' rights and/or human rights.

2.3.9.5.3 Legal Complications and Medical Treatment Costs

It is important to set up the relevant institutional framework to stipulate rules and regulations that would investigate into the legal aspects of POPs in Mauritius. The spill-over effects which are adverse to the Civil Society, workers and the environment would have to be treated in a true and fair

manner among affected parties. Property Rights[45] issue is paramount when it comes to developing compensation mechanisms involving affected parties or victims.

There must be well- defined laws that could be relied upon to protect the interests of people suffering injuries, health problems and personal losses because they have been exposed to POPs. In the absence of a policy or legal framework for POPs, it would be a very complex and tedious task to prosecute the responsible parties and to compensate the affected parties; but an immediate solution could be to amend the Dangerous Chemicals Control (DCC) Act 2004 as all the 12 POPs are banned under that piece of legislation. It may be not economically desirable neither for victims who themselves have to bear the cost of for treatment nor for those who use public health care services.

2.3.9.5.4 International Trade Strategy

Forward-looking countries tend to promote trade and their growth performance by ratifying conventions which have to do with the environment and food safety. Since it is known that POPs can easily constitute a threat to the environment and food safety by penetrating into the food chain, it is prudent to analyse how the competitiveness of a country's exports could be threatened if it refrains from adopting certain environmental policies that would ensure food security.

Countries that foresee trade rules and regulations which would be enforced to declare suspect products, especially seafood items, as "POPs-free" would cautiously set up the mechanisms now, in their domestic market, to challenge any such international policy. Otherwise, it may prove to be detrimental for them whenever rival countries would have already adopted policies to produce and export "POPs-free" products. Hence, strategy wise, it would be in Mauritius' comparative advantage to adopt the relevant policies in this

[45] Property Right is a jargon used in Economics. The question is who owns the right? Is it the Civil Society which has the right to breathe clean air, enjoy health and physical environment or the firm/enterprise which has the right to pollute because it creates employment, profits and contributes somehow to GDP. This is where the law must stipulate who owns that right which is actually the debate.

direction given that the country is an exporter of food and live animals (though in small quantity).

2.3.9.5.5 Unsustainable Development

Any development policy which underestimates threats to the environment is considered as unsustainable, more so, if such policy leads in the long run to the degradation of natural resources. POPs have been identified as having the potential to damage the physical environment through their penetration in the food chain, rivers, soil and in the air. If we continue to look only at the economic benefits derived from certain POPs-related activities and discard the environmental implications, we would simply be looking at development through a rose-tinted glass. This would suggest unsustainable development that would contravene the national policy of a holistic approach to resource management.

2.3.10 DESIGNED SYSTEM FOR ASSESSMENT, REGULATION AND LISTING OF EXISTING AND NEW CHEMICALS

The Stockholm Convention on Persistent Organic Pollutants (POPs) puts in safeguards for preventing the use and exposure of human beings and the environment of already identified POPs.

In addition to the requirement of banning identified POPs, Article 3 Paragraph 3 of the Convention requires that countries include POPs' limit values and cut-off criteria in their regulatory systems. The logic behind it is that if chemicals having POPs' characteristics are not allowed to enter the usage stage, they cannot pose problems in the future.

The appropriateness of the administrative and management structure of chemicals' control in Mauritius has been evaluated with emphasis on barriers to entry for new POPs-like chemicals into the country. In order to assess if the chemical assessment scheme is preventing POPs-like chemicals, the whole administrative/scientific structure needs to be studied. All chemicals should be assessed according to the same criteria and the substances that pose problems should be automatically identified in a functioning scheme.

2.3.10.1 Chemicals Management Structure in the Past and Future

2.3.10.1.1 The Former Approach

The different aspects and areas of chemical management were under the responsibility of a number of ministries and governmental institutions until the legal structure has changed in 2004 when the Dangerous Chemicals Control (DCC) Act was passed in Parliament. The DCC Act 2004[46] puts the Ministry of Health clearly in charge of authorisation of all chemicals in Mauritius.

In the old scheme, no real home-grown risk assessments have been performed as a part of the pesticide or chemical authorisation schemes.

[46] The Act is available on the Ministry of Health and Quality of Life's website (http://health.gov.mu/download/chemact.pdf, March 2005).

This is quite understandable taking into consideration the size of the country and the quantities of chemicals procured and consumed. There are also insufficient manpower and especially, shortage of trained personnel who would be familiar in modern risk assessment methodologies. Therefore, authorisations have been made based on guidance from a number of international risk assessments and procedures such as evaluations under the FAO, IOMC[47], WHO, the Prior Informed Consent (PIC) Procedure and other internationally recognized schemes.

Furthermore, restrictions in use or bans have been introduced in cases where domestic experience shows that the chemical cannot be used safely. There was no systematic approach into selecting which chemicals to be evaluated for their safety under local use conditions. The substances were selected on a case-to-case basis and it is difficult to guarantee that the most risky substances and scenarios were covered.

Taking full benefit of assessments made abroad by international organisations has been a very reasonable approach. There are, however, some risks involved in such an approach. The international risk assessments are conducted only after considerable time has passed after their introduction on the market. Therefore, there is a gap of several years before conclusions are reached within the international organisations on top of the several years of testing before the risks are highlighted. There is then the possibility of a continuing use over a long period of time before proper action is taken.

The second problem that may arise is that assessments are often based on data in temperate regions, while this does not institute a problem for industrial chemicals, the local situation may differ when it comes to agricultural and household chemicals. The international assessments cannot cater for all local scenarios, as there may be hundreds of these worldwide nor can they take into consideration the educational and awareness levels of the end users.

[47] The Inter-Organisation Programme for the Sound Management of Chemicals – a loose network between international organisations working on chemicals.

2.3.10.1.2 The New Legal Structure

The Dangerous Chemicals Control Act 2004 moves the responsibility of all chemical substances under a common structure independent of the final use of the substance in question. This new piece of legislation repeals and overrules the former system where agricultural pesticides where treated by a separate structure than other chemicals.

The new approach is an important step in the right direction. This is especially the case for environmental concerns from chemical pollution where the main issue is what substances are released and in which quantities.

These following important points have been taken into consideration in the Dangerous Chemicals Control Act 2004:

- The distinction between hazard and risk;
- The difference between hazard assessment (degree, concentration and exposure levels to which a substance is dangerous) and risk assessment (risk management, precautionary measures, working procedures, etc.).

The DCC Act provides for a classification[48] where chemicals are assessed according to their intrinsic characteristics, i.e. the hazard they pose. The Act also introduces the possibility for the Dangerous Chemicals Control Board to establish committees or working groups for further discussing and assessing the risks and potential risk mitigation measures or restrictions.

At the Ministry of Health, there are three technical committees on Agricultural Chemicals, Industrial Chemicals and Consumer Chemicals discussing issues related to risk assessment/mitigation according to the end use. One important thing is that any subsequent work in a risk-assessment working group shall not influence the classification. The fact that a certain chemical will not be distributed to household use or will always be used

[48] Article 7, Functions of the Dangerous Chemicals Control Board and the 5th Schedule.

with respiratory protection does not change the intrinsic properties of the chemical itself.

The technical committees at the Ministry of Health have had their working procedures established. Administrative and scientific guidelines and formats have also been developed regarding application for permission to market a particular substance and written rules on the unacceptable types of chemicals have been established. This is a common approach used in many countries and is highly relevant in order to avoid future POPs.

2.3.10.1.2.1 The Need for Criteria and Guidelines

In order to ensure the laws are keeping new POPs-like chemicals out of Mauritius, the Dangerous Chemicals Control Act 2004 should be amended in order to have provisions for making it impossible to authorize the use or manufacture of substances that show persistence and bioaccumulation exceeding the cut-off criteria in the Stockholm Convention, especially for substances with health or environmental concerns.

Based on this, the DCC technical committees should develop guidelines on what characteristics for chemicals are unacceptable in Mauritius. These guidelines could also cover other parameters beside the POPs parameters.

Clear guidelines are important not only to protect the health and environment, but also for the trade of chemicals. Clear set of published criteria will also guarantee a functioning market of chemicals and an equal treatment of companies marketing chemicals, especially pesticidal products (both agricultural and biocidal applications) as well as consumer chemicals.

The risk of unequal treatment of chemical producers and distributors is the biggest in cases where the restriction or banning of a chemical substance or a product is based on incidents resulting of malpractices or unsafe use. It is obviously right and appropriate to restrict the use of a chemical if several incidents following misuse or poisoning have been reported. This measure should, however, be coupled with a thorough analysis of the whole class of similar chemicals. Otherwise, the measures taken on one

chemical will only change the use to another alternative chemical substance which may pose the same problems, but for which no incident has been reported.

In certain cases, a ban may have an international trade implication in the framework of the commitments made under the World Trade Organization (WTO). This would happen when a certain chemical would be banned without due scientific assessment (or criteria) and another competing substance for the same application with similar hazards and risks would still be allowed to be marketed. This could be considered as an artificial trade barrier, especially if the banned substance would be an imported item while the allowed alternative would be locally manufactured.

In order to avoid such cases and have an understanding of the chemical substances in the market, a Chemical Inventory needs to be established. It is planned to undertake such an exercise. This would be a highly recommendable first step for having a proper overview of the situation and could be implemented alongside with the development of the criteria for acceptable chemical substances in all areas in use.

3. STRATEGY AND ACTION PLAN FOR MAURITIUS

3.1 POLICY STATEMENT

The Government of Mauritius is fully committed to meet its obligations under the Stockholm Convention. The National Implementation Plan (NIP) makes recommendations and proposes action for the phasing out of the various POPs sources and the management of the reduction and the elimination of existing stockpiles in the short, medium and long terms. Every effort will be made to achieve the objectives of the Stockholm Convention though full implementation of the NIP.

3.2 THE IMPLEMENTATION STRATEGY

The proposed implementation strategy is to set up the institutional needs first and then tackle the activities and projects that have been earmarked in the short, medium and long terms. Details in tabular form are available at Section 3.5.

One salient recommendation is the setting-up of a Chemical MEAs Desk at the Department of Environment (Ministry of Environment) in order to co-ordinate all activities and projects under the guidance of the Implementing Agency which is the Ministry of Health and Quality of Life and the setting-up of a Technical Advisory Committee (TAC) with all stakeholders concerned and chaired by the Department of Environment so as to advise on the technicalities of the projects and activities. Government/Implementing Agency will have also to source the necessary funding (locally and internationally) for at least the short-term and the medium-term projects.

On the regulatory front, a number of amendments will have to be brought to existing pieces of legislations (Regulations, Guidelines, etc.) so as to be in conformity with the various aspects and implications of the Stockholm Convention. The lobbying towards the setting up of the POPs Regional Technical Centre in Mauritius will have to start once the proper mechanism will be set up between the Implementing Agency and the proposed Chemical MEAs Desk.

A few Technical Committees and Task Forces will have to be also set up in order to address specific issues, including the management and disposal of PCBs and DDT. Training will have to be imparted to the CEB personnel, staff of hospitals and clinics, governmental laboratories' employees, etc. in order to meet the required needs and demands. Awareness-raising on different aspects of POPs in Mauritius will have to be on a continuous basis, whether targeting specific audiences or the public at large.

As for the emission of Dioxins and Furans, a number of actions are being recommended in order to minimise them. Plans and recommendations for environmentally-friendly solutions to medical waste incineration, bagasse

burning, open waste burning, landfill leachate, etc. are being proposed both for the islands of Mauritius and Rodrigues.

Research will have to be persevered with throughout. One of the top priorities will be research on the emission of PCCD/Fs out of the burning of sugar-cane and bagasse, which is indeed a relatively critical issue for Mauritius. A POPs Monitoring Programme will also have to be rapidly put in place so as to monitor on a permanent basis the amount of POPs in food, animal feed, sediments and so on.

In the process of all the activities and projects, capacity building will have to be on top of the agenda, whether on the infrastructure or human resources side[49].

[49] Details of the Monitoring Programme are found in the report of Dr. B. Graham (Annex 4).

3.3 ACTIVITIES, STRATEGIES AND ACTION PLANS

3.3.1 INSTITUTIONAL AND REGULATORY STRENGTHENING MEASURES

The Government of Mauritius is fully committed to the protection of the health of workers and the public and to the protection of the environment from the harmful effects of chemicals in general and of POPs chemicals in particular. With the promulgation of the Dangerous Chemicals Control Act in 2004 and the various regulations under the Environment Protection Act (EPA) 2002, the country is already addressing most of the requirements of the Stockholm Convention.

Nevertheless, in spite of the existing legislation, some strengthening is still needed in the present institutional and regulatory systems for the proper execution of the National Implementation Plan (NIP).

This section gives anticipated measures of institutional initiatives, regulatory and enforcement actions that need to be undertaken in order to provide the operational capacity and legal basis to implement NIP in practical terms, along with the proper management of POPs compounds, especially those listed in Annexes A, B and C of the Stockholm Convention.

3.3.1.1 Present Institutional Arrangement

The Ministry of Environment & National Development Unit has, through the EPA 2002, an overall responsibility for the setting up of environmental standards and regulations on, inter-alia, hazardous wastes, water and air. It is therefore the institution that has the authority to regulate unintentionally formed and released POPs chemicals - Dioxins and Furans - in air (through emission limits) and in water (drinking and inland surface). The EPA furthermore enables the Ministry to exercise control on collection, transport, treatment and disposal of used oil (regarded as hazardous wastes).

The Ministry of Environment is also the focal point for several chemicals-related conventions, including the Stockholm, Bamako and Basel Conventions. It has therefore the responsibility of ensuring inter-linkages and

synergies among other national Multilateral Environmental Agreements (MEAs) executing agencies. Furthermore, the Ministry of Environment has developed particular competence in industrial pollution control and in monitoring the environmental quality in different media.

On the other hand, the Ministry of Health & Quality of Life, through its Dangerous Chemical Control Board, is mandated to ensure an environmentally sound and safe management of all chemicals in the country, including the intentionally produced POPs chemicals. This Ministry is also responsible for ensuring the quality of food (imported or produced locally) under the Food Act 1998. The Ministry of Local Government & Solid Waste Management is the authority responsible for the disposal of hazardous wastes, including POPs chemicals and obsolete chemicals.

Successful implementation of the NIP will require participation of the above main institutions and other relevant governmental (see Table 20) and non-governmental organisations, along with the setting up of an on-going monitoring programme for the POPs chemicals, based on the various baseline and preliminary surveys.

3.3.1.2 Additional Institutional Requirements

The management of existing and any future POPs and the implementation of NIP requires further financial resources and capacity-building. Implementation of NIP and other related activities would be most effective if these are coordinated by a leading institution with the necessary administrative set-up and dedicated staff. This structure, namely the Chemical MEAs Desk, would be required to assume the following functions and responsibilities:

- Act as secretariat for POPs management;
- Coordinate and monitor activities of the various institutions which are assigned specific tasks under the NIP;
- Report, update and submit regular evaluation of POPs management to the Stockholm Convention Secretariat for POPs;
- Implement a notification and registration process with regard to specific exemptions and related issues on POPs;

- Provide and disseminate relevant guidelines on BAT and BEP and make arrangement of programmes to promote application of BAT and BEP;
- Arrange for mobilisation of funds and resources for implementing the NIP;
- Evaluate NIP implementation progress at short, medium and long term;
- Coordinate the dissemination of public information, education and awareness programmes on POPs;
- Be responsible for setting up and management of an Information Exchange Network (IEN) on chemicals, including POPs chemicals, in the country.

In view of the technical nature of the activities required to implement NIP and other obligations under the Stockholm Convention, it is recommended that the above responsibilities be entrusted to the Department of Environment within the Ministry of Environment & NDU. The Department of Environment may also wish to integrate its work with other MEAs[50] related to chemical conventions (Basel, Rotterdam and Bamako in particular) and to have the necessary administrative set-up with a dedicated staff to implement the above functions.

[50] For example, the combined implementation of priority chemical Multilateral Environmental Agreements (MEAs) can address most aspects of a chemical's life cycle including the evaluation of hazardous chemicals to determine hazards based on inherent characteristics; the development and application of clean production methods to avoid generation of hazardous wastes, substances and products; the provision of information to all levels of the society on chemicals' hazards; the reduction and eventual elimination of POPs releases; the use and production of POPs; international trade in toxic chemicals; the transportation of hazardous and radioactive wastes; avoidance of the introduction of new hazardous chemicals either via unintended use or illegal dumping; the environmentally sound remediation of waste stockpiles; and the identification of contaminated sites.

TABLE 20 –
LIST OF THE MAIN INSTITUTIONS RESPONSIBLE FOR THE IMPLEMENTATION OF THE NIP

INSTITUTIONS	RESPONSIBILITIES
Ministry of Environment & NDU (Department of Environment)	• Ensure overall coordination and inter-agency collaboration for the POPs NIP projects. • Make arrangements for funds and resources for the NIP implementation. • Identify and arrange for remediation of POPs contaminated sites. • Arrange for monitoring of POPs' residues in the environment. • Arrange for the environmentally sound disposal of POPs wastes in collaboration with the Ministry of Local Government and Solid Waste Management. • Ensure application of BAT/BEP in different social and economic activities. • Make arrangement for training on POPs management. • Provide training for Customs Officials on technical aspects for identification of PCBs in oil, equipment and products. • Coordinate awareness-raising activities with other stakeholders. • Amend the legislative framework and follow-up on enforcement.
Ministry of Health & Quality of Life (Dangerous Chemical Control Board)	• Handle, collect and store of 'Annex B' POPs pesticide (DDT mainly) in an environmentally sound manner. • Training for personnel of the Ministry of Health on usage, handling and storage of DDT. • Arrange for the environmentally sound disposal of obsolete DDT and DDT wastes (in collaboration with Department of Environment and the Ministry of Local Government). • Identify and arrange for remediation of DDT contaminated sites in collaboration with the Department of Environment. • Assist in the application of BAT and BEP in medical waste incinerators. • Collaborate with the Department of Environment on awareness raising activities. • Amend the Dangerous Chemicals Control Act 2004 and ensure its enforcement.
Ministry of Agriculture, Food Technology & Natural Resources (Agricultural Chemistry Division)	• Provide information to support the monitoring of POPs pesticides. • Identify and arrange for remediation of 'Annex A' POPs pesticides contaminated sites in collaboration with the Department of Environment.

University of Mauritius, National Environmental Laboratory, Mauritius Sugar Industry Research Institute, Food and Agricultural Research Council	• Upgrade and modernise existing laboratories. • Establish analytical capabilities of POPs compounds in organisations dealing with POPs. • Coordinate environmental monitoring programmes of POPs' compounds. • Research on effects of POPs on human health and the natural environment • Research on emission factor for release of Dioxins and Furans from burning of bagasse and other biomass.
Central Electricity Board	• Continue with the inventory exercise so as to identify all PCB-containing transformers. • Ensure proper management of existing PCBs and PCB-containing equipment. • Provide labelling of inventoried PCB-containing equipment. • Arrange for training of maintenance workers on PCBs. • Arrange for final disposal of PCBs and PCB-containing equipment.

3.3.1.3 Upgrading of the Regulatory Framework

The Dangerous Chemicals Control Act 2004 is the main legal framework that regulates the various life cycle stages (production, use, import, export, monitoring, control, disposal and treatment) of chemicals, including to some extent the POPs ones. Provisions under the Environment Protection Act 2002 relating to POPs chemicals are limited to control of hazardous wastes, various effluent discharge regulations and standards/guidelines on pesticide residues on raw food commodities. The EPA 2002, however, does not provide for specific management of the 12 POPs.

