Revised National Implementation Plan under the Stockholm Convention on Persistent Organic Pollutants in Sri Lanka - 2015

Project on Enabling Activities to Review and Update the National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) in Sri Lanka (GEF/UNIDO)

Ministry of Mahaweli Development & Environment, Sri Lanka
October 2017

Revised National Implementation Plan under the Stockholm Convention on Persistent Organic Pollutants in Sri Lanka - 2015

ISBN978-955-8395-14-1

Published by : Project on Enabling Activities to Review and Update the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants, Ministry of Mahaweli Development and Environment

Funded by : Global Environment Facility (GEF)
United Nations Industrial Development Organization (UNIDO)

Year of Publication : 2017

Printed by : K.S.U. Graphic (Pvt) Ltd.
510, Rajagiriya Road, Rajagiriya.
Tel: 011 2884701 Fax: 011 2882323
E-mail: ksugraphic@yahoo.com

Project on Enabling Activities to Review and Update the National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) in Sri Lanka (GEF/UNIDO)

PROJECT COORDINATING UNIT

Project Director

Mr. Anura Jayatilake

Project Office

Mr. S M Werahera, Assistant Director
Ms. Vindya Hewawasam, Research Assistant
Ms. U Dilhani Maheshika, Trainee
Ms. K G Chathuni Malsha, Trainee

Expert Panel

Prof.Ajith De Alwis - PBDE
Dr.Parakrama Karunarathne-UPOPs
Dr.Shameen Jinadasa-PFOS
Prof.Piyasena Abeygunawardena-Socio economics
Dr. J A Sumith-Pesticides
Mr. J K A B Wijegunasekera -PCBs

Disclaimer

The content of this publication are the sole responsibility of Ministry of Mahaweli Development & Environment.

ශ්‍රී ලංකා ජනාධිපති
இலங்கை சனாதிபதி
President of Sri Lanka

Message

Protection and conservation of the environment for the sake of present and future generations is one of the priorities of the government. In this effort, we have to pay our attention to solve the visible problems such as destruction of forest cover, declining of scenic beauty due to haphazard dumping of solid waste and soil erosion etc. as well as issues that we cannot observe directly but experience in our day to day life such as declining biodiversity and pollution.

When I was the Minister of Environment, the National Implementation Plan (NIP), which evaluates issues related to the Stockholm Convention, the international treaty on management of Persistent Organic Pollutants was developed in 2006 and I am glad to note that the NIP has been comprehensively updated. The NIP outlines, not only the extent of the presence of Persistent Organic Pollutants in the country and their inflows but also identifies the ways and means of minimizing their releases and inflows. It also disseminates the knowledge among the general public including school children who are the future of our country. The activities proposed to be implemented under the NIP will assist to minimize the challenges created due to Persistent Organic Pollutants.

I wish to thank for Global Environmental Facility for its financial contribution for the project. The role played by United Nations Industrial Development Organization giving the technical inputs and knowhow to the implementation of project activities is also highly valued. Finally my sincere thanks goes to the staff of the Ministry of Mahaweli Development and Environment and all the national experts and all officials who contributed for the effort including the members of the Project Steering Committee.

Maithripala Sirisena

October 26, 2017

ශ්‍රී ලංකා ප්‍රජාතාන්ත්‍රික සමාජවාදී ජනරජය
இலங்கைச் சனநாயக சோசலிசக் குடியரசு
Democratic Socialist Republic of Sri Lanka

PREFACE

It is an individual and collective responsibility of all citizens to adhere to the Stockholm Convention on Persistent Organic Pollutants (POPs) which is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods, spread widely to most areas and get accumulated in the fatty tissue of humans and animals. Exposure to POPs can lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and even diminished brain power.

In order to address these issues, the Stockholm Convention on POPs was adopted in May 2001 and it entered into force in 2004. Sri Lanka became a signatory to the Stockholm Convention on POPs on 5th September 2001 and ratified the Convention on 22nd December 2005. Ministry of Mahaweli Development & Environment acts as the National Focal Point to the Convention and Sri Lanka submitted it's first (1st) National Implementation Plan (NIP) to the Stockholm Convention Secretariat in 2006.

The updated National Implementation Plan (NIP) for the Stockholm Convention on POPs has been prepared to review and modify the preliminary inventories on Polychlorinated Biphenyls (PCBs), unintentional POPs (UPOPs), POPs Pesticides and newly listed Perfluorooctanesulfonic Acid (PFOS), its Salts and Perfluorooctane Sulfonyl Fluoride (PFOSF) and listed Polybromobiphenyl Ether (POP-PBDEs).

A project was launched in June 2014 and inventory update was carried out by the respective Sector Experts with the support of Working Group Members, Steering Committee Members and the Stakeholders. The NIP was prepared based on the recommendations made by the Sector Experts and, it has identified the priority actions to be implemented based on the POPs management principles. Specific goals have been formulated and related actions identified by the POP Sector Experts of NIP development and they are addressed within the proposed chemical management framework.

The Ministry of Mahaweli Development and Environment wishes to extend its sincere appreciation to all participatory Ministries, Government agencies/ Institutes, Private Sector Institutes, Non-Governmental Organizations and Sector Experts for their cooperation and contribution extended for the success of the Project. Financial and technical assistance provided by UNIDO/GEF is much appreciated and I look forward to successful implementation of the proposed National Implementation Plan (NIP) in the Country.

Anura Dissanayake
Secretary
Ministry of Mahaweli Development & Environment
October 26, 2017

"Sobadam Piyasa",
No.416/C/1,Robert Gunawardana Mawatha
Battaramulla

FOREWORD

The project for the preparation of the Updated National Implementation Plan (NIP) for the Stockholm Convention was implemented in collaboration with the Global Environmental Facility (GEF) and United Nations Industrial Development Organization (UNIDO).

The project activities followed a phased process set out in the guidelines for actions under the Stockholm Convention viz. Determination of coordinating mechanisms and organization of process; Assessment and enhancement of national infrastructure and capacity and the establishment of POPs inventories; Setting up of priorities and determination of objectives; Formulation of an Updated National Implementation Plan (NIP) and Specific Action Plans; and Endorsement of the updated NIP by the stakeholders.

A National Project Coordinator and six experts were appointed to evaluate the situation in Sri Lanka in relation to the 22 chemicals designated for international action by the Stockholm Convention (SC), POPs Pesticides, Socio Economic Aspects of POPs, PCBs, unintentional POPs, polybrominateddiphenyl ethers (PBDEs) and hexabromobiphenyl (HBB) as well as perfluorooctanesulfonic acid (PFOS) and related substances were designated sectors used for the preparation of the updated NIP. The experts were assisted by Dr. Roland Weber, technical expert provided by UNIDO. Stakeholder workshops were conducted during all stages of