In order to conform to the obligations under the various articles of the Stockholm Convention, certain amendments would need to be brought to the main legislations as well as to some subsidiary ones. These are summarised in the table below.

TABLE 21 –

IDENTIFIED AREAS REQUIRING AMENDMENTS

STOCKHOLM CONVENTION		PROPOSED AMENDMENTS
Article 3-1	Legal and administrative measures to eliminate: • The production and use of the chemicals listed in Annex A. • The import and export of the chemicals listed in Annex A.	Amendments to the Dangerous Chemical Control Act 2004: • New schedule to be added listing POPs chemicals, except for DDT, for which no license shall be issued for any purpose; • Make provisions, under Section 27, for specific exemptions with regard to DDT which is authorised only for disease vector control in accordance with the Stockholm Convention; • Section 10 (4) of the principal Act to be amended by adding, "The Board shall not grant or renew a permit for new chemicals presenting POPs-like characteristics."
Article 3-2	Ensure that any exported POPs Chemicals is used in accordance with the Stockholm Convention.	The Dangerous Chemical Control Act 2004 to be amended as follows: • Chemicals in new schedule [e.g.18 (b)] to be exported only for use and/or environmentally safe disposal as provided for under the Convention.
Article 6-1 (d) (iii)	Measures such that wastes are not permitted to be subjected to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of POPs.	The Environment Protection (Standards for Hazardous Wastes) Regulations be amended as follows: • Include insulation and heat transmission oils (PCBs) in the First Schedule.
Annex A- Part II	Elimination of PCBs.	Draft new regulations on PCBs to provide for: • Include a list of prohibited goods, all equipment and products containing PCB oils in the Second Schedule of the Consumer Protection (Control of Imports) Regulations 1999; • Identification of PCB oils and equipment containing PCBs; • Control on import/export of equipment and products contaminated with PCB oils; • Labelling of PCB-containing equipment; • Cut-off dates for the stoppage of usage (before 2025) and disposal (before 2028).

Annex C **Part V B, C**	Best Available Techniques (BAT) and Best Environmental Practices (BEP).	• Review the Environment Impact Assessment (EIA) approval mechanism such that BAT and BEP are taken into account in the licensing procedures. • Possible amendments also to the current EIA conditions for the unintentional production of POPs. • Set emissions limits for Dioxins and Furans released from medical waste incinerator and municipal solid waste incinerator (under EPA 2002). • Set limit values for POPs in imported food (under the Food Act). • Review POPs limit values in drinking water standards.
Article 4 - 1	Registration of specific exemption for DDT.	The Dangerous Chemical Control Board shall upkeep a DDT register which should be made available to the public.

A Chemical Inventory for the Republic of Mauritius will have to be done as it does not exist and has not been done so far.

3.3.2 ACTIVITY, PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES, WASTES, REDUCTION AND ELIMINATION OF POPS' PESTICIDES

As per the inventory carried out regarding POPs' pesticides (Section 2.3.1), Mauritius does not produce, import and export any Persistent Organic Pollutant pesticide. There are currently around 127 tons of DDT in stock as it is used for malaria control and small amounts of Aldrin (13 litres), Dieldrin (8 litres) and Mirex (64kg).

Key players in the control and management of pesticides are the Ministry of Health, responsible for DDT use in vector control; the Ministry of Agriculture for the monitoring of agricultural pesticides and the Ministry of Local Government and Solid Waste Management for disposal of obsolete pesticides. The Pesticides Control Board was previously responsible for the control of import and use of pesticides in Mauritius. It has now been replaced by the Dangerous Chemicals Advisory Council and the Dangerous Chemicals Control Board, in accordance with the Dangerous Chemicals Control Act 2004.

3.3.2.1 Measures for Current POPs' Pesticides

- Provisions for storage, management and disposal of POPs pesticides must be adhered to as specified in the pieces of legislation.
- Safe storage and ultimate destruction of Aldrin, Dieldrin and Mirex should be ensured. Mirex is a solid compound that can be stored in the future Waste Complex to be burnt eventually in the Hazardous Waste Incinerator. Dieldrin and Aldrin are liquid pesticides.

3.3.2.2 Current Practices for DDT Stocks

DDT is used currently only in malaria control and has been banned as an agricultural pesticide. Around one ton of DDT is used per year in Mauritius and there are two forms of DDT: in powder and in flakes. It is sprayed in regions/areas when there are risks of transmission and as a preventive measure, at the airport and the seaport.

At present, there are 127.3 tons of DDT which are available from stocks dating as far back as 1982 and 1983 but as per efficacy tests, they are still effective at 76% and 59% respectively. However, while analysing the breakdown rates as indicated in Section 2.3.1, it is seen that the flake formulation has deteriorated beyond any possibilities for reuse and the powder formulation has also started to decompose. Therefore, the DDT stocks can neither be reformulated nor re-exported for future use.

The totality of the DDT is now stored at the Powder Mill in Pamplemousses. The premises are properly fenced and are not accessible to the public.

As a measure of prevention, the Ministry of Health officials must carry out a very effective exercise to remove stagnant water on the roofs of houses and in the backyards in order to reduce the breeding of malaria-mosquitoes, thus indirectly reducing need for vector control.

Mauritius has been granted an exemption for the use of DDT (1,500kg per annum) in malaria control by the Stockholm Convention Secretariat in 2004. However, an action plan should be developed for the reduction in reliance on DDT and on its eventual/possible replacement by safer alternatives.

3.3.2.3 Short-term Management Options (0 to 3 years)

A Technical Committee, under the aegis of the proposed Chemical MEAs Desk, should be set up to cater for DDT handling, stocking and utilisation, in accordance with the World Health Organisation's (WHO) guidelines. High level representation from the Ministry of Health & Quality of Life should be ensured with representatives of the Ministry of Environment and other relevant stakeholders.

The stock of DDT for 10 years will be kept at the Ministry of Health and an amount of 20 tons should be planned in the event of a malaria outbreak in Mauritius. The officials of the Ministry of Health will, however, continue the use of DDT for the following in the short term as the stock is available and partly usable and because the shelf life of alternatives is small. However, expertise has to be sought to further verify the effectiveness of the existing stocks whether they can still be used or not.

Training of the personnel of the Ministry of Health on the usage, handling and storing of DDT should be carried out on a mixed mode, i.e. both at the local and international level. Training on the best practices to be adopted for the cleaning of premises where there have been DDT stocks should also be done.

Public health measures should be strengthened so as to ensure early detection and immediate treatment for those exposed to malaria. More information on community hygiene practices should be communicated to the relevant groups in order to reduce habitat and breeding sites of insects that transmit malaria.

Further actions to be taken are:

- Collection of non-DDT POPs pesticides to a central storage site.
- Proper monitoring and reporting on the status of DDT utilisation.
- Send the surplus of DDT abroad for destruction by using the environmentally sound guidelines of Basel convention.

3.3.2.4 Medium-term Management Options (3-5 years)

- Training should be provided in the safe handling, storage and disposal of alternative chemicals.
- Replacing DDT by a safe alternative adapted to the tropical context with particular attention on the increased resistance of vectors to certain chemicals. This could be developed as a research topic involving research institutions and relevant ministries, such as the Ministries of Health and Environment.
- Ensure a sustainable transition from DDT to an integrated use of alternatives. Particular cautions should be taken so as not to increase transmission risk of the disease.

3.3.2.5 Long-term Management Option (5 years +)

The DDT stock can be destroyed at the incinerator located within the future Waste Complex.

ACTION PLAN

OBJECTIVES	Ensure disposal of the stock of DDT safely	Prepare the replacement of DDT by safer alternatives	Training on DDT and alternatives	Develop infra-structure for analysis and research
Activities	Establish stocks of DDT and characteristics and verify effectiveness. Pack and transport existing stocks. Send DDT stock abroad for destruction.	Investigate into safer chemicals such as pyrethnoids, etc. (use, costs and efficiency). Import and use of pyrethnoids. Assess efficiency of synthetic pyrethnoids as compared to DDT. Consider measures to enhance efficiency of chemical alternative(s).	Train the personnel in the handling, use, storing and disposal of DDT. Train the personnel on synthetic pyrethnoids. Training in safe handling and disposal of alternative chemicals to be provided.	Equip existing laboratories with facilities for DDT analyses and chemical alternatives.
Expected Results	DDT stock to be stored and handled properly. DDT surplus stocks destroyed.	DDT phased out. Use of chemical alternatives. Synthetic bednets with pyethnoids placed in high risk areas. Use of appropriate chemicals on an alternate basis to decrease resistance.	Ministry of Health's officials knowledgeable in safe handling of DDT, its storage and on alternative chemicals.	Laboratories equipped to do DDT analyses. Research on the chemical alternatives.

Responsible Institution	Ministry of Health and Quality of Life. Chemical MEAs Desk at the Ministry of Environment.	Ministry of Health and Quality of Life. Research Institutions. Chemical MEAs Desk at the Ministry of Environment (focal point).	Ministry of Health and Quality of Life. Chemical MEAs Desk at the Ministry of Environment.	Ministry of Health and Quality of Life. Private Laboratories. Chemical MEAs Desk at the Ministry of Environment.
Time Period	0-3 years.	0-3 years.	3 to 5 years.	5 years + from 2005.
Estimated Budget	MUR 11.6m USD 400,000	MUR 5.51m USD 190,000*	MUR 3.48m USD 120,000	MUR 290,000 USD 10,000
Source of Financing	Government of Mauritius. Foreign funding.	Government of Mauritius. Foreign Funding, GEF and WHO.	Government of Mauritius. Private Sector. Training and Community Awareness by GEF and WHO.	Government of Mauritius. Private Sector.

* These costs are based on the assumption that an amount of synthetic pyrethroids equivalent to 1,000kg of DDT would be sprayed per year.

3.3.3 PRODUCTION, IMPORT AND EXPORT, USE, STORAGE AND DISPOSAL OF PCBs AND EQUIPMENT CONTAINING PCBs

As mentioned in Section 2.3.4, PCBs or PCB-containing equipment are neither produced nor imported in Mauritius. The efforts must therefore be geared towards the sound management of existing PCBs in the country and to ensure that no further PCBs are imported into Mauritius as a constituent of oils or equipment.

The PCB inventory revealed the existence of a maximum of 80 low-level contaminated transformers (ranging from 53 to 143ppm of PCBs). All these contaminated transformers are of the same make (NGEF, India) and manufacturing years 1979-81 and they all belong to the Central Electricity Board (CEB), responsible for the distribution of electricity in Mauritius. The total amount of PCB-contaminated oil is about 20 tons.

The CEB is clearly the key stakeholder with regards to PCBs in Mauritius, as it owns nearly all the existing transformers in Mauritius which amount to more than 4,000. The few transformers that are owned by private companies have been found to be all PCB-free. In order to meet the Stockholm Convention's obligation towards the elimination of PCBs or PCB-contaminated equipment, the Government of Mauritius, in close collaboration with the CEB, will undertake the following:

- Identify all PCB-containing transformers.
- Manage/store soundly PCBs and PCB-contaminated equipment.
- Enable actions for the final disposal of PCBs and PCB-contaminated equipment.

3.3.3.1 Short-term Measures (0-3 years)

To prevent cross contamination and unnecessary exposure risk to PCBs, the CEB should immediately implement / take the following measures:

- Ensure that its employees have the proper training on the safe handling/storage/labelling of PCB-contaminated oils and/or equipment.
- Give training to its officers on the proper use of PCB test kits.

- Raise awareness among its personnel concerning PCBs.
- Properly label the transformers whether PCB-contaminated or not.
- Inform the Fire Department about special precautions/measures to be taken in case of fires occurring to PCB-contaminated transformers/oils.
- Immediately replace all PCB-contaminated transformers found in sensitive areas e.g. near schools, public places, residential areas, etc. in order to avoid unnecessary exposure in case of fires/accidents.
- To manage PCB-contaminated transformers separately from 'clean' ones.
- To store safely already identified PCB-contaminated oils/equipment in a restricted area until final disposal/destruction.
- To ensure that no further PCBs or PCB-containing equipment/products enter the country, the law/legislation will be amended/strengthened in this respect. Furthermore, appropriate training will also be given to Customs Officers for the identification of PCBs or PCB-containing equipment.

3.3.3.2 Medium-term Measures (3-5 years)

Although, only one transformer make (NGEF) was identified to contain PCBs at levels greater than 50ppm, the CEB should however put in place a system in order to systematically check all transformers sent for repair/servicing using the PCB test kits and send for confirmation by GC-MS if required.

The CEB should also envisage the possibility of constructing an interim storage facility with the proper infrastructure in order to contain widespread contamination in case of spills, accidents or fires.

For the final disposal of PCBs and PCB-contaminated equipment, two options have been identified:

OPTION 1

All the transformers have low level of PCB contamination (less than 500ppm, with a highest reported concentration of 143ppm). Therefore, a draining of the oil, followed by washing of equipment and replacement of oil by mineral oil in

all contaminated transformers will bring down the level of contamination to well below the 50ppm level.

The contaminated oils and contaminated solvent must be placed in the appropriate containers and safely kept in an interim store (either at CEB premises or at the future Waste Complex) until final disposal for destruction abroad is done. Funding for undertaking this disposal will have to be looked for either locally or internationally (e.g. GEF). Of course, the adequate permit(s) must be obtained (e.g. Basel Convention requirements) for the transportation of these hazardous wastes to be incinerated/destroyed abroad.

OPTION 2

Same as explained in Option 1 except for the final disposal. The oils will be safely stored in proper containers at the CEB premises (or at the future Waste Complex) until final destruction by the hazardous waste incinerator that would be constructed within the Waste Complex as proposed by the Ministry of Local Government.

The big advantage of the proposed options is that in both cases, only contaminated oil will have to be disposed of, not the transformers, making the operation significantly less expensive.

In order to swiftly move towards a PCB-free Mauritius, Option 1 is the preferred one. This would also be the more cost effective option. While there are high transport costs involved in PCB destruction abroad, the setting-up and tuning in the future hazardous waste facility for PCB incineration with appropriate monitoring would cost more for the low volume of oil identified. All operations will have to follow the safety regulations and acceptable technologies as laid down in the relevant technical guidelines for issued by the Stockholm and Basel Conventions[51].

[51] Technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with Polychlorinated biphenyls (PCBs), Polychlorinated terphenyls (PCTs) or Polybrominated biphenyls (PBBs), 2004.

3.3.3.3 PCB Management

For the proper implementation of the proposed measures/options, it is suggested that a PCB Task Force be set up under the aegis of the proposed Chemical MEAs Desk. That Task Force would be constituted by representative(s) of the following institutions/bodies/agencies:

- The Ministry of Environment & NDU.
- The Ministry of Health and Quality of Life.
- The Central Electricity Board.
- The Ministry of Local Government.
- Customs Department
- The UNDP.
- Relevant NGO(s).

This PCB Task Force, in close collaboration with the CEB, will make sure that the following tasks will be executed within three to five years:

- Identification of all PCB-contaminated transformers.
- Decommissioning and decontamination of the transformers.
- Replacement of contaminated oil in transformers by mineral oil.
- Safe storage of contaminated oils in proper containers (drums).
- Availability of a proper interim storage area.

The Task Force will also have to look for funding, locally or internationally for sending the contaminated oils abroad for final disposal (e.g. GEF) to undertake the task. The task will include looking for an appropriate company having the capacity of destroying such type of waste, getting the appropriate permit (Basel Convention) and undertaking the shipment of the totality of the contaminated oil.

ACTION PLAN

Objectives	Identify all PCB-containing transformers	Manage soundly PCBs and PCB-contaminated equipment	Enable actions for PCB disposal	Develop infra-structure for analysis and monitoring
Activities	Complete screening of all transformers with PCB test kit. Further investigation by GC/MS.	Train the CEB personnel in the handling, use, storing PCB containing equipment Train CEB personnel and Custom Officers for the use of PCB test kits. Proper labelling of transformers. Empty and cleaning of contaminated transformers. Store contaminated oils and solvent in adequate containers. Construct/ Elaborate adequate interim facility for safe storage of PCB wastes.	Look for funding from local or international sources. Look for appropriate company for destruction of PCBs and PCB-contaminated equipment. Obtain appropriate permits/licen ses to be able to export PCB wastes (Basel Convention. Ship PCB wastes for incineration.	Equip and/or upgrade existing laboratories with facilities for PCB analyses. Give training to laboratory personnel for sample preparation and PCB analyses.

Expected Results	All PCB contaminated transformers identified.	Less risk of exposure to PCBs. Less risk of PCB contamination/ exposure. Customs officers trained to identify PCB oils/equipment. PCBs properly managed and stored.	All PCB wastes disposed soundly.	Laboratories equipped to do PCB analyses. PCB monitoring possible.
Responsible Institution	CEB. Ministry of Environment & NDU. PCB Committee (Chemical MEAs Desk).	CEB. Ministry of Environment & NDU. Ministry of Local Government. PCB Committee (Chemical MEAs Desk).	PCB Task Force (Chemical MEAs Desk) Ministry of Environment & NDU. Ministry of Local Government	Ministry of Environment & NDU (Focal Point). Ministry of Health & Quality of Life. PCB Committee (Chemical MEAs Desk).
Time Period	0-3 years as from 2005	0-3 years as from 2005	3-5 years from 2005.	3-5 years as from 2005.
Estimated Budget	MUR 145,000-290,000 USD 5,000-10,000	MUR 2.03m-2.9m USD 70,000-100,000	MUR 2.9m-4.35m USD 100,000-150,000	MUR 290,000-580,000 USD 10,000-20,000*
Source of Financing	Government of Mauritius. CEB.	Government of Mauritius. CEB. Foreign agencies (e.g. GEF).	Government of Mauritius. Foreign agencies (e.g. GEF).	Government of Mauritius

*Please refer also to Sections 3.3.12 and 3.3.13.

3.3.4 REGISTRATION FOR SPECIFIC EXEMPTIONS

Chemicals listed in Annexes A and B of the Stockholm Convention are presently not produced/manufactured in the Republic of Mauritius while Annex A Part I Chemicals are neither imported nor used in Mauritius. Annex A Part II Chemicals (PCBs) will be phased out as directed by the Convention in due time.

Mauritius has not filed any exemption to use Annex A or Annex B Chemicals except for DDT. The country notified the Convention's Secretariat in March 2003 on the use of DDT for the prevention of malaria and its control. An exemption of 1,500kg of DDT per annum has thus been registered on 25 August 2004 for a period of three years.

However, Mauritius will discontinue the use of DDT once appropriate and cost-effective alternatives are made available and approved by the relevant authorities.

3.3.5 REDUCTION OF RELEASES FROM UNINTENTIONAL PRODUCTION

As stated in Section 2.3.3, an estimated amount of about 26.5g TEQ PCDD/Fs had been released in 2003 on the island of Mauritius with bagasse burning amounting to 33.4%, medical waste incineration to 20.8%, uncontrolled waste burning to 12.2% and landfill leachate to 10.6% - all these representing more than 75% of the total release. These activities were therefore ranked as highest priorities in view of reducing releases of unintentional POPs (UPOPs). For Rodrigues, the total estimated release is 3.7g TEQ for 2003 with uncontrolled burning at the Roche Bon-Dieu dumpsite contributing to 80% of the total.

3.3.5.1 Medical Waste Incineration

Healthcare waste management is under the responsibility of the Ministry of Health and Quality of Life although the Ministry of Local Government, through the Hazardous Waste Regulations 2001, and the Department of Environment of the Ministry of Environment, through the Environmental Protection Act (EPA 2002), control the main activities such as the disposal of wastes.

As per an inventory carried out in 2003, nine hospitals and health centres and six private clinics are operating incinerators for the destruction of medical wastes and the annual PCDD/Fs' release from medical waste incineration amounts to some 5,5g TEQ.

The main reason to the high PCDD/Fs releases in this category is that medical incinerators in hospitals and clinics in mainland Mauritius are neither equipped with proper air control equipment nor with secondary burners. The medical incinerator in Rodrigues has both primary and secondary burners.

3.3.5.1.1 Short-term Measures (0-3 years)

- Awareness raising and training of the personnel in hospitals and clinics on the operation of incinerators and best environmental practices in view of reducing PCDD/Fs' releases.

- In order to reduce the quantity of waste incinerated, the existing procedures to sort between hazardous and non-hazardous wastes generated on the premises of hospitals and clinics need to be strengthened. Sorting procedures have to follow WHO guidelines and emphasis must be laid on removing chloride containing components to avoid formation of PCDD/Fs in the combustion process.
- Adopt a 'Waste Minimization Strategy' within healthcare facilities by reducing the amount of disposables and by looking towards alternative practices.
- Develop a recording mechanism for the amount of hazardous wastes being burnt at the hospital incinerators and the need to have a long term monitoring of air emissions, including PCDD/Fs in flue gases.
- Dispose of ash from medical wastes incinerators in the Hazardous Waste Cell of the Mare Chicose Landfill.

3.3.5.1.2 Medium-term Measures (3-5 years)

- Improve the height of the stack in existing incinerators.
- Consider reducing the amount of hazardous wastes to be incinerated by switching to other disposal alternatives not producing Dioxins like steam autoclaving and compacting before land-filling. A cost benefit analysis will thus have to be carried out.
- Establish a continuous recording system with incinerators on primary/secondary chamber temperatures, hourly wastes charging rates and oxygen levels.
- Plan and prepare for centralized medical waste disposal units including separation, collection and other logistical arrangements such as preparing temporary storage and loading for contagenious waste at the Waste Complex.
- Upgrade the incinerator at the SSR Hospital with proper air pollution control devices.

3.3.5.1.3 Long-term Measures

- All hazardous wastes generated in hospitals and private clinics should be collected and sent to the future Waste Complex to be burnt and the ash stored in the secure landfill of the Complex.
- Implement the centralized collection and disposal plan in medical facilities.

ACTION PLAN

Objective: emission reduction target at 80%	**Ensure proper operation of exiting incinerators**	**Ensure safe disposal of hazardous medical wastes as per BAT/ BEP**	**Ensure analysis and recording of PCDD/Fs in flue gas**	**Equip existing incinerator with BAT devices**
Activities	Training of personnel in handling wastes, operating incinerators and disposing of ash. Establish waste minimization and separation programmes in the medical facilities Develop a legislative framework to include POPs in medical waste incineration	Dispose medical wastes in the incinerator of the future Waste Complex.	Develop a long term monitoring program for analysis of flue gases and fly ash from SSR Hospital incinerator.	Upgrade SSR Hospital incinerator with proper pollution control devices.
Expected Results	Personnel trained in hospitals and clinics. Waste separation programmes established. Legislative framework developed.	Medical waste destroyed in the future Waste Complex.	Records of PCDD/Fs' levels in flue gases of incinerator at SSR Hospital.	SSR Hospital incinerator upgraded.
Responsible Institution	Ministry of Health & Quality of Life, hospitals and clinics, Chemical MEAs	Ministry of Local Government, Ministry of Health & Quality of Life, Ministry of	Chemical MEAs Desk, Ministry of Environment & NDU, Ministry of Health & Quality	Ministry of Health & Quality of Life.

	Desk, Ministry of Local Government.	Environment & NDU.	of Life.	
Time Period	Short-term (0-3 years).	Long-term (5 years +).	Short-term (0-3 years).	Short-term (0-3 years).
Estimated Budget	MUR 9.28m USD 320,000	MUR 104.4m USD 3.6m	MUR 435,000 USD 15,000	MUR 14.5m USD 500,000
Sources of financing	WHO, Government of Mauritius. Foreign funding.	Government of Mauritius. Private funding.	Government of Mauritius.	Government of Mauritius.

3.3.5.2 Bagasse Burning for Power Generation

Bagasse burning for power generation amounted to 33.4% of total PCDD/F's release to the environment in 2003 in Mauritius. These values have been calculated from agreed emission factors using UNEP Toolkits and validated from samples taken from a few sugar factories. However, only four samples were taken and as no published data for PCDD/Fs with regard to sugar-cane burning exists, further research studies/analyses on PCDD/Fs' levels in ash samples from bagasse burning should be carried out. In the meantime, further investigations have been initiated.

A total of 11 sugar factories are presently operating in Mauritius with three independent power producers (IPP). Bagasse is burnt during the sugarcane harvest season over four to five months per year while coal is burnt during the rest of the year.

The three Independent Power Producers (Belle-Vue, Beau Champ and FUEL) produce electricity only whereas six other sugar factories generate steam and electricity on a continuous process, and two other factories generate only steam. However, two factories situated in the south, St. Felix and Riche-en-Eau, will close down in the near future.

Particulate matter is the most significant pollutant of the bagasse power generation. It is known that Dioxins and Furans fix themselves on the particulate matter - It is therefore very important to minimise particulate matter emission from the combustion process. However, only three sugar factories (the three IPPs) are equipped with electrostatic precipitators while the others have wet scrubbers for air pollution control.

3.3.5.2.1 Short-term Measures (0-3 years)

1. Perform a validation of emission factors of Dioxins and Furans from bagasse burning.
2. Research into PCDD/Fs' distribution in water phase where wet-scrubbers are used for air pollution control.
3. Conduct research into parameters affecting PCDD/Fs formation and emissions from bagasse burning, especially the relationship between oxygen level, moisture and temperature and residence times.
4. Training of the personnel on 'bagasse loading practice', bagasse screening and operation of incinerators. Issues to be covered are purity of fed bagasse by avoiding any contamination by PVC or agricultural film, operating furnaces in excess air, maintaining of steady burning of bagasse, avoiding gaps in input of bagasse, better management of stocks and keeping moisture content of bagasse as low as possible.
5. Provide adequate storage of contaminated fly ash. Encapsulate and place in the Hazardous Waste Cell at Mare Chicose.
6. Enforcement of legislation to prevent and control sugar-cane burning.
7. Improve height of stacks where emissions higher than standards are observed.
8. Establish a proper monitoring of flue gas temperatures and emissions.

3.3.5.2.2 Medium-term Measures (3-5 years)

1. Develop and establish BEP and BAT for sugarcane incineration based on research findings.
2. Amend legislation(s) to include measures to eliminate PCDD/Fs' emissions from bagasse burning plants.
3. Develop a monitoring plan for PCDD/Fs emissions from bagasse incinerators.
4. Control particulate matter emissions by installing adequate Air Pollution Control System (APCS) equipment such as Electrostatic Precipitators and in bagasse burning plants.

3.3.5.2.3 Long-term Measures (5 years +)

1. Implement BEP and BAT by installing bagasse pre-treatment practices and equipment, multiple incineration chambers and other APCS. Run bagasse incinerators at optimal conditions.
2. Have a dedicated landfill for disposal of fly ash from bagasse plants in the upcoming Waste Complex.
3. Implement the PCDD/Fs monitoring plan and follow-up on the release levels.

ACTION PLAN

OBJECTIVE 100 %	**Ensure proper operating practices of furnaces.**	**Ensure development of research on dioxins emissions from bagasse and proper operating practices.**	**Apply BAT/BEP principles to existing sugar factories and proper operating control. Ensure adequate air pollution control.**	**Safe storage/treatment and disposal of fly ash or effluents with wet scrubbers.**	**Regular monitoring of flue gas for PM, PCDD/Fs.**
ACTIVITIES	Training of cane operators in bagasse loading and emission factors.	Conduct research on: • Actual emission of PCDD/Fs. • Drying of bagasse. • Distribution of PCDD/Fs in water phase. • Dioxin reformation from flue gases. Develop BEP and BAT for bagasse incineration.	Install electrostatic precipitators in furnace power plants for major sugar factories.	Construct dedicated waste cell for fly ash. Proper containment for contaminated fly ash.	Develop monitoring requirements: parameters and frequency. Purchase Monitoring Unit Sampler. Monitor flue gas for PCDD/Fs.
EXPECTED RESULTS	At least two operators trained in each sugar factory.	Scientific results on larger number of samples. Best operating practice in furnaces. Measures to avoid Dioxin reformation.	BAT applied to combustion process. ESP installed.	Fly ash properly treated/disposed of.	Records obtained.

RESPON-SIBLE INSTITU-TION	Private sector.	MSIRI, UOM. Foreign research/ academic institution.	Sugar factories.	Ministry of Local Government, Ministry of Environment & NDU.	Ministry of Environment & NDU, sugar factories, MSIRI.
TIME PERIOD	3-5 years	0-3 years	5 years +	3-5 years	0-3 years
ESTIMATED BUDGET	MUR 2.32m USD 80,000	MUR 7.54m USD 260,000	MUR 116m USD 4m	MUR 7.25m USD 250,000	MUR 870,000 USD 30,000
SOURCES OF FINANCING	Foreign funding: GEF. Govern-ment of Mauritius. Sugar factories.	International funding, Mauritius Research Council (MRC), University of Mauritius.	Sugar factories.	Sugar factories.	Sugar factories.

3.3.5.3 Open Uncontrolled Burning of Wastes

Uncontrolled waste burning amounted to 12.2% of total release with 3,240mg TEQ of PCDD/Fs. It is estimated that around 90% of domestic wastes is collected and land-filled in mainland Mauritius. For Rodrigues, the inventory showed that an estimated annual amount of 3.7g TEQ is produced and the Roche Bon Dieu dumping site being responsible for 80% of the releases.

3.3.5.3.1 Short-term Measures

1. Develop public education campaigns about impacts of uncontrolled waste burning and potential of Dioxins/Furans' emissions.
2. Restrict uncontrolled burning of wastes by law.

3.3.5.3.2 Medium-term Measures (Rodrigues)

1. Ensure proper waste management strategy and construct a sanitary landfill. The costs for such a landfill are estimated to be around 10 million USD (MUR 290m).

3.3.5.4 Landfill Leachate

Landfill leachate is responsible for 10.6% of release of PCDD/Fs with 2,819mg TEQ.

3.3.5.4.1 Short-term Measures

1. Ensure regular monitoring of PCDD/Fs in landfill leachate (every six months).
2. Ensure proper disposal of hazardous wastes in the Hazardous Wastes Cell of Mare Chicose.
3. Avoid chlorine-containing compounds or other hazardous wastes to get in the Domestic Waste Cell of the landfill.

3.3.6 STRATEGY FOR IDENTIFICATION OF STOCKPILES, ARTICLES IN USE AND WASTES

As the assessment of Persistent Organic Pollutants' pesticides (chemicals listed in Annex A, Part I, of the Stockholm Convention with the exception of PCB) was thoroughly done and reported in Section 2.3.1 and as the chemicals listed in Annex C of the Stockholm Convention are not concerned, the strategy for identification of stockpiles, articles in use and wastes would concern only PCBs. However, further research will have to be done to measure the effectiveness of the existing DDT stockpile which has been imported in the country more than 20 years ago.

During the PCBs' inventory, only transformers and capacitors were assessed as they were considered as the equipment likely to contain the most significant amount of Polychlorinated Biphenyls. However, other applications such as electric motors, electrical light ballasts, hydraulic fluids, switches, circuit breakers, vacuum pumps or lubricants listed in the UNEP document "Guidelines for the Identification of PCBs and Materials Containing PCBs" (UNEP, First Issue, August 1999) may also be PCB-contaminated.

To meet its obligation towards the Stockholm Convention, there is need for Mauritius to identify all PCB-containing and/or contaminated applications, equipment and wastes not considered in Section 2.3.2[52]. Mauritius will therefore need to build capacity in order to:

- Identify all applications/locations likely to be PCB-contaminated.
- To make an inventory of PCB-contaminated applications/wastes.

3.3.6.1 Short-term Actions (0-3 years)

The Chemicals MEAs Desk will have to constitute a Task Force under its aegis which will undertake the identification and inventory of PCB-contaminated applications. The Task Force, divided into teams, will have to be properly trained in order to:

- To provide training to personnel/members of the Task Force for the identification and testing of PCB-containing materials and wastes.

[52] Assessment of PCBs (stockpiles, contaminated sites and wastes).

- To set up a list of all potentially PCB-contaminated applications likely to have been used or still being used in Mauritius.
- To establish a users' list (e.g. industries) of these applications.
- To determine possible target locations for PCB inspection.
- To inspect all target locations for PCBs.
- To determine potential PCB-containing wastes at target locations.
- To test the identified applications and wastes for actual presence and concentration of PCBs.
- To make use of the existing POPs database for the proper management of all locations.

The Task Force will have to cover all applications (closed, partially closed or opened) given in the UNEP guideline document (UNEP, 1999) with the exception of transformers and capacitors that have been assessed in Section 2.3.2.

3.3.6.2 Medium-term Actions (3-5 years)

With the help of information given in the UNEP document for the identification of PCBs and materials containing PCBs (UNEP, 1999), the teams constituted will have to:

- To inspect all target locations for PCBs.
- To determine potential PCB-containing wastes at target locations.
- To test the identified applications and wastes for actual presence and concentration of PCBs.
- To make use of the existing POPs database for the proper management of all locations.

In the medium-term, the additional PCB-contaminated equipment, wastes and applications will be properly managed to prevent exposure and releases to the environment. During the assessment, the locations where PCB-containing materials and/or wastes have been identified will be properly managed to prevent exposure or releases to the environment. Measures like containment, restriction, labelling or isolation must be taken until these materials or wastes are soundly dealt with by the appropriate persons (Section 3.3.7).

ACTION PLAN

OBJECTIVES	IDENTIFY ALL APPLICATIONS/LOCATIONS LIKELY TO BE PCB-CONTAMINATED	MAKE AN INVENTORY OF PCB-CONTAMINATED APPLICATIONS/WASTES
Activities	To constitute the Task Force. To give training to personnel involved in PCB inspection. To set up a list of all potentially PCB-contaminated applications likely to have been used or still being used in Mauritius. To establish a list users (e.g. industries) of these applications. To determine possible target locations for PCB inspection.	To inspect all target locations for PCBs. To determine potential PCB-containing wastes at target locations. To test the identified applications and wastes for actual presence and concentration of PCBs. To test the identified applications and wastes for actual presence and concentration of PCBs. To make use of the existing database for the proper management of all locations.
Expected Results	Capacity built for PCB inspection. All possible applications/locations identified.	PCB contaminated applications/wastes identified and located. Amount/volume of PCB-contaminated materials and wastes known. Information stored in database.
Responsible Institution	Chemical MEAs Desk (PCB Committee/Task Force), Ministry of Environment & NDU and Ministry of Local Government.	Chemical MEAs Desk (PCB Committee/Task Force), Ministry of Environment & NDU and Ministry of Local Government.
Time Period	0-3 years.	0-3 years.
Estimated Budget	MUR 870,000-1.45m. USD 30,000-50,000.	MUR 2.32m-3.48m. USD 80,000-120,000.
Source of Financing	Government of Mauritius, GEF.	Government of Mauritius, GEF.

3.3.7 MANAGEMENT OF STOCKPILES AND DISPOSAL OF ARTICLES IN USE AND REDUCTION OF RELEASES

In line with the Stockholm Convention, the totality of the PCB-contaminated materials and wastes that will be identified during the assessment proposed in Section 3.3.6 need to be soundly managed and safely disposed. The Government of Mauritius will therefore have to set in place the proper mechanism and allocate the necessary financial and human resources so as to manage soundly these hazardous and toxic materials and wastes from collection, transport and storage until final disposal. Hence, exposure to PCBs and PCB releases to the environment will be minimised.

3.3.7.1 Short-term Actions (0-3 years): Awareness, Training and Setting-up of Management System

For this task, the key stakeholder is the Ministry of Local Government which is the responsible institution for the management of wastes in Mauritius. To soundly manage these hazardous wastes, that Ministry, in close collaboration with the proposed Chemical MEAs Desk (PCB Task Force) and the Ministry of Environment will have to set up a separate management system including collection, transport and storage before final disposal. For this to happen, a number of measures/actions need to be set up/implemented:

- Set up appropriate units to handle, store and transport these PCB-containing materials or wastes.
- Provide training to personnel in the proper handling, labelling and storage of PCB wastes/materials.
- Raise awareness among the public and especially among relevant stakeholders e.g. companies/locations where PCB-containing materials and wastes have been identified or may potentially exist.

3.3.7.2 Medium-term Actions (3-5 years): Collection and Storage

The PCB-containing materials and wastes need to be properly and safely handled. The handling of the PCB-containing materials or wastes can only be done under the supervision of the trained officers of the Ministry of Local Government. These should be put in the appropriate containers (e.g. drums or

airtight containers for liquids), properly labelled and transported to an adequate storage facility. The following facilities/measures should therefore exist/be implemented:

- Make available appropriate containers for the different type of wastes e.g. PCB-contaminated hydraulic fluids (liquids) or switches (solids).
- Provide proper labels.
- Provide adequate devices/equipment for safe collection of PCB wastes/materials.
- Put in place a separate transport/collection system.
- Provide appropriate interim storage facilities within the premises of the Ministry of Local Government.

3.3.7.3 Long-term Actions (5 years +): Disposal

A Hazardous Waste Incinerator might be operational within a future Waste Complex in Mauritius by 2010. As Mauritius has ratified the Stockholm Convention, this incinerator will be one complying with BAT. It is proposed that the collected PCB-containing materials and wastes be destroyed by this incinerator. Until these collected materials and wastes are incinerated, the following needs to be done:

- Make provision for the storage of these wastes within the Waste Complex.
- Ensure proper labelling of the storage area.
- Restrict the storage area.
- Inspect the storage area on a regular basis.

During the destruction of the wastes, the PCB Task Force, under the aegis of the Chemical MEAs Desk, must make sure that the incineration is carried out under the adequate BAT conditions to prevent/minimise the formation and release of chemicals listed Annex C of the Stockholm Convention.

In the event that the Hazardous Wastes Incinerator is not constructed, the PCBs and the PCB-containing equipment will be sent abroad for destruction.

ACTION PLAN

OBJECTIVES	TO PUT IN PLACE UNITS TO SOUNDLY MANAGE PCB WASTES	TO SOUNDLY COLLECT, TRANSPORT AND STORE PCB WASTES	TO SAFELY DISPOSE OF PCB WASTES
Activities/ Measures	Set up appropriate units to handle, store and transport these PCB-containing materials or wastes. Provide training to personnel in the proper handling, labelling and storage of PCB wastes/materials. Raise awareness through workshops among relevant stakeholders e.g. companies/ locations where PCB-containing materials and wastes have been identified or may potentially exist.	Provide appropriate containers. Provide proper labels. Provide adequate devices/ equipment for safe collection of PCB wastes/ materials. To supervise safe collection of PCB wastes. Put in place a separate transport/collection system. Provide appropriate interim storage facilities.	To soundly store wastes until incineration. To ensure BAT conditions during incineration.
Expected Results	Personnel trained to soundly deal with PCBs. Awareness raised concerning PCBs.	PCB containing materials and wastes safely collected and stored.	PCB wastes soundly destroyed.
Responsible Institutions	Chemical MEAs Desk, Ministry of Environment & NDU and Ministry of Local Government.	Chemical MEAs Desk, Ministry of Environment & NDU and Ministry of Local Government.	Chemical MEAs Desk, Ministry of Environment & NDU and Ministry of Local Government.
Time Period	0-3 years	3-5 years	5 years +
Estimated Budget	MUR 580,000-870,000 USD 20,000-30,000	Depends on volume of PCBs identified.	Depends on volume of PCBs identified.
Sources of Financing	Government of Mauritius, GEF.		

3.3.8 STRATEGY FOR IDENTIFICATION OF CONTAMINATED SITES AND REMEDIATION IN AN ENVIRONMENTALLY SOUND MANNER

The Stockholm Convention requires that all parties develop their own strategy for identification of areas contaminated by POPs' compounds listed in its Annexes A, B and C. It is also stipulated that remediation should be carried out in an environmentally appropriate manner.

From the inventories carried out in the early phases of the project, the potential contaminated sites in Mauritius are soils around DDT stores, soils around CEB workshops, the Hazardous Waste Cell at the Mare Chicose landfill site, soils around furnaces of sugar factories and fly ash deposits.

3.3.8.1 Strategies for Identification of Contaminated Sites

Proper mechanisms have to be set up to identify the potential contaminated sites in Mauritius. The proposed Chemical MEAs Desk at the Department of Environment, together with other concerned ministries, has to ensure that the following measures be taken:

1. Develop a national strategy in order to identify and label all potential contaminated sites.
2. Devise a methodology to prioritize contaminated areas for recovery purposes.
3. Develop new regulations regarding the identification of stockpiles.
4. Prepare a strategy for contaminated areas' recovery and treatment.
5. Upgrade the laboratories' capacities so as to identify contaminated sites.
6. Develop a sound plan for hazardous waste management strategies to avoid the contamination of soils.
7. Raise awareness among industries and the public on the hazards of contaminated sites, especially if they contain POPs.

3.3.8.2 Existing Contaminated Sites

3.3.8.2.1 DDT

The inventory, as revealed in Section 2.3.1, shows that some soils around the former DDT storage sites were heavily contaminated with an excess of 1,000mg/kg soil at Mahebourg Hospital with a current level of 1,146.8mg/kg. Although the whole stock of DDT is now stored at Pamplemousses, contaminated soils are still present at Fort George and Mahebourg. The Fort Georges Store and the Mahebourg one, where DDT had been stored, will have to be nevertheless cleaned and decontaminated.

Further analyses have indicated that the levels of contamination are highest near the doors of the stores at Pamplemousses with a concentration of 145.6ppm and Mahebourg with a concentration of 761.5ppm.

Based on the measured concentrations and considering 1ppm of DDT concentration as a limit for acceptable contamination figures, an estimate of the amount of soil contamination with DDT has been done.

Around 2,000m^3 of soil at Mahebourg is contaminated with DDT and around 375m^3 of soil is contaminated near the store at Pamplemousses. At Fort George, the limit value of 1ppm DDT is measured still at 30 meters from the store. If supposed that the soil is contaminated to a depth of 1.5 metre and the remediation needs to be carried out a 50 metre stretch along the warehouse, some 1,500m^3 needs to be treated if soil remediation is considered.

At present, the Pamplemousses site is contaminated above the 1ppm level at 15 metres from the store. However, before the DDT moves away from Pamplemousses, no site remediation should be considered. Efforts should rather be put in minimizing the spread of DDT by proper store management.

No DDT contamination was however found in water and soil samples from Rodrigues.

3.3.8.2.2 PCBs

During the inventory, the soil samples taken around the PCB transformers at the St. Louis CEB Workshop have not shown any indication of contamination

by PCB. The same results were obtained from the adjourned drain where the used oils are thrown. However, monitoring/analyses of soil near PCB-contaminated materials/wastes/transformers should be carried out.

3.3.8.2.3 Dioxins and Furans

Sediments coming from textile industries and topsoil from sugarcane fields as well as fly-ash from sugar furnaces showed presence of Dioxins and Furans although the levels were very low (Section 2.3.3). However, Dioxins monitoring will be carried out, as proposed in Section 3.3.12, at selected sites like the coastal zones (sediments), near medical waste incinerators or near the Mare Chicose landfill site (soils).

3.3.8.3 Measures

3.3.8.3.1 Short-term Measures (0-3 years)

1. Fence all contaminated sites. Protect existing sites by fencing and preventing access to the public.
2. Develop Soil Guidelines for POPs chemicals.
3. Develop adequate training programmes to build capacity among local people to assist with remediation of contaminated sites.
4. Ensure decontamination of Fort George Store and Mahebourg Store in an environmentally sound manner. Other soils where very low levels of DDT have been noted can be kept on site but access to the public must be restricted.
5. Send contaminated soils to the Mare Chicose Hazardous Waste Cell as contaminated soil is a permitted item at the Mare Chicose landfill although pesticides and biocides are listed as “un-permitted” waste. The contaminated soil can be stored at the Hazardous Waste Cell.
6. Monitor soils around PCB-containing transformers in CEB workshops to ensure that no contamination is occurring.
7. Monitor soils and/or sediments at selected sites e.g. coastal zone, near medical waste incinerators or near Mare Chicose landfill site.
8. Upgrade the laboratories’ capacities in order to monitor remediated sites.

3.3.8.3.2 Medium-term Measures (3-5 years)

1. Develop new regulations to impose compulsory application of environmentally sound remediation practices to the contaminated sites.
2. Assess the Pamplemousses DDT storage site once DDT is shifted and then conduct site remediation.
3. Monitor DDT-remediated sites at Mahebourg and Fort George on a regular basis.
4. Adopt legal and technical measures to ensure safe and efficient and environmental sound management of contaminated sites.

ACTION PLAN

OBJECTIVES	**Develop a strategy to identify and rank contaminated sites**		**Prepare environmental assessments of the contaminated area at Mahebourg**	**Protect the contaminated area at Fort George and Pamplemousses in an environmentally sound manner**		**Develop laboratory facilities to monitor remediated sites and identify contaminated sites**
ACTIVITIES	Conduct inventory of existing PCB, DDT stores, landfill, transfer stations and fly-ash deposits.	Undertake assessment to prioritise contaminated sites.	Develop methodology for environmental assessment on human beings/the environment and risk evaluation.	Prepare work procedures such as fencing and/or digging of soil. Send the contaminated soil to Mare Chicose.	Decontaminate the former DDT stores at Mahebourg and Fort George.	Monitor remediated soils. Monitor soils around PCB transformers in CEB's workshops.
EXPECTED RESULTS	Sites identified. Soil guide-lines developed.	Priorities set.	Methodology developed.	Contaminated soil protected/ removed/sent to landfill site.	Mahebourg and Fort George Stores decontaminated.	Analyses obtained.

RESPON-SIBLE INSTITU-TIONS	Chemical MEAs Desk, Minis-try of Local Government, Ministry of Health, CEB and the sugar	Chemi cal MEAs Desk.	Chemical MEAs Desk.	Chemical MEAs Desk and Ministry of Local Government.	POPs Regional Centre and laboratories.
TIME PERIOD	Short-term.		Short-term.	Medium-term.	Medium-term.
ESTIMATED BUDGET	MUR 4.93m USD 170,000		MUR 2.18m USD 75,000	MUR 3.19m USD 110,000 / MUR 2.32m USD 80,000	MUR 580,000/year USD 20,000/year
SOURCES OF FINANCING	Government of Mauritius and GEF.		Foreign funding.	Government of Mauritius/GEF.	Private Sector and Government of Mauritius.

3.3.9 INFORMATION EXCHANGE AND STAKEHOLDERS' INVOLVEMENT

Mauritius has to consider developing an appropriate information infrastructure for information exchange on chemicals among the relevant stakeholders. There are indications which confirm that due to the lack of a national strategy for information exchange, there are many cases of overlapping and redundancies among activities carried out by the different institutions.

This lack of synergy is also brought to light when existing chemical management schemes are considered. In this respect, the approach is very often reactive not proactive. It is habitually on a case-to-case basis without national guidelines and at times, it is an add-up of assessments made by international organisations.

The development of an Information Exchange Network (IEN) is timely and appropriate, and would enable people involved in chemical management at national level to access reliable information in the right format in order to control POPs and other types of pollutants. The IEN would be within the proposed Chemical MEAs Desk and would also help to provide data for research and knowledge-sharing opportunities at national, regional and international levels as Mauritius forms part of the Chemical Information Exchange Network (CIEN).

In the context of the Enabling Activities of the POPs Project, a database has been developed for the Republic of Mauritius to capture inventory POPs data and contamination by geographical locations. That database, located at the Department of Environment and which should be located at the proposed Chemical MEAs Desk, will be instrumental in regard to the addition of new chemicals under the Stockholm Convention.

Moreover, the setting up of the Chemical MEAs Desk within at the Ministry of Environment - the national focal point for the Stockholm Convention - would lay the ground for the development and sharing of information on chemicals in Mauritius and among countries of the region.

3.3.9.1 International Linkages

Mauritius will have to establish links with existing international chemical information exchange programmes - e.g. International Labour Organisation (ILO) and the Food and Agricultural Organisation (FAO) - and also within the framework of the Alliance of Small Island States (AOSIS). Information exchange could also be bolstered through linkages with existing mechanisms of INFOCAP, UNEP Chemicals, through the Strategic Approach to International Chemicals Management (SAICM) and the Clearance House mechanism under the Stockholm Convention and other related conventions.

3.3.10 PUBLIC AWARENESS, INFORMATION AND EDUCATION

The awareness campaign carried out in the context of the POPs Enabling Activities Project has provided momentum and has laid ground to address standing issues at the occupational level in respect to PCBs and DDT and more broadly, about Dioxins.

Awareness-raising activities on the 12 POPs should be conducted on a continuous basis and it should be an integral part of new awareness and/or educational programmes on chemical pollution and safety.

3.3.10.1 PCBs and DDT

In the short term, the CEB and the Ministry of Health and Quality of Life, in collaboration with the proposed Chemical MEAs Desk, should consider implementing a series of awareness activities to address concerns regarding PCBs and DDT and they should empower their employees to achieve safeguards against these chemicals.

Among the activities that could be organised, there are regular thematic seminars/workshops and training programmes on safe handling of PCBs and DDT for capacity building for the concerned personnel. External parties involved with these chemicals (e.g. the Customs Department within the Mauritius Revenue Authority) could also be invited to participate. The workshops should cover identification, i.e. types and labelling of hazardous equipments, personal protection, awareness about hazardous sites, emergency response, etc.

Moreover, the authorities will also have to work out and add a set of guidelines and principles to existing occupational regulations so as to mitigate risks of exposure to PCBs and DDT. In this respect, performance indicators such as handling precautions, incidents and exposure, etc. could be helpful to assess the safe practice. At the end of each involvement with PCBs or DDT, the relevant staff could be invited to fill in a reporting sheet whereby compliance to the guidelines will be verified and through the process, poor performance would be benchmarked against required codes.

Furthermore, at specific intervals, formal internal/external surveys among staff and interested parties could be conducted to assess awareness of the risks and precautions to be taken in regards to handling of the chemicals. The surveys should provide insights of knowledge gaps and potential areas of improvement and communication programmes should be set up in order to monitor knowledge deficiencies and further raise awareness. A budget of some MUR 1.16m (USD 40,000) is needed for developing the required materials and for conducting the first workshops.

Finally, in the medium to long term, the management of the CEB could seriously consider embarking in the Responsible Care[53] initiative under which it will be able to closely monitor aspects relating to health and safety issues and thus addressing other issues than that of PCBs.

3.3.10.2 Dioxins

At least 20 activities have been identified as releasing PCDD/Fs. These include, amongst others, industrial sources such as bagasse burning for power production, medical waste incineration, uncontrolled biomass burning and incinerators owned by the Central Electricity Board. It is understood that awareness about these issues should be raised alongside with management option solutions that are endorsed and implemented in the future.

To minimize Dioxins' emissions out of domestic waste burning, the appropriate pieces of legislation should be enforced. However, the issue of domestic waste burning should be considered in respect to the bigger issue of waste management. In general, people seem ready to embark into recycling and waste prevention programs.

In the near future, support should be given to recycling initiatives at the level of the individual, while the authorities/international agencies could provide incentives to encourage the population to recycle their wastes. The separation of organic waste, the composting of organic waste at household or community level are options that can significantly contribute to waste prevention and waste management in Mauritius. In this respect, the Government of Mauritius

[53] A best practice programme on chemical safety in the chemical industry.

has already planned to build two composting units to manage the green wastes.

In order to provide incentives at community/district/municipal levels, the proposed Chemical MEAs Desk - through the Government or international donors - could launch Small Grants Programmes to encourage people, associations and NGOs to showcase more actively the benefits of recycling, garbage separation and composting. These programmes could provide for pilot basis experimentations and lessons learnt could well serve for the implementation of national recycling programs. Funds from the Global Environment Facility (GEF), the UNDP and the National Environment Fund (Ministry of Environment) should be tapped. An estimated budget of MUR 5.8m (USD 200,000) would be earmarked for these purposes.

3.3.10.3 Collection and Dissemination of Chemical Information

In order to strengthen the information exchange mechanism on chemicals at the Ministry of Environment & NDU and between various ministries, the services of a Documentation Officer could be hired for three months. Her/His terms of reference would include the collection of information on chemicals from sources, their classification, its routine dissemination between concerned government officials and the establishment of a library database on chemicals at the Education, Research and Development Unit of the Ministry of Environment. The training of a staff of that ministry for the collection, classification and dissemination of chemical information to relevant parties would also be required. For these, a budget of some MUR 580,000 (USD 20,000) is earmarked.

3.3.11 EFFECTIVENESS EVALUATION AND REPORTING

Article 16 of the Stockholm Convention stipulates that four years after its implementation at country level, there should be regular reporting and proper evaluation of the status of the Persistent Organic Pollutants. It is only through proper monitoring that it would be possible to identify cases of non-compliance or ineffective treatment of the pollutants by discarding Best Available Techniques (BAT) and Best Environmental Practices (BEP), increasing thus health hazards. However, to evaluate the conditions of POPs in the near future, there are certain first-order conditions that need be put in place and in practice.

3.3.11.1 Role of Stakeholders and Individual Reporting

For each identified POP in Mauritius, stakeholders involved - especially those concerned with the uses and applications of the pollutant in question - should feed the database that is now in place at the Department of Environment and which should be located at the proposed Chemical MEAs Desk. That database, which is one of the recommendations of the Convention, makes it easier for the computation of indicators to capture the evolution of emissions. Prompt reports produced by concerned stakeholders (governmental organisations as well as NGOs) would contain figures related to emissions of Dioxins and Furans[54] or to mitigate the hazardous impacts of these pollutants on the ecosystems and on society as a whole.

For this to happen, there should be periodic reporting of data to the authorities, at regular intervals, on emissions rates, imports and disposal of any such pollutants or any other effective form of treatment adopted during the course of time to reduce the hazardous impacts - practices which should be BAT and/or BEP-compatible. It is therefore understood that stakeholders would have to prepare their periodic reports covering all the safety measures ensured at their level for this purpose.

[54] Emphasis is put on Dioxins and Furans as inventories done so far have shown that the PCB issue is located at the Central Electricity Board and that the only pesticide concerned, DDT, is also found at a centralised place at Pamplemousses.

3.3.11.2 Evaluation and National Reporting

The government should set up the relevant mechanism to ensure that reports by private stakeholders and public departments concerned with the uses and applications of POPs submit their periodic reports promptly and that the indicators provided are fully updated and provide a true and fair picture of the statuses of POPs. Based on such reports, there should be proper evaluation made on the effectiveness of the measures that have been adopted or put into practice to mitigate the hazardous effects of Dioxins and Furans.

Moreover, to increase public awareness about these persistent pollutants, it is vital that the Ministry of Environment or the proposed Chemical MEAs Desk issues national reports to indicate how Persistent Organic Pollutants are constantly being monitored at the country level. This form of transparency would also help to match any complaint made by the Civil Society with the measures adopted by stakeholders – a means to actually counter-check the effectiveness of such measures.

To provide further guidance on the regulation of emission rates and the reduction of the hazards of POPs after the implementation of the NIP, the following table could be used:

TABLE 22 –
EFFECTIVENESS EVALUATION AND REPORTING

MONITORING GUIDELINES	RESPONSIBILITY
0-3 years after the NIP (Short-term) • Capacity building. • Identification and quantification of POPs and POPs-affected areas. • Systematic reporting of adopted measures by stakeholders. • Identification of constraints and proposed solutions. • Monitoring data on emissions, their quality and frequency. • Minimising impacts on Civil Society and the ecosystems.	MOE and MOH. MOE. MOE. MOE, MOH and MOLG.

3-5 years after the NIP (Medium-term) • Review of methodology applied. • Monitoring and reporting on health hazards. • Intermediate data analysis. • Strengthening capacity building.	MOE. MOH. MOE and MOH. MOE.
Beyond 5 years (Long-term) • Adopting best measures and practices. • Adopting general technical guidelines. • Identifying financial constraints and financial solutions.	MOE, MOH and MOLG.

However, further reporting and evaluation of the effectiveness of the NIP will be provided to the Stockholm Convention Secretariat as requested and per guidance provided and agreed by the Conference of the Parties (COP).

3.3.11.3 Non-compliance

Cases of non-compliance should be dealt with immediately and with full effect in regard to the laws and regulations in force. Moreover, there should be an assessment made by local authorities to investigate into the reasons of non-compliance. Once identified, relevant actions must be taken. In situations where heavy investment might be required to adopt the best practices or techniques, a justified delay might be given for the designed action to be taken.

3.3.12 RESEARCH, DEVELOPMENT AND MONITORING

3.3.12.1 MONITORING

As a party to the Stockholm Convention, Mauritius is bound to carry out Monitoring and Research & Development activities, in accordance with Article 11 of the Convention.

On the basis of studies carried out in other countries, it is probable that the Mauritian population could have already been exposed to POPs chemicals mainly through both local and imported food and that their bodies contain measurable concentrations of some of these chemicals.

However, at present, there is no information available on what the concentrations might be and the possible health significance. The same applies for environmental concentrations of POPs. The Government Analyst Laboratory (Ministry of Health) does undertake a Food Monitoring Programme but it does not cover POPs chemicals or other significant risk elements such as multi-residue screening for pesticides.

There are other reasons for carrying out proper monitoring programmes. There is a need to understand the current and past sources of exposure and develop relevant strategies for reducing these as well as verify the effectiveness of these strategies.

In addition, there are particular risk areas for Mauritius in with regard to POPs chemicals that should be monitored on a routine basis. These include the possible contamination of imported foods by POPs, the imported materials used for making animal feeds and the export fish trade[55].

3.3.12.1.1 Proposed POPs Monitoring Programme and its Components

The components of the proposed Mauritian POPs Monitoring Programme[56] are summarised in the table below:

[55] The commercial risks are significant, should fish become contaminated. In 2003, the FOB value of fish exports from Mauritius was in excess of three billion rupees (about USD 103m).

[56] The Monitoring Programme has been devised by Dr. Bruce Graham, International Chemical Expert, and details are found in his report, "Capacity Assessment and Recommendations for POPs Monitoring", August 2004.

TABLE 23 –

PROPOSED MAURITIAN POPs MONITORING PROGRAMME

PROGRAMME	SAMPLE TYPE	SAMPLE NUMBERS	FREQUENCY
1. Baseline Survey	1. Blood. 2. Food. 3. Coastal Sediment.	1. 20 composites. 2. 20 composites. 3. 10 composites.	Once every five years.
2. Food Basket Survey	All common food groups.	100 composites.	Once in a year.
3. Routine Food	Selected food groups.	50 composites.	Annually.
4. Routine Environmental	Soils, sediment, vegetation, leachate.	75 samples.	Annually[57].
5. Export Fish	Canned Tuna.	20 samples.	Annually[58].
6. Animal Feed	Mixed Feed.	20 samples.	Annually[59].
7. Source Investigations	Gas/Particle Emissions.	5 samples per study.	Only once.

3.3.12.1.2 Surveys

The first step in determining the current impacts of POPs' exposures should be a Baseline Survey to determine the POPs levels in the probable reservoirs, i.e. human beings, selected foods[60] and coastal sediments. This initial work would indicate the severity or otherwise of the existing POPs levels. It may well be that the results indicate no great cause for concern and in that case, most of the proposals for subsequent monitoring could be dropped.

Following on from the Baseline Survey, there should be a detailed study made of the POPs' levels in the full range of common foods. This is usually referred to as a Food Basket Survey and it will be new in Mauritius, although some

[57] If the levels of POPs are too high in the items when being analysed, they then would be done on a more frequent basis - e.g. every three or six months.

[58] Only the first analysis will be done within the programme whereas the relevant companies must undertake the subsequent analyses.

[59] *Idem.*

[60] These would be selected from the most commonly-consumed items within the general groupings of meat, fish, eggs, fats, oils and dairy products.

components are already present in the routine food monitoring (for other non-POPs contaminants) carried out by the Ministries of Agriculture and Health.

The results from the Food Basket Survey will give an indication of the most significant food sources for POPs' intake in Mauritius. These specific items of food should then be targeted for inclusion in a continuing programme of food quality monitoring. This could be set up as an extension of the existing food monitoring programmes mainly through the coverage of some additional food items that may not be covered and, of course, through the specific testing for POPs chemicals. The POPs' food monitoring could be on-going over a number of years with periodic reviews (every four years) to assess the need for any changes in the programme.

The Routine Environmental Monitoring Programme would start soon after the initial Baseline Survey and would be incorporated into the current routine monitoring programmes led by the National Environmental Laboratory (NEL).

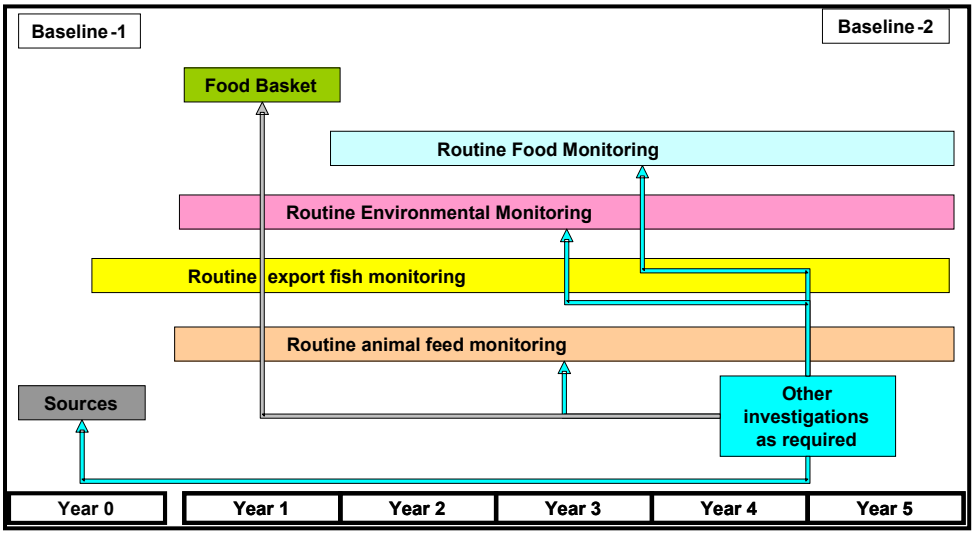
An initial selection of sites would be done for the sediment samples. These would allow particular areas in Mauritius to be targeted for more detailed investigations on the basis of any high concentrations. For each of these sites, a soil and sediment sampling programme would be designed to monitor the extent of contamination in the watersheds adjacent to the original coastal sites.

The programme would also include vegetation samples and possibly leachate sampling from the rubbish dumps and other contaminated sites. The overall aim of this part of the programme would be to identify locations with elevated levels of POPs and then monitor any changes over time in the contaminant levels at these sites. Sampling exercises would be carried out in such a way that each sampling site be tested at least once a year.

Finally, there should be a repeat of the original Baseline Survey once every five years. Some elements of the original survey, such as food and sediment sampling, would not need to be repeated because of the continuing food survey work described above. A scheme illustrating the whole process is found at Figure 2.

Figure 2 –

PROPOSED TIMELINE FOR THE POPs MONITORING PROGRAMME



3.3.12.1.3 Risk Areas

The three specific risk areas for POPs in Mauritius are imported foods, imported animal feed and export fish. The first risk area (imported foods) would be included in the food monitoring programmes. However, separate programmes would be established for the other two items and as they are quite independent of any of the above impact studies, they could then get started either in parallel with the Baseline Survey or soon after. Both, however, will be established as continuing programmes to be run over a number of years but subject to periodic reviews.

It is foreseen that the relevant industry sectors (imported animal feed and export fish) would cover the costs of this monitoring.

3.3.12.1.4 Additional POPs Sources and Investigations

The only specific source investigations identified to date are those related to the sugar industry; i.e. POPs' releases from sugar-cane and bagasse burning. Mauritius can be considered as having a 'competitive advantage' for participating in these investigations although it lacks the specialised sampling and analysis equipment required.

There may be need for a few other investigations in response to some of the results produced in the proposed programmes detailed above. For example, any unusually high results for food or soil samples would need to be investigated further to identify the probable cause(s). In addition, there will most likely be a need for detailed investigations and monitoring at a number of suspected contaminated sites around the country.

The amount of effort and resources needed for this work cannot be planned in advance but should be recognised by ensuring sufficient flexibility and capacity in the routine work programmes.

3.3.12.1.5 Implementation of the POPs Monitoring Programme

There are two general principles regarding the implementation of the POPs Monitoring Programme: First, the Ministry of Environment & NDU, through the proposed Chemical MEAs Desk, will be the lead agency for the programme and secondly, analytical work should be done in Mauritius rather than overseas as far as possible. This would apply to all analyses other than those requiring use of a High Resolution Gas Chromatography High-Resolution Mass Spectrometer (HR GC/HR MS).

3.3.12.1.6 Programme Set-up and Management

As with most environmental matters, the POPs monitoring proposals range across a variety of subject areas and there are, of course, many stakeholders involved. The Ministries of Agriculture, Fisheries and Health as well as the fishing, poultry and sugar industries will have be taken on board. Participation from the MSIRI, the University of Mauritius, relevant NGOs and the Civil Society will have also to be sought.

It is proposed to set up a Technical Advisory Committee (TAC), under the aegis of the proposed Chemical MEAs Desk, in order to provide technical input to the implementation and review of the overall monitoring programme. The TAC would be chaired by the Department of Environment which will provide necessary human and other resources to manage the programme. The

members would be senior technical representatives of the stakeholders listed above.

The role of that Committee should include the following:

- Agreement on the detailed elements of the designed programme;
- Facilitation for the participation of the relevant laboratories and other government personnel (e.g. Health Inspectors) in the implementation of the programme;
- Provision of other technical input and review of the programme as required.

3.3.12.1.7 Sample Collection, Processing and Analysis

The choice of a lead laboratory for this work is complicated by the fact that the types of samples range across the traditional work areas of a number of different laboratories. Under the present structure, the sampling and analysis of soils and sediments rest squarely with the National Environmental Laboratory and fish analyses with the Fisheries Laboratory but they both lack the key analytical equipment to do this work. Some of the food testing would rest with the Agricultural Chemistry Laboratory which is similarly deficient. Meanwhile, the laboratory of the Government Analyst does have the necessary equipment but lacks human resources.

The proposed approach to work through this situation is via the Technical Advisory Committee mechanism as outlined above. The technical representatives on that committee should agree among themselves as to the most effective way to implement this programme and make recommendations accordingly.

The following sample processing and analysis arrangements are proposed in Table 24 as a starting point for the TAC discussions.

TABLE 24 –

PROPOSED ARRANGEMENTS
FOR SAMPLE PROCESSING AND ANALYSIS

PROGRAMME	SAMPLE TYPE	SAMPLE PROCESSING	ANALYSIS
Baseline Survey	1. Blood. 2. Food. 3. Sediment.	1. Government Analyst. 2. NEL & Ministry of Agriculture. 3. NEL.	1. Overseas Laboratory. 2. Government Analyst & Overseas Laboratory. 3. Government Analyst & Overseas Laboratory.
Food Basket	Food.	NEL & Ministry of Agriculture.	Government Analyst
Routine Food	Food.	NEL & Ministry of Agriculture.	Government Analyst
Routine Environmental	Soil, sediment, vegetation, leachate.	NEL.	Government Analyst
Export Fish	Canned Tuna.	Contracted-out Laboratory.	Contract-out Laboratory.
Animal Feed	Animal Feed.	Contracted-out Laboratory.	Contract-out Laboratory.
Source Investigations	Emissions.	MSIRI and others.	Overseas Laboratory.
Other investigations	As required.	As required.	As required.

The proposal for joint activities between NEL and the Agricultural Chemistry Laboratory is intended to spread the workload across existing resources (personnel) and also to broaden the current staff capabilities. The use of the Government Analyst facilities for analysis is based on the optimisation of the use of existing instrumental resources. The alternative GC/MS facilities at the Wastewater Laboratory and the MSIRI could also be considered, subject to appropriate additional staffing and financial arrangements. However, the Government Analyst option is the preferred one.

The analytical requirements for POPs in human blood are extremely demanding and this work will need to be contracted out to a specialist laboratory overseas. Some of the food and sediment samples included in the

Baseline Survey should also be analysed by this laboratory to provide an initial reference point (cross-check) for the measurements carried out within the island of Mauritius.

When the Ministry of Agriculture will be establishing their new Food Technology Laboratory, it will certainly be an additional resource that could be considered for some of the work.

3.3.12.1.8 Monitoring Capabilities and Capacity

A review of the chemical laboratories has shown that there is adequate capability within the country for implementing a POPs Monitoring Programme although additional supporting materials such as glassware, chemicals and standards will be required. Some analyses will also need to be contracted out to specialist laboratories overseas, namely for the analyses of PCBs, Dioxins and Furans.

There are some limitations at present in the human resource capacity for carrying out this work which will be addressed through the recruitment of additional staff. In addition, a coordination mechanism needs to be developed to allow the optimum use of existing analytical facilities, especially GC-MS.

The question of purchasing a new Low Resolution GC-MS may arise as the equipment of the Government Analyst (Ministry of Health) could not be fully available for the Monitoring Programme.

3.3.12.1.9 Set-up and Operating Costs for the Programme

For the setting up and operating the Monitoring Programme, a number of actions and activities have to be done/enabled including recruitment of new staff, training, etc. Estimates[61] of the set-up and operating costs for the Monitoring Programme are for these are as follows:

Personnel Programme Coordinator (within the Chemical MEAs Desk) and three laboratory staff.	**MUR 1.5m/year** (USD 51,700/year)
Training	**MUR 400,000**

[61] The detailed estimates are found in Dr. B. Graham's Report.

(e.g. Two persons over a week)	(USD 13,800)
Laboratory Set-up (Glassware, solvents, standards + new Low Resolution GC-MS)	**MUR 3,500,000** (USD 121,000)
Baseline Survey (Sample collection plus overseas laboratory costs)	**MUR 700,000** (USD 24,100)
Annual Operating Costs (Sample collection, laboratory supplies, etc.)	**MUR 700,000/year** (USD 24,100/year)

Overall Set-up Cost:

MUR 4.6m (USD 159,000 approx.).

Annual Operating Costs:

MUR 2.2m/year (USD 76,000 approx.).

In working out the figure for the annual operating costs, the food basket survey work and the routine food and environmental monitoring programme have been covered. As mentioned earlier, it has been thus is assumed that the costs for the monitoring of fish and animal feed will be met by the relevant industry sectors.

3.3.12.1.10 Other Important Issues

There are several other matters which should be kept in mind during the implementation of the monitoring programme and these are elaborated below.

3.3.12.1.10.1 Monitoring for of Other Pesticides

As it has been said before, pesticide residue monitoring in Mauritius is limited to only those chemicals known to be in common use. Consideration should be given to establishing a multi-residue pesticide screening system for a much wider range of pesticides. This work would be complementary to the POPs Monitoring Programme and the costs of implementation would be relatively minor. The main cost would be for the purchase of standards because most of the additional instrumentation required is already available in several of the laboratories.

3.3.12.1.10.2 Participation in Global Monitoring Activities

The Technical Advisory Committee/Chemical MEAs Desk should ensure that Mauritius is included in any future global monitoring activities related to POPs. This would include the five-yearly Breast Milk Programme which is coordinated by the World Health Organisation. In addition, formal linkages will have to be established with the Global POPs Monitoring Programme.

3.3.12.1.10.3 Establishment of a Regional Technical Centre

The possibility of establishing a Regional Technical Centre (RTC) for the Convention is a matter of concern for Mauritius which will do the needful in order to have that Centre on its territory. The Ministry of Environment and the University of Mauritius have the necessary infrastructure to support such a development and the potential for staff contributions from a variety of relevant disciplines. The RTC would also draw upon the expertise and resources developed within the government laboratories in implementing the POPs Monitoring Programme.

3.3.12.1.10.4 Future Monitoring for New POPs Chemicals

There will be also need to keep abreast of international developments regarding other Persistent Organic Pollutants which may be added to the Convention in accordance with Article 8. There should be no major difficulties in adding these to the POPs Monitoring Programme because most of the analytical requirements will be very similar to those already in use.

3.3.12.2 RESEARCH

There is a need to participate in research & development activities related to some of the specific POPs sources, including those in the sugar industry. As there is no study as such on the PCDD/Fs' emissions resulting from sugar-cane and bagasse burning in the world, Mauritius could take the lead in that area of research. Dioxin distribution between water and solid phases when using wet-scrubbers in existing plants will have also to be looked into.

The government will have to discuss with sugar producers in order to develop proposals for joint studies. This initiative would be driven by the proposed Chemical MEAs Desk with the assistance of the MSIRI which has very useful contacts and partnerships with worldwide centres of excellence such as Sugar Research International (Queensland, Australia).

On the other hand, further analyses and research will have to be done on the effectiveness of the existing and only DDT stockpile at Pamplemousses. Research will also have to be done on the alternatives to DDT for malaria vector control in Mauritius.

3.3.13 TECHNICAL AND FINANCIAL ASSISTANCE

Mauritius clearly lacks the capacity and technical know-how to soundly manage and/or dispose of the POPs stockpiles and wastes identified in the previous sections. In this respect, capacity has to be built not only to manage these stockpiles and wastes but also to properly monitor these POP chemicals in the different compartments of the environment and in the food basket as proposed in section 3.3.12.

Therefore, assistance, both financial and technical, will have to be sought internationally in order to carry out the activities as proposed in the action plans laid down in the previous sections of the NIP in view of eliminating POPs and/or minimising their releases in Mauritius.

3.3.13.1 Foreseen Demands for Assistance

Technical and financial assistance from abroad will be sought for the following:

- Training of Laboratory Staff in view of the POPs Monitoring Programme and expertise in setting-up the different components of the Programme itself.
- Training of technical staff of the proposed Chemical MEAs Desk in the overall management of the NIP.
- Development of a National Chemicals Profile and an Information Exchange Network (IEN) on chemicals in Mauritius and Rodrigues
- Assistance for a legal expert in the drafting of new legislations and provisions for amending existing ones as identified.
- Training for the preparation of the different types of samples and analysis for congeners of PCBs, Dioxins and Furans.
- International co-operation in research for PCDD/Fs' emissions from sugar-cane and bagasse burning.

- Research in the safest alternative solution to DDT adapted in our tropical context with particular attention on the increased resistance of vectors to certain chemicals.
- Training to be provided in the safe handling, storage and disposal of alternatives to DDT in the medium-term.
- Training for the safe handling and storage of PCB-containing materials and wastes.
- The possible transfer of the DDT stock abroad for destruction.
- The transfer of PCB-contaminated oil abroad for destruction.
- Decontamination and treatment of soils affected by DDT.
- Remediation of contaminated sites.

3.3.13.2 Resourced International Organisations

In order to finance the different projects for the proper management of POPs, Mauritius will look for funding locally but also from international organisations like the Global Environment Facility (GEF), the UNDP or the World Bank.

However, whenever possible and feasible, co-funding between private and public sources will be promoted. For example, in the management of PCBs contained in transformers, the CEB will have to contribute, mainly in kind, during the process of identification, storage and elimination of PCB-contaminated materials and oils.

3.4. DEVELOPMENT AND CAPACITY BUILDING PROPOSALS AND PRIORITIES

The previous sections lay down many agreed action plans which will increase the capacity of Mauritius to manage existing POPs chemicals and releases as well as to avoid the imports and production of additional POPs. The key for enhancing the capacity is the development of human competences for identifying and analyzing POPs in addition to the increase in knowledge of the switching possibilities to non-POPs chemicals. Importance shall also be given to the provision of advice and technical means for completing the POPs inventories, minimising the formation of POPs, disposing of existing POPs stockpiles and the switching over to non-POPs chemicals and practices.

The actions presented in this section are based on a priority-setting exercise conducted in September 2004 among the key stakeholders after the initial POPs inventories were compiled. The priority-setting exercise identified the DDT use and stockpiles as the main POPs problem in the country. There is no clear-cut number two priority as PCBs, unintentional POPs and POPs contamination classes all scored very close to each other. However, the contamination concerns were in first hand directed to the possible food contamination for which very little data is available. Environmental contamination is clearly of lesser concern.

3.4.1. DDT

Due to its large stockpile, the DDT problem is the biggest by magnitude and there are also analysis reports indicating that the stockpiles have contaminated areas around the storage sites (Section 2.3.1).

While there is an on-going discussion about the timeline, there is a consensus that steps should be taken for investigating how the use of DDT could be discontinued and the use of alternative chemicals and practices would be established.

Before the switching to non-POPs alternatives may happen, risky practices still exist in the handling, application and the stock-keeping stages of the

existing DDT. In order to mitigate these risks, the personnel in contact with DDT will need training in safer practices.

3.4.2 PCBs

The issue of PCBs is recognized as a priority issue even if not considered as a prime interest to officials. This can be explained by the novelty of the problem as well as the restricted ownership of the PCB-contaminated oils identified so far. The finalisation of the investigation into equipment contaminated with PCBs beyond the power generation and distribution sectors is one of the priorities.

Further steps should include communication on hazards and the reduction of PCB exposure to handlers. This would be obtained through the labelling of equipment and the development of safety procedures at maintenance and contingency procedures, e.g. for fire risks. The risks would be reduced considerably if the above measures were coupled with the training of the maintenance staff and the procurement of appropriate personal protection equipment in addition to the monitoring of their use. All these actions require an increase in knowledge and capacity within the organisations and individuals dealing with potentially contaminated equipment.

3.4.3 PCCD/Fs and Bagasse Burning

Dioxins are the least tangible of the POPs classes. There are two distinctive areas where the reduction in Dioxins was considered to be of priority. These are in the cultivation of sugar-cane and its subsequent energy generation activities and in the medical waste management and incineration.

Regarding Dioxin emissions from sugar-cane cultivation, it was recommended by the Priority-setting Workshop that the open burning of the residues in the field should be discontinued. For this to happen, awareness-raising, specific training and other kinds of measures - for example, the switching to other sugar-cane species - will be needed.

The energy generation activity, i.e. bagasse burning, releases potentially high amounts of Dioxins. Measurements performed on ash samples indicate the

formation of significant Dioxin levels in the bagasse burning process. The formed Dioxins are subsequently emitted both to the atmosphere and waters due to the wet scrubbing of the flue-gas.

Elevated Dioxin levels are not uncommon from combustion of biomass fuels but the situation with bagasse burning seems to have been less studied at international level. It is, therefore, a priority in the short term to study the releases and to verify the emissions. Once a correct baseline is known, different emission reduction strategies could be applied. These may include pre-treatment of the bagasse - For example, by drying of the bagasse, optimizing the combustion conditions as well as end-of-pipe technologies.

Establishing a correct baseline for Dioxin emissions from bagasse requires well-designed investigations with release sampling and analysis together with more theoretical calculations into combustion conditions, incinerator design and properties of the incinerated materials. There are untapped resources both in academic and research centres for leading and doing, at least, parts of that kind of research. However, fostering international cooperation around the bagasse burning and Dioxin releases seem the best way forward. This would increase the country's capacity considerably especially when it comes to sampling and analysis as well as further enhancing the POPs monitoring capacity.

The other major and prioritized activity emitting Dioxins in Mauritius is medical waste incineration. This situation has arisen due to the setting-up of small medical incinerators at each hospital and at many clinics. Taking into account the high investment costs of proper pollution control systems, the optimal solution would be one or two state-of-the-art incineration facilities which would receive medical wastes from all around the island.

It is recognised that the drafting of a proper piece of legislation on medical waste incineration will be needed for ensuring that real progress is made in the right direction. Furthermore, capacity building is needed in the separation, transportation and disposal phases of medical wastes, taking into account its contagious particularity.

3.4.5 POPs Contamination

With an overall view, it can be said that the concern for POPs' contamination in the different media is not considered high, resulting from the low quantities of POPs used or identified. However, some caution should be taken in drawing final conclusions as very few POPs analyses and no monitoring programme are carried out in Mauritius at present.

The lack of the monitoring is not solely dependent on the existence of laboratory equipment. Investigations show that there is some spare capacity in the Government Analyst Laboratory and other agencies performing chemical analysis. The knowledge and experience level of laboratory staff do not match analysis possibilities with the available equipment. For rectifying this mismatch, the capacity of laboratory staff at key laboratories dealing with POPs should be enhanced with the appropriate training. This would further increase the domestic capacity for researching POPs' emissions from bagasse burning.

Due to the high bio-accumulation potential of POPs, another priority area for further studies and monitoring should be food products, whether those produced locally or imported.

3.4.6. Outlines of Priorities and Capacity-building Proposals

The suggested actions and the detailed capacity-building needs for the above-mentioned priorities are found in the corresponding sections of the NIP. From these priority needs, a number of themes emerge and it is proposed that the first capacity- building efforts for the management of POPs in Mauritius will be concentrated around these themes.

Identified priorities for POPs themes are:

1. POPs waste and contamination.
2. Switch to non-POPs pesticides for malaria vector control.
3. Medical waste management.
4. Research into PCCD/Fs' emissions from bagasse burning and monitoring and analysis capacities of POPs.

It is foreseen that the above themes will be tackled in a number of individual project-based interventions. This approach seems optimal for the reasonably well-defined tasks and the time-span needed for carrying out the interventions, making the establishment of additional permanent structures unnecessary apart from the proposed Chemical MEAs Desk at the Department of Environment. Some parts of the interventions will have a natural follow-up in form of continuing monitoring or enforcement. It is, however, expected that this follow-up action can be taken-up by the responsible Ministry in its day-to-day activities.

3.4.6.1.POPs Wastes and Contamination

This priority intervention would work towards the identification of further POPs' sources and articles or sites contaminated by POPs. Actions included would entail the expansion of the PCB inventory to equipment other than industrial size transformers and capacitors. Furthermore, capacity building for the identification of contaminated sites by the various POPs as well as the carrying out of specific site assessments would be included.

This intervention would also decontaminate and remediate already identified POPs contaminated sites like the ones at the Mahebourg Hospital and at Fort George. Finally, the project would oversee the packing and shipping of the identified PCB oils and contaminated washing solvents as well as the excess DDT stockpiles to final disposal abroad. The organisation/company chosen for the final disposal shall demonstrate the highest environmental standards in its operations. If non-combustion technologies are financially sustainable, it would be given preference.

The Ministry of Environment and NDU is seen as the executing and implementing agency for the above intervention.

3.4.6.2 Switch to non-POPs Pesticides for Malaria Vector Control

The intervention on switching to alternatives for malaria vector control will ensure a safe move from DDT to other non-POPs chemicals and non-chemical based malaria vector control in Mauritius without compromising public health at any stage of the change. For this to happen, a step-wise approach will be

used. As a first step, different approaches and alternatives for DDT will be tested initially at sites where the DDT spraying is done as a preventive measure. This testing would be undertaken while still retaining some DDT for outbreaks of actual malaria cases.

A first activity in this process will therefore be the training of officials responsible for malaria vector control in different approaches adopted worldwide. The increase of knowledge in the benefits and drawbacks of alternative pesticides as well as the non-chemical management of mosquito species potentially 'carrying' malaria would enable the development of new management approaches locally. These approaches would then be tested in field conditions at sites where preventive spraying is being done and, at a later stage, at all sites.

Once a full confidence in the new approach is obtained, the project would oversee the packing and shipping of the rest of the DDT stockpile for final disposal.

The Ministry for Health and Quality of Life will be the executing and implementing agency for this intervention.

3.4.6.3 Medical Waste Management

This intervention aims at sizable reductions in Dioxins and Furans' emissions in Mauritius by centralising medical waste disposal to the planned hazardous waste incinerator at the future Waste Complex and potentially to the existing hospital incinerator at the SSR Hospital in Pamplemousses (North) which would need some upgrading to BAT (Best Available Techniques) standard. The concerned hospitals and clinics would further be prepared for the centralised waste collection system.

For hospitals and clinics, the intervention would further entail training in waste minimization and separation. Waste minimization concerns mainly activities inside the medical facilities where the shifting to practices where less disposable items are used can reduce the overall amount of waste. In a POPs context, the waste minimization could also imply the shifting of used materials to less Dioxins-forming ones by avoiding, for example, the use of PVC. Waste

separation deals with waste sorting at source, in wards and laboratories, resulting in a smaller proportion of the total waste to be incinerated.

It is foreseen that a separation scheme will be established at all hospitals and clinics according to international standards and practices. A waste collection scheme covering the whole country will also be developed as a part of the intervention and tried out on a pilot scale.

Provisions will have to be made for the development and enactment of a proper legal framework for Dioxins and Furans' emissions from medical waste incinerators together with requirements of PCCD/Fs' sampling and analysis from concerned incinerators. Furthermore, the project would foresee that the future Hazardous Waste Complex has an appropriate design catering for the types of containers used in the medical waste collection and that no possibility of spreading contagious waste exists in the final disposal stage.

This intervention will be executed by the Ministry of Health and Quality of Life and implemented in cooperation with the Ministries of Environment and Local Government for the legal framework, setting-up of the collection schemes and the design of the hazardous waste incinerator and its operation.

3.4.6.4 Monitoring and Analysis Capacities of POPs and Research into PCCD/Fs' Emissions from Bagasse Burning

This priority will increase the capacity of POPs analysis and monitoring in all matrices in order to ensure the sound health of the population and of the environment. Under the aegis of this project, the planned POPs Monitoring Scheme, including the monitoring of food, will be established and the baselines set. These baselines would be compared with the outcomes of future monitoring results. This comparison would indicate the change of POPs' exposure to the population and the environment.

In order to achieve this, a comprehensive training program will be required at the concerned laboratories and organisations undertaking the sampling exercises. Training would start as soon as an agreement is reached on the final responsibilities for sampling and POPs analyses in different matrices between the various governmental bodies.

Much of this intervention would be devoted to further studying and verification of the Dioxin and Furans' levels emitted from bagasse burning. A comprehensive sampling would be conducted at selected sugar factories and IPPs using bagasse as fuel for in order to obtaining a robust database for PCCD/Fs' emissions to air, particulates (ash) and water under different combustion conditions. This study is expected to be of international interest taking into consideration that the guidance documents developed for the Stockholm Convention do not contain emission factors or Best Available Techniques (BAT)/Best Environmental Practices (BEP) for bagasse burning.

It should be further noted that this intervention would work towards the establishment of Dioxin stack sampling capacity in the country. That capacity would be further utilised especially in the fields of medical waste incineration and incineration of other hazardous substances.

Taking into account the complexity of the investigations, it is foreseen that the study will be conducted in cooperation between research organisations such as the University of Mauritius, the Mauritius Research Council, MSIRI as well as foreign research/academic institutions.

The above outlined process could qualify for targeted research funding such as PDF-C of the Global Environment Facility (GEF). For this reason, the Ministry of Environment and NDU would be the executing body but it will have to implement the different parts in cooperation with other ministries, such as the Ministry of Industry and the Ministry of Health (Government Analyst) as well as with domestic and foreign academic and research organisations.

3.5 TIMETABLE FOR PLAN IMPLEMENTATION AND MEASURES OF SUCCESS

3.5.1 Short-term Measures (0-3 years)

SECTOR/FIELD	ACTIVITIES/PROJECTS	MEASURES OF SUCCESS
Institutional, Regulatory and Information/ Communication.	• Setting up the proposed Chemical MEAs Desk at the Ministry of Environment (with the proper logistics and dedicated staff) and thus define activities and priorities in the implementation of the NIP.	Chemical MEAs Desk set up.
	• Ensure the funding of the various activities/projects whether locally or internationally.	Funding assured.
	• Setting up the Technical Advisory Committee (TAC) under the chairmanship of the Department of Environment to ensure the technical support/best practices for the implementation of the NIP.	TAC set up.
	• Amendments to main pieces of legislation and subsidiary ones (PCBs, Emissions from Medical Waste Incineration, Uncontrolled Burning of Wastes,	Amendments brought in.
	• Enforcement of legislation to prevent sugar-cane burning.	Law being enforced.
	• Legislation to protect people suffering from POPs through possible amendments to DCC Act 2004.	Matter having been looked into.
	• Amendments to DCC Act 2004 for persistence and bioaccumulation cut-off limits for POPs.	Amendments brought in.
	• Lobbying for the POPs Regional Technical Centre to be set up in Mauritius.	Lobbying/appropriate actions being taken.
	• Development of an Information Exchange Network (IEN).	IEN developed.
	• Establishment of links with existing international chemical information exchange	Links established.

	programmes. • Mass campaign on the recycling of wastes. • Evaluation exercise to measure the effectiveness of the National Awareness Campaign to be done. • Setting up of a Small Grants Programme as incentives for recycling, composting, etc. • Hiring of a Documentation Officer on contract at the Chemical MEAs Desk for the collection of information on chemicals and their dissemination.	Campaign being done. Evaluation done. Programme set up. Documentation Officer hired.
POPs' Pesticides.	• Setting up of a Technical Committee, under the aegis of the Chemical MEAs Desk, to cater for DDT handling, stocking and utilisation. • Training of the personnel of the Ministry of Health on the usage, handling and storing of DDT. • Collection of non-DDT POPs pesticides to a central storage site; proper monitoring and reporting on the status of DDT utilisation; and sending the surplus of DDT abroad for destruction.	Technical Committee on safe handling, storing and utilisation of DDT set up. Personnel of Ministry of Health trained. Non-DDT POPs stored adequately and excess DDT sent abroad for destruction.
PCBs.	• Establish a Task Force, under the aegis of the Chemical MEAs Desk, to undertake the identification and inventory of PCB-contaminated applications. • Training of the members of that Task Force and building up capacity. • Training for the CEB Staff on the safe handling/storage/labelling of PCB-contaminated oils and/or equipment. • Training of CEB Officers on the proper use of PCB test kits.	Task Force constituted. Capacity built to identify and manage PCBs. CEB staff trained to manage PCBs and PCB-contaminated equipment. Number of CEB Officers able to perform analyses using PCB test kits.

	• Awareness-raising among the CEB personnel on PCBs. • Proper labelling of the transformers. • Inform the Fire Department about special precautions/measures regarding PCB-contaminated transformers/oils. • Immediately replace all PCB-contaminated transformers found in sensitive areas. • Manage PCB-contaminated transformers separately from 'clean' ones. • Store safely already identified PCB-contaminated oils/equipment in a restricted area until final disposal/destruction. • Ensure that no further PCBs or PCB-containing equipment/products enter the country. • Appropriate training to be given to Customs Officers for the identification of PCBs or PCB-containing equipment.	Percentage of CEB personnel made aware. Number of transformers properly labelled. Fire Department aware of the dangers of PCBs. PCB-contaminated transformers secured. Separate transformer management system set up at CEB. PCBs and PCB-contaminated equipment safely stored. Appropriate legislation concerning PCBs enforced. Customs Officers trained for the identification of PCBs.
Medical Waste Incineration.	• Training of the personnel in hospitals and clinics on operation of incinerators and BEP. • Strengthening of existing procedures for sorting of hazardous and non-hazardous wastes generated in hospitals and clinics. • Adoption of a 'Waste Minimization Strategy' within healthcare facilities. • Development of a recording mechanism for the amount of hazardous wastes being burnt at hospital incinerators. • Mechanism for the disposal of	Personnel trained on operation of incinerators and BEP. Existing procedures on sorting of wastes strengthened in clinics and hospitals. Waste Minimisation strategy adopted. Data on hazardous wastes burnt obtained. Ash disposed at landfill.

	ashes from medical wastes incinerators in the Hazardous Waste Cell of the Mare Chicose Landfill. • Capacity building for the transportation of medical wastes.	Local People trained on transportation of medical wastes.
Bagasse Burning.	• Validation of emission factors of Dioxins and Furans from bagasse burning. • Research into PCDD/Fs' distribution in water phase where wet-scrubbers are used. • Research into parameters affecting PCDD/Fs formation and emissions from bagasse burning. • Training of the personnel on 'bagasse loading practice', bagasse screening and operation of incinerators. • Provide adequate storage of contaminated fly ash at the Hazardous Waste Cell of Mare Chicose. • Improve height of stacks where emissions higher than standards are observed. • Establish a proper monitoring of flue gas temperatures and emissions.	Emission factors for Dioxins and Furans validated. Findings obtained for PCDD/Fs' distribution. Factors affecting PCCD/Fs formation determined. Personnel trained. Contaminated fly ash stored at landfill. Height of stacks improved. Data obtained for flue gas temperatures and emissions.
Open Uncontrolled Burning of Wastes.	• Public education campaigns on impacts of uncontrolled waste burning and potential of Dioxin/Furans' emissions.	Public aware of impacts of uncontrolled waste burning.
Landfill Leachate.	• Regular monitoring of PCDD/Fs in landfill leachate. • Ensure proper disposal of hazardous wastes in the Hazardous Wastes Cell of Mare Chicose. • Avoid chlorine-containing compounds or other hazardous wastes to get in the Domestic Waste Cell of the landfill.	Data on PCDD/Fs in landfill leachate obtained. Hazardous wastes disposed in Hazardous Waste Cell at Mare Chicose. Chlorine-containing compounds and other hazardous wastes absent from domestic waste cell of landfill.
Management of stockpiles,	• Set up a separate management	Separate management system set up.

disposal of articles in use and reduction of releases.	system including collection, transport and storage of hazardous wastes before final disposal. • Set up appropriate units to handle, store and transport PCB-containing materials or wastes. • Provide training to personnel in the proper handling, labelling and storage of PCB wastes/materials. • Raise awareness among the public and relevant stakeholders where PCB-containing materials and wastes have been identified or may exist.	Capacity built to safely manage PCBs. Staff trained for managing/handling PCBs. Relevant stakeholders aware of the dangers of PCBs.
Strategy for identification of contaminated sites and remediation.	• Fence all contaminated sites. • Develop Soil Guidelines for POPs chemicals. • Develop adequate training programmes to build capacity among local people to assist with remediation of contaminated sites. • Ensure decontamination of Fort George and Mahebourg Stores. • Send contaminated soils to the Mare Chicose Hazardous Waste Cell. • Monitor soils around PCB-containing transformers in CEB workshops. • Monitor soils and/or sediments at selected sites. • Upgrade the laboratories' capacities in order to monitor remediated sites.	Fencing and civil work completed. Soil Guidelines developed. Local people trained in managing contaminated sites. Fort George and Mahebourg Stores fully decontaminated. Contaminated soils have been disposed of at the Hazardous Waste Cell at Mare Chicose. Soils monitored for PCB contamination. Monitoring done regularly. Laboratories better equipped.
Effectiveness Evaluation and Reporting – Monitoring Guidelines.	• Identification and quantification of POPs and POPs-affected areas. • Systematic reporting of adopted measures by stakeholders. • Identification of constraints	Actual identification with figures indicating their levels. Sites identified. Reports/Information Sheets submitted by stakeholders. Sources of constraints

	and proposed solutions. • Monitoring of data on emissions, their quality and frequency. • Minimising impacts on Civil Society and the ecosystems.	identified with solutions. Reliability of data confirmed. Reduction in emission rates, stockpiles, etc.
POPs Monitoring and Research.	• Setting up and implementation of the POPs Monitoring Programme (Baseline and Food Basket Surveys, Routine Food, Environmental, Export Fish and Animal Feed Monitoring and other additional Source Investigations). • Purchase of a Low Resolution GC-MS for the Ministry of Health (Government Analyst). • Establishment of a multi-residue pesticide screening system. • Training of Laboratory Staff for the Monitoring Programme. • Participation in Global Monitoring Programmes. • Research on PCDD/Fs' emissions from sugar-cane and bagasse burning. • Further research on effectiveness of the existing DDT stockpile and on alternatives to DDT for Mauritius.	Capacity built for monitoring of POPs. Laboratory equipped for POPs analysis. Laboratory equipped for POPs analysis. Staff trained for POPs analysis. Mauritius included in Global Monitoring Programmes. Research data obtained for the combustion of bagasse. Alternatives gradually replacing DDT.

3.5.2 Medium-term Measures (3-5 years)

SECTOR/FIELD	ACTIVITIES/PROJECTS	MEASURES OF SUCCESS
Institutional, Regulatory and Information/ Communication.	• Amend legislation(s) to eliminate PCDD/Fs' emissions from bagasse burning plants. • Develop new regulations to impose compulsory application of environmentally sound remediation practices on contaminated sites.	Amendments brought in. Regulations developed.

	• Exemption regarding DDT to be possibly renewed.	Matter looked into.
POPs' Pesticides.	• Training in the safe handling, storage and disposal of alternative chemicals. • Replacing DDT by a safe alternative adapted to the tropical context of Mauritius. • Ensure a sustainable transition from DDT to an integrated use of alternatives.	Personnel trained for safe handling and storage and disposal. Safer Substitute for DDT used. Alternatives used.
PCBs.	• The CEB to check all transformers sent for repair/servicing using the PCB test kits. • The CEB to look into the possibility of constructing an interim storage facility in order to contain widespread contamination in case of spills, accidents or fires. • Final disposal of PCBs and PCB-contaminated equipment according to options proposed.	Screening of all transformers. Adequate store built. PCBs destroyed.
Medical Waste Incineration.	• Reduce the amount of hazardous wastes to be incinerated by switching to other disposal alternatives not producing Dioxins. • Establish a continuous recording system with incinerators on primary/secondary chamber temperatures, hourly wastes charging rates and oxygen levels. • Improve the height of the stack in existing incinerators. • Plan and prepare for centralized medical waste disposal units including separation, collection and other logistical arrangements. • Upgrade the incinerator at the SSR Hospital with proper air pollution control devices.	Amount of hazardous waste sent for incineration reduced. Recording system established. Height of stacks improved. Centralised medical waste disposal units. Incinerator upgraded.

Bagasse Burning.	• Develop and establish BEP and BAT for sugar-cane incineration based on research findings. • Develop a monitoring plan for PCDD/Fs emissions from bagasse incinerators. • Control particulate matter emissions by installing adequate Air Pollution Control System (APCS) equipment.	BEP and BAT developed and implemented for sugar-cane incineration. Data obtained on PCDD/Fs emissions from bagasse incinerators. Air Pollution Control System equipment installed.
Open Uncontrolled Burning of Wastes.	• Rodrigues: Ensure proper waste management strategy and construction of a sanitary landfill.	Waste management strategy developed and sanitary landfill in Rodrigues constructed.
Management of stockpiles, disposal of articles in use and reduction of releases.	• The PCB-containing materials and wastes to be properly and safely handled. • Additional PCB-contaminated equipment, wastes and applications to be properly managed.	PCB-containing equipment safely stored. All identified PCB-contaminated wastes/materials/equipment safely stored.
Strategy for identification of contaminated sites and remediation.	• Assess the Pamplemousses DDT storage site once DDT is shifted and then conduct site remediation. • Monitor DDT-remediated sites at Mahebourg and Fort George on a regular basis. • Adopt legal and technical measures to ensure safe and efficient and environmental sound management of contaminated sites.	Former site at Pamplemousses remediated. Monitoring of DDT-remediated sites regularly conducted. Legal and technical framework developed to ensure safe and efficient environmental control of contaminated sites.
Effectiveness Evaluation and Reporting – Monitoring Guidelines.	• Review of methodology applied. • Monitor and report on health hazards. • Intermediate data analysis. • Strengthen capacity building.	Methodology reviewed. Data on health hazards available/collected. Time series comparison. More people being trained.
Research.	• Possibility to switch to other cane species so as to avoid open burning in the fields.	Possibility to switch to other cane species studied.

3.5.3 Long-term Measures (5 years and beyond)

SECTOR/FIELD	ACTIVITIES/PROJECTS	MEASURES OF SUCCESS
POPs' Pesticides.	• Possibility of destruction of the DDT stock at the incinerator which would be located at the future Waste Complex.	DDT stock destroyed at Waste Complex.
Medical Waste Incineration.	• All hazardous wastes generated in hospitals and private clinics should be collected and sent to the future Waste Complex to be burnt and the ash stored in the secure landfill of the complex. • Implement the centralized collection and disposal plan in medical facilities.	Hazardous wastes generated in hospitals and private clinics destroyed at the Waste Complex. Centralised collection and disposal plan implemented in targeted medical facilities.
Bagasse Burning.	• Implement BEP and BAT by installing bagasse pre-treatment practices and equipment, multiple incineration chambers and other APCS and running of bagasse incinerators at optimal conditions. • Have a dedicated landfill for disposal of fly ash from bagasse plants in the upcoming Waste Complex. • Implement the PCDD/Fs monitoring plan and follow-up on the release levels.	BEP and BAT for bagasse incinerators implemented. Waste Complex has been equipped with a dedicated landfill for proper fly ash disposal. PCDD/Fs monitoring plan has been successfully implemented.
Management of stockpiles, disposal of articles in use and reduction of releases.	• Hazardous waste incinerator to be operational within a future Waste Complex on the island of Mauritius by 2010. PCB-containing materials and wastes to be thus destroyed there. • Until these collected materials and wastes are incinerated, needful to be done for the proper storage, labelling, inspection of the storage area, etc. • During the destruction of the wastes, the PCB Task Force to make sure that the incineration is carried out under the adequate BAT conditions.	PCB contaminated materials/wastes destroyed. PCB contaminated materials/wastes properly labelled and stored. PCBs destroyed under BAT conditions.

Effectiveness Evaluation and Reporting – Monitoring Guidelines.	• Adopting best measures and practices. • Adopting general technical guidelines. • Identifying financial constraints and financial solutions.	BAT and BEP adopted. Guidelines actually respected. Gaps in financial resources identified and financial conflicts/constraints resolved.

3.6 RESOURCES REQUIREMENTS

To help in the implementation plan, it is vital to have sources of funds which could be relied upon to ensure that proper monitoring and evaluation of POPs are effectively carried out. These funds would help at different stages of the future monitoring of POPs, in terms of adopting the Best Environmental Practices and/or Best Available Techniques. These funds would vary in terms of their sources, amount and sustainability. Three major stakeholders can actually be identified in the funding aspects: The Government of Mauritius, the private sector and international funding agencies.

3.6.1 Overall Estimated Cost of the NIP

The public sector would commit itself to the smooth running of the Chemical MEAs Desk, capacity building and the monitoring aspects and regulation of pollutants which emanate essentially from public sector activities or having public characteristics, such as DDT, medical wastes by public hospitals, uncontrolled burning and landfill leachate.

As indicated in Section 3.3, the involvement of the private sector is necessary to reduce emissions related to PCBs, medical wastes and bagasse burning. Regarding PCBs, the concerned institution is the CEB which has to be ultimately responsible for taking the necessary initiatives and measures stipulated to manage that chemical safely: From their detection, storage to incineration. The Sugar Industry should be at the forefront to deal with Dioxin emissions from bagasse burning to produce electricity/heat. They would have to seek the proper finance to be able to comply with the stipulated measures. Medical wastes also require the involvement of the private clinics and hospitals to take the necessary actions to finance the different methods suggested in the NIP.

At this stage, the overall estimated cost for the NIP of the Republic of Mauritius has been estimated to be around MUR 635.2m (USD 21.9m). The breakdown with respect to the monitoring of different types of POPs is given in Table 1 below. One important point to note is that all figures given in that section do not include project/intervention management costs.

By involving itself in the reduction of POPs and in trying to minimize the hazardous impacts of such pollutants, the Government also ensures that the ecosystems and the physical environment as such would be safely protected. This represents a dual commitment of the authorities in protecting the natural environment and would compensate for the money that would otherwise have to be sought elsewhere for the same purpose.

However, the amounts stated in the table below do not reflect in many parts the management costs of the Chemical MEAs Desk, which to a large extent could be in kind through proper arrangement and coordination among various ministries and public sector departments. Costs shown in the table may also be in kind transfers or project-based - For instance, the Government might be assisted by a foreign organisation in terms of providing expertise in capacity building. Detailed costs are actually obtained from the different sub-sections of 3.3.

TABLE 25 –

BREAKDOWN OF OVERALL COST OF THE NIP

ISLAND OF MAURITIUS		
POPs and related activities	**Cost (MUR)**	**Cost (USD)**
PCB/DDT Contaminated Sites	15,225,000	525,000
Bagasse Burning[62]	141,230,000	4,870,000
Medical Waste & Upgrading of SSR Medical Incinerator	114,115,000	3,935,000
DDT	35,380,000	1,220,000
PCB and its Waste Disposal	13,920,000	480,000
Landfill Leachate	580,000	20,000
Uncontrolled Burning	7,540,000	260,000
Baseline Survey and Monitoring Equipment	9,670,000	330,000
Awareness-raising Activities and Communication (DDT, PCBs and PCDD/Fs) + Evaluation	6,960,000	240,000
Training of Staff for Dissemination of Chemical Information	580,000	20,000
SUB-TOTAL	**345,200,000**	**11,900,000**

[62] The costs related to bagasse burning (mainly hardware/pollution control equipment) will be incurred only if research shows that it contributes significantly to the formation of PCDD/Fs.

ISLAND OF RODRIGUES		
Construction of new landfill	290,000,000	10,000,000
TOTAL	**635,200,000**	**21,900,000**

With respect to the island of Rodrigues, it is recommended to construct a new landfill, a cost which has been estimated at MUR 290m (USD 10m). While the responsible stakeholders to finance the relevant share of expenditure have already been discussed in the previous subsections of 3.3, the remaining parts in this section emphasize on identifying resource requirements, management of resources, the appropriation mechanism and the sustainability.

3.6.2 Approaches to Funding

The Government of Mauritius must ensure itself that funds required would be appropriated for two purposes. The first need would be to support the establishment of the Chemical MEAs Desk which will be responsible for the monitoring, evaluation and reporting of the future statuses of POPs.

Secondly, funds should also be mobilized to finance several projects mentioned in the National Implementation Plan that relate to measures or activities (BAT & BEP) in order to eliminate and/or reduce POPs or POPs' emissions in the country.

Arguments with respect to human rights and, in particular, to the rights of workers may be raised while dealing with funding agencies along with issues pertaining to sustainable development and Small Island Developing States (SIDS) which are undoubtedly very relevant during negotiations and applications for funds.

Another source of funding could be co-partnership, especially with countries with which Mauritius has international or regional co-operation agreements such as SADC, COMESA, etc.

3.6.3 Sustainability of Funds

Another important aspect is to ensure the timely flow of funds essentially because dealing with POPs could be a long lasting exercise at the level of their monitoring, mitigating their effects and adopting safe and reliable measures to reduce their emissions. Proper co-ordination at the Chemical MEAs Desk would safeguard the adequacy of funds and in case there is any doubt of

potential gaps in the financing exercise, the relevant effective mechanism must be set up to secure the flow of funds on a prompt basis.

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LIST OF FIGURES AND TABLES

Table 26
ENVIRONMENTAL INTERNATIONAL AND REGIONAL CONVENTIONS AND TREATIES TO WHICH MAURITIUS IS A PARTY TO xx

Annex 1

GOVERNMENT ENDORSEMENT DOCUMENT

The National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants was approved by the Cabinet of Ministers of the Republic of Mauritius on 25 August 2006.

Annex 2

RECORDS OF STAKEHOLDERS AND PUBLIC CONSULTATIONS

1. WORKSHOPS/TRAINING SESSIONS

1.1. INCEPTION WORKSHOP/TRAINING

5–8 April 2004

As part of its Enabling Activities project, an Inception Workshop was organised on Monday 5 April 2004 at Domaine les Pailles. The Workshop had as main objective the presentation of the Stockholm Convention and the POPs Project in Mauritius to all national stakeholders.

This was followed by the training sessions on POPs inventory compilation and identification on 6– 8 April 2004.

1.1.1. Inception Workshop - Monday 5 April 2004

The following presentations were made at the Inception Workshop:

- The Stockholm Convention and general information on POPs worldwide;
- Persistent Toxic Substances and their current situation in the region with emphasis on Mauritius;
- The current legislations and status of POPs nationally;
- The aims and objectives of the project and the forthcoming National Implementation Plan.

The participants then agreed on a project work plan to achieve the goals of the project in the given timeframe.

1.1.2. Training Sessions: Tuesday 6 April–Thursday 8 April 2004

Tuesday 6 April 2004

Polychlorinatedbiphenyls (PCBs)

The training session on PCBs covered the following themes:

- Structure of PCBs ;
- Toxicity ;

- Sources of PCBs ;
- Uses of PCBs ;
- Sampling and Analysis of PCBs ;
- Compilation of PCB inventories ;
- Use of the PCB test kits.

The inventory sheets to be used and the sources of information were discussed in details by the participants.

The last part of the session involved the use of PCB test kits. Synthetic oil and mineral oil (containing chlorine) were used as samples, rather than actual PCB oil.

Wednesday 7th April 2004

Pesticides

The Pesticides POPs training session was on:

- The Pesticides POPs and their uses;
- Toxicity ;
- Inventory taking of pesticides ;
- Pesticides storage and stock control ;
- Personal safety and protective clothing ;
- Sampling and analysis of pesticides POPs;
- Compilation of pesticides POPs inventories.

There was a visit to a pesticides storage site, Roger Fayd'herbe Ltd, Plaine Lauzun, where participants had an opportunity to see how pesticides are stored, which was followed by a de-briefing session on the observations made by the participants in light of the discussions of the morning session regarding the conditions of storage as well as presence or absence of certain pesticides, their labelling and safety conditions of work of the employees of the store.

Thursday 8th April 2004

Dioxins & Furans

The training session involved the:

- Structure and nomenclature of Dioxins and other unintentional POPs;
- Formation of Dioxins ;
- Toxicity ;
- Sources of Dioxins ;
- Sampling and analysis of Dioxins ;

- Compilation of Dioxin inventories ;
- Using the UNEP toolkit.

The participants were also trained on how to use the UNEP toolkit *(Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases)* in order to estimate dioxin emissions from some given sources and to report it in the appropriate format.

List of documents circulated (hard copies)

- Aldrin
- Annex B – Toxic Equivalency Factor (TEF) Schemes
- Case study of/exercise in using the UNEP dioxin toolkit
- Case study of/exercise in using the UNEP dioxin toolkit – with results
- Compilation of EU dioxin Exposure and Health Data – Task 7 – Ecotoxicology
- Compilation of EU dioxin Exposure and Health Data – Task 8 – Human toxicology
- Dioxin resource paper
- Dioxins and compilation of dioxin inventories
- Example of a completed Pesticides Inventory sheet
- FAO training manual for inventory taking of obsolete pesticides
- Guidance for sampling
- Guidelines for screening and quick analysis of transformers for possible PCB content
- Guidelines for the identification of PCBs and Materials containing PCBs
- Hazard Classification and Health risks of POPs Pesticides and Pesticides included in the PIC procedure/Rotterdam Convention
- Manual sampling system of PCDDs/PCDFs in accordance with the standard EN 1948 – 1
- Method 4020: screening for PCBs by immunoassay
- Method 8081A – Organochlorine Pesticides by Gas Chromatography
- Method 8081B – Organochlorine Pesticides by Gas Chromatography
- Method 8082 – PCBs by Gas chromatography
- PCB inventory form
- PCB production in the former Soviet Union
- PCB Transformers and Capacitors – from management to reclassification to disposal
- PCBs – Chemical Properties
- PCBs and compilation of PCB inventories
- PCDD/PCDF Inventory
- PCDD/PCDF Release Inventory
- PCDD/PCDF Release Inventory (PCDD/PCDF Toolkit Questionnaire)
- Pesticide Storage and Stock Control Manual
- Pesticides POPs and Compilation of inventories

- Ridding the World of POPs: Guide to the Stockholm Convention on POPs
- Subpart M – Pipeline Sampling
- Subpart M – Pipeline sampling
- Ten Rules for proper Pesticides Storage and Stock Management
- Test Method – The Determination of PCBs in Transformer Fluid and Waste Oils
- UNEP Toolkit – Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases
- US EPA Environmental Response Team – Standard Operating Procedures (Soil Sampling)
- WWF – Fact sheet

Power Point Presentations: PCBs, Pesticides, Dioxins & Furans.

Participating Organisations:

- POPs Project
- Ministry of Health & QL
- Ministry of Environment & NDU
- Farmers Service Corporation
- MSIRI
- MACOSS
- Agricultural Chemistry Division, Ministry of Agriculture & NR
- Nouvelle France Young Farmers Club
- NEL, Ministry of Environment & NDU
- CEB
- Mauritius Telecom
- Customs & Excise Department
- Ministry of Commerce & Cooperatives
- AREU
- University of Mauritius
- Ministry of Finance & Economic Development
- Ministry of Industry, F.S. & C.A.
- UNDP
- Ministry of Labour & I. R.
- Ministry of Local Government & Rodrigues

1.2. PRIORITY SETTING WORKSHOP

Tuesday 28–Wednesday 29 September 2004

As part of the POPs project, a Priority Setting Workshop was organised on Tuesday 28 and Wednesday 29 September 2004 at Domaine les Pailles. The Workshop had as main objective the prioritisation between and within the POPs classes by national stakeholders.

1.2.1. Priorities within POPs classes and regions

After the first prioritisation between the POPs classes an internal prioritisation is conducted within each class/problem area.

Prioritisation within the group

1.2.1.1. Emissions/Dioxins

	Total Release mg TEQ	Share of releases (%)	Objective	Major point source location in relation to contaminant concentration findings	Human health findings	External pressures for action. (legal, public pressure)	Main means of achieving the goal	Cost indication (High-Low)	Ranking within class
Waste incineration									
Hazardous waste incineration (CEB)	1330	5.0	-50%	-	-	legal	Elimination at source- No burning of PCB	low	6
Medical/hospital waste incineration	5510	20.8	-80%	-	-	Public complaints due to odour	-Link to Management of Medical Waste framework -Separation of waste - Other means for waste disposal -centralise incinerator -Improved APCS -Increasing stack height	Low High	2
Power generation and heating									
Fossil fuel power plants	251	0.9							
Biomass power plants	8850	33.4	Further research studies	Fly ash: 220 pg/g (CTBV), 40pg/g (DRBC) Data needs to be confirmed by further analyses	-	Public complaints due to particulate matter	-Bagasse drying? -Improve APCS -Short term further research studies -Outcome of studies to be implemented in medium term	Medium/High	1
Household heating and cooking - biomass	35.2	0.1							

Domestic heating - fossil fuels	7.1	0.03							
Transport	45.5	0.17							
Uncontrolled combustion processes									
Grassland fires	13.5	0.05							
Sugarcane burning	330	1.2	-100%	Low levels PCDD/Fs in soil		Complaints for fly ash	Stop sugarcane burning	Low?	
Accidental fires in houses, factories (per event)	1806	6.8	?				More prompt intervention of fire services		5
Uncontrolled domestic waste burning	3240	12.2	-100%	-	-	legal	-Law enforcement -Better waste collection system -Public awareness	Low medium	3
Miscellaneous									
Crematoria	359	1.4							
Tobacco smoking	0.11	0.0							
Landfill leachate		10.6	?	-	-	-	-Recycling of waste - Proper Management of leachate	-	4

It was found that in general there was a low level of awareness as regards to Dioxins and its effects among the public.

1.2.1.2. PCBs in use

Transformers:

Possible issue	Level of problem (target group)	Reason for problem	Level of concern	Objective	Main means of achieving objective	Timeline	Cost High-Low	Ranking of issue within class

In Use	CEB (Management, TX workshop, Dirstricts area, Oil recyclers, MoL)	Potentially PCB containing equipment	Minor Problem (less than 2%)	To carry out 100% Quick Test (+ve to be conf by GC/MS) on 77 TX NGEF <1981.	Training and Awareness. And Performing Oil test and labelling where needed. retrofilling	6 months	High	1
Handling	CEB	Unawareness	Minor Problem	Risk reduction	Developing safety procedures + PPE	4 months	High	2
Labelling	CEB	Unawareness	Minor Problem	Awareness	Procuring appropriate labels and implementation program.	5 months	High	1
Inspections	CEB, MOE, MoL	Unawareness	Minor Problem	To abide by OSHWA		Regular basis		7
Out of use/waste	CEB		Minor Problem	To carry out 100% Quick Test (+ve to be conf by GC/MS) on 77 TX NGEF <1981.	Training and Awareness. And Performing Oil test and labelling where needed.	3 months	High	5
Collection								
Storage	CEB	Unawareness	Minor Problem	To separate PCB from Non-PCB	Creation of special storage site at CEB.	12 months	High	3
Disposal	CEB		Minor Problem	To maintain safety	Funding under GEF	To be determined	High	6
Uncertainty of data	Not Applicable							
Regions								
Industry Sectors	Not Applicable							

Data: Total amount of PCBs, including number of equipment. Main industries concerned.

1.2.1.3. Pesticides

All Stockholm Convention Pesticides are banned. The second stage priority setting assessed the overall management of the identified stockpiles and the completeness of the data.

Possible issue	**Level of problem (target group)**	**Reason for problem**	**Level of concern**	**Objective**	**Main means of achieving objective**	**Timeline**	**Cost** **High-Low**	**Ranking of issue within class**
Import/export	Nil							

Handling	Yes	Handling (Contamination)	Moderate	Reduce risk	Training, Proper stocking Reduce no. of personnel in handling	Immediate	**Low**	
Labelling	No	Nil						
Inspections	Yes							
Out of use/waste	Other 3 pops except DDT							
Collection	No							
Storage	No	Obsolete						
Disposal	Yes			Safe disposal	Incineration	Short term	High	
Uncertainty of data	No							

Possible actions: Ensure that POPs are not imported and used, identify new POPs, monitoring.

1.2.1.4. POPs Contamination

Findings/priority action	**Soils**	**Sediments**	**Water**	**Humans**	**Products**	**Food**
DDT	Yes High	**Not done**	**Nil**	**Not done**		
PCB	**Low**	**Low**		**Not done**		
Other POPs pesticides	**No**					
Dioxins	***Low***	**Low**		**Not done**		
Uncertainty	**Dioxins in imported pesticides, wood, furniture and food**					
Costs (High/Low)						
Priority	**High**			**High**		**High**

1.2.1.5. Priority geographical

Region (or area, river etc)	Environmental compartment	Possible sources of contamination	Priority for source reduction (pollution prevention)	Other action (remediation etc)	Level of concern (urgency, extent, exposure)	Priority region
Port Louis	Soil & air	DDT Stock pile Dioxins from medical waste incinerators	Stock transfer	Cleaning of site	Action being taken	
Grand Port	Soil & air	DDT Stock pile	Stock transfer	Cleaning of site	Action being taken	
Pamplemousses	Soil & air	DDT Stock pile	SOUND MANAGEMENT	RESTRICTED AREAS	IMMEDIATE	
Plaine Wilhems	Air	Medical waste	incineration			

2. CONSULTATION MEETINGS WITH STAKEHOLDERS

2.1. Technical Meeting on Law and Chemical Management Schemes

Venue and Date	Organisations present	Matters discussed	Decision taken
Conference Room, Ministry of Environment & NDU Port Louis. 10 May 2005	POPs Project Ministry of Environment & NDU University of Mauritius Ministry of Health & QL CEB Ministry of Finance & Economic Development Ministry of Agriculture, N.R. & F.T. Ministry of Commerce & Consumer Protection Customs Department	Nomenclature in final NIP Responsibilities of each organisation Health & Safety	The proper (same) nomenclature would be used to identify each item. The POPs issue could be dealt with within the existing administrative structures. The Department of Environment would coordinate activities with the various organisations with strong interactions between the POPs Unit as the Dangerous Chemicals Control Board. The need for additional equipment for laboratories would be addressed by the Technical Advisory Committee for POPs as proposed by the NIP. The officers of the Customs department would be given appropriate training in the identification of goods and equipment which might be liable to contain POPs, more specifically PCBs. The H.S. code used by the Customs Departments for the identification of items should be adjusted so as to have the same code for the same chemical. It was proposed to include regulations on PCBs and PCB containing equipment in the OSHWA for the safety of workers.

2.2. Technical Meeting on Management Options of PCBs and PCB-containing equipment

Venue and Date	Organisations present	Matters discussed	Decision taken
Conference Room, Ministry of Environment & NDU Port Louis. 7 April 2005	POPs Project, University of Mauritius Officers of the Central Electricity Board	The inventory findings: two makes of transformers – NGEF from India of year 1980/81 and Savigliano from Italy – had revealed presence of PCBs at significant levels.	To continue with the screening of all the Savigliano and the NGEF transformers of the year 1980/81 for PCB using the test kits and to determine the PCB level of transformers showing positive results. To screen all transformers sent to the Workshop for repair/servicing for possible contamination in order to prevent cross-contamination of clean transformers as well as reduce the risks of exposure to the workers. To take measures to ensure that CEB workers take necessary precautions while handling suspected equipment To manage contaminated transformers separately. To store contaminated oils in appropriate storage facilities until proper destruction by incineration. To seek financial aid for the destruction of the oils. To send all contaminated items under the convention for destruction in one shipment so as to reduce costs. In-service transformer, which might be contaminated, would be left in service until the end of its lifetime. But whenever such transformers were sent to repair or maintenance, their oils would be replaced and the contaminated oils properly collected in appropriate containers and safely stored. In the short/medium term, the screening of the transformer oils would be extended to those makes manufactured after 1986. It was agreed that any transformer identified as having contaminated oil would be appropriately labelled so as to be easily identifiable. It was proposed that the phasing out of PCB contaminated transformers in Mauritius would be done before 2025 as mentioned in the Stockholm Convention.

2.3. Technical Meeting on phasing out of DDT use as vector control

Venue and Date	Organisations present	Matters discussed	Decision taken
Conference Room, Ministry of Environment & NDU Port Louis. 17 March 2005	POPs Project. University of Mauritius Ministry of Local Govt & Solid Waste Management Ministry of Health & QL Dangerous Chemicals Control Board, Ministry of Health & QL Ministry of Environment & NDU Mauritius Sugar Industry Research	In Mauritius malaria had been eradicated except for imported cases. DDT is sprayed only when there is a risk of local transmission of malaria and only in specific areas. The DDT stock presently under the responsibility of the Ministry of Health & QL was received around the years 1982-	Need to consider shifting to alternatives. Cost of shifting to alternatives would not be a drawback since only 1 ton of DDT is used annually. Phase-out period of 10 years. The Ministry of Health & QL will keep 30-40 tons of the present DDT stock to cater for any possible outbreaks of malaria in future as anopheles mosquitoes are present in Mauritius. Handlers of DDT should use proper safety measures so as to minimise exposure to the chemical. The previous storage sites of the DDT should be properly decontaminated. The help of foreign experts might be needed for the decontamination of these sites, as local expertise may not be present. The contaminated areas near the storage facilities It was felt that these areas should be immediately restricted to

	Institute	1983. About 1,000kg (1 ton) of DDT is used annually by the Ministry	public. The volume of DDT contaminated soil must be determined.

2.4. Technical Meeting on Emission of Dioxin from bagasse burning for power generation

Venue and Date	Organisations present	Matters discussed	Decision taken
Conference Room, Ministry of Environment & NDU Port Louis. 3 March 2005	POPs Project University of Mauritius Deep River Beau Champ Ltd Union Sugar Estates Co ltd Societe Usiniere du Sud Mauritius Sugar Authority Ministry of Environment & NDU Sud Union St Aubin Mauritius Sugar Industry Research Institute	Bagasse burning for power production is the number one emitter of dioxins/furans. Research needs for drying of bagasse before combustion and large-scale application. Research needs on the emission of dioxins from bagasse burning.	An optimum temperature of between $1,000^0$-1100^0C to be used in the burner to prevent formation of dioxins. The temperature gradient should be made as steep as possible so as to minimise the time the burner takes to reach this optimum temperature. Installation of an ESP and proper APCS. However, it was pointed out that some of the boilers in some of the milling factories may not support ESP. The proper landfilling of the ash produced thereof

2.5. Technical Meeting on Medical Waste Incineration

Venue and Date	Organisations present	Matters discussed	Decision taken
Conference Room, Ministry of Environment & NDU Port Louis. 24 February 2005	POPs Project, Ministry of Health & Q.L., SSRN Hospital Flacq Hospital J. Nehru Hospital MedPoint Hospital City Clinic Environmental Health Unit, Ministry of Health & QL	Medical Waste incineration is ranked second with regard to the amount of dioxins emitted. Medical Waste Incinerators are not of the BAT standard. Upgrading these equipment may have high cost implication.	Improve the APCS on the existing incinerators. Have a primary and a secondary burner in the incinerator to ensure complete combustion. The residence time and temperature should be properly monitored to attain optimum conditions for complete combustion. Burners should be properly cleaned. Proposal to have two centralised, state-of-the-art incinerators to cater for all medical wastes produced in the country.

	University of Mauritius Ministry of Environment & NDU		

2.6. Technical Meeting on Monitoring, Analysis and R&D capacity for POPs

Venue and Date	Organisations present	Matters discussed	Decision taken
Conference Room, Ministry of Environment & NDU Port Louis. 03 February 2005	POPs Project, Dangerous Chemicals Control Board, Min. of Health & Q.L. University of Mauritius Min of Agriculture, NR & FT Wastewater Management Authority CWA Government Analyst Division, Min of Health & QL MSIRI Ministry of Environment & NDU SGS (Mauritius) Ltd Mauritius Standards Bureau	Presently exported food is monitored only for heavy metals and histamines. Proper accreditation of the laboratories to perform the required analyses. Training of lab personnel POPs to be monitored The frequency to analyse exported food items for POPs Frequency of monitoring Dedicated labs and equipment	Collaboration between national labs and overseas labs and to get analysis results validated. Two or more lab staff would need to be trained DDT, PCB, Dioxins/Furans. Depend on the clients. Some food items produced locally like canned tuna would be included in monitoring programme only initially. The analyses would fall under the responsibility of the manufacturing company. All monitoring/analyses be performed on a yearly basis Baseline survey would be done once every five years. Proviso: if the levels of POPs are too high in the items being analysed, then the analyses would be done on a more frequent basis e.g. every 3 or 6 months. This would be decided by the Technical Advisory Committee (TAC) to be chaired by the Ministry of Environment. Purchase of a new Low Resolution GC-MS needs also to be addressed by the TAC.

Annex 3

PUBLIC INFORMATION MATERIALS

Annex 3A – Technical Publications

- NATIONAL ENVIRONMENTAL LABORATORY, *NEL News, 2nd issue*, April 2005.
- MAURITIUS COUNCIL OF SOCIAL SERVICES, *Macoss Info*, January 2005.
- AREU PUBLICATION, *Farming News*, Vol. 34 No 1/2005.
- GEF-UNDP, *Enhancing local capacities for sustainable development*, January 2005.

Annex 3B – Newspaper Reports

- "*Sensibiliser aux polluants persistants*", L'Express – Friday 22 April 2005, Page 7.
- "*Le combat contre les POP continue*", Week-End – Sunday 24 April 2005, Page 15.
- "*Un plan national élaboré prochainement*", Le Militant, Friday 22 April 2005, Page 6.
- "*La chasse aux Polluants Persistants*", Week-End Scope, Wednesday 27 April 2005, Page 101.
- "*Convention on Pollutant*", News on Sunday, Friday 22 April, 2005, Page 6.
- "*Maurice sensibilisée au POP*", Le Matinal, Friday 22 April 2005, Page 4.

Annex 3C – Awareness Campaign Materials

- Advertorial published in nine newspapers;
- Poster;
- TV Caption;
- Brochure.

Advertorial
Brochure (one face)
Poster TV Caption (clock-face)

Annex 4

SUPPORTING INFORMATION ON CHEMICALS

The following reports from consultants and experts are available online on the Stockholm Convention Page of the Ministry of Environment's web site at the URL http://www.gov.mu/portal/site/stock/menuitem.7e6690e83e651a9b57409de479b521ca:

1) **Inventory of POPs Pesticides** by Mr. P. Oogarah - http://www.gov.mu/portal/goc/stock/file/rep.pdf

2) **Assessment of Industrial POPs** by Dr. R. Choong - http://www.gov.mu/portal/goc/stock/file/rep1.pdf

3) **Capacity Assessment and Recommendations for POPs Monitoring** by Dr. B. Graham - http://www.gov.mu/portal/goc/stock/file/cap.pdf

4) **Assessment of chemical management schemes in relation to POPs in Mauritius** by Mr. K. Tyrkko - http://www.gov.mu/portal/goc/stock/file/popass.pdf

These reports have been produced during the Enabling Activity Project and their contents have been widely used in the drafting of the National Implementation Plan.

Annex 5

DETAILS OF INTERNATIONAL AND REGIONAL CONVENTIONS AND TREATIES TO WHICH MAURITIUS IS A PARTY TO

Besides the details of the four international conventions closely related to the POPs issue listed at Section 2.2.3, Mauritius has signed and ratified a number of conventions, treaties and agreements on environmental issues. They are shown in the following table.

Table 26 –

ENVIRONMENTAL INTERNATIONAL AND REGIONAL CONVENTIONS AND TREATIES TO WHICH MAURITIUS IS A PARTY TO

THEME	NAME OF TREATY/CONVENTION/PROTOCOL/AGREEMENT	SIGNED	RATIFIED	ACCESSION	ENTRY INTO FORCE
BIODIVERSITY					
	CBD • Convention of Biological Diversity – 1992	June 1992	September 1992		December 1993
	• Cartagena Protocol on Biosafety - 2000			April 2002	September 2003
	CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora - 1973		April 1975		July 1975
	Convention on the Conservation of Migratory Species of Wild Animals			January 2004	
	Convention on the Conservation of the Antarctic Marine Living Resources			October 2004	

	Ramsar • Convention on Wetlands of International Importance Especially as waterfowl habitat (Ramsar) – 1971 • Protocol to Amend the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Paris Protocol to the Ramsar Convention) • The Amendments to Articles 6 and 7 of the Convention (Regina) or "Regina Amendments"	May 2001			September 2001 Not Ratified
	AEWA African Eurasian Migratory (Water Bird) Agreement				January 2001
	CMS Bonn Convention on Migratory Species				
	Jakarta Mandate on Marine and Coastal Biological Diversity				
	African convention on Conservation of Nature and Natural Resources – 1968	September 1968			
	Convention on Fishing and Conservation of Living Resourced of the High Seas - 1958				
	IPPC International Plant Protection Convention (IPPC) – 1971 • Revised text of the International Plant Convention art. XIII Paragraph 4			June 1971	June 1971
	• Protocol concerning protected areas and wild fauna and flora in the Eastern African Region – 1985			September 1990	April 1991
	• International Treaty on Plant Genetic Resources for Food and Agriculture		July 2000		

	• International tropical timber agreement - 1983			March 2003	
ATMOSPHERE-RELATED CONVENTION					
CLIMATE	UN Framework Convention on Climate Change - 1992	June 1992	September 1992		March 1994
	Kyoto Protocol			May 2001	
OCEANS AND LAW OF THE SEA CONVENTIONS					
TUNA	Indian Ocean Tuna Commission			December 1994	
	Convention on Fishing and Conservation of Living Resources of the High Seas - 1958			October 1970	November 1970
REGIONAL SEAS	Nairobi Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region and Related Protocols – 1985 • UNEP Global Plan of Action for the Land-based Sources of Marine Pollution			July 2000	
MARINE POLLUTION	Convention on Civil Liability for Oil Pollution Damage (CLC) – 1969 • Protocol to CLC of 1976			April 1995	July 1995
	Convention on the Prevention of Pollution from Ships – 1973 • Protocol of 1978 relating to the 1973 International Convention for the Prevention of Pollution from Ships, including: Annex III, Annex IV & Annex V of the Convention				
	International Convention on the establishment of an International Fund for compensation for Oil Pollution Damage (FUND) – 1971 • Protocol to the International Convention on the establishment of an International Fund for compensation for Oil Pollution Damage - 1976			April 1995	July 1995
	Oil Spill Preparedness and Readiness Convention - 1997				
	Protocol concerning Cooperation in combating Marine Pollution in cases of		10 July 2000		

	Emergency in the Eastern African Region – 1985				
	International Convention on Oil Preparedness, Response and Cooperation (OPRC) - 1990			March 2000	
	International Convention for the Prevention of Pollution from Ships (MARPOL) – 1973 • Amended by the 1978 Protocol			April 1995	July 1995
	International Convention relating to Intervention on the High Seas in cases of Oil Pollution Casualties		November 2002		
	Protocol relating to International Convention on the High Seas in cases of Pollution by Substances Other than Oil			October 2003	
MARITIME LAW	United Nations Convention on the Law of the Sea (UNCLOS) – 1982 • Agreement relating to the implementation of Part XI of the UNCLOS Convention • Agreement for the implementation of the provisions of the UNCLOS Convention relating to the conservation and management of straddling fish stocks and highly migratory fish stocks	December 1982	November 1994		
			November 1994		
				March 1997	
	Convention for the Safety of Life at Sea (SOLAS) - 1974	February 1988		May 1988	
	Convention on the High Seas - 1958			October 1970	
	Convention on the International Regulations for Preventing Collusions at Sea - 1972				
	Convention on the Continental Shelf			October 1970	October 1970
	Convention on the Territorial Sea and Contiguous Zone - 1958				
	Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas				

MARINE SAFETY	Convention on Load Lines - 1966				
	Convention on Standards of Training and Certification of Watch Keepers (STCW) - 1978			July 1991	October 1991
SOIL					
	United Nations Convention to Combat Desertification (UNCCD) - 1994				
	Convention to combat drought and Desertification in those countries experiencing Drought and Desertification, particularly in Africa - 1995	March 1995	January 1996		December 1996
HERITAGE					
	Convention for the Protection of the World Cultural and Natural Heritage - 1972		September 1995		
MILITARY ACTIVITIES AND THE ENVIRONMENT					
	Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under water - 1963			May 1969	
	Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Sea Bed and the Ocean Floor and in the Subsoil thereof - 1971			May 1971	
	Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (biological) and Toxin Weapons, and on their Destruction	April 1972	August 1972		
	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and their Destruction (also called the Chemicals Weapons Convention) - 1993		February 1993		
	Convention on the prohibition of military or any other hostile use of environmental modification techniques			October 1992	
	Treaty on Principles Governing the activities of States in the exploration and use of Outer Space including the moon and other celestial bodies			April 1969	
	Treaty of Pelindaba – African Nuclear Weapon Free Zone	November 1996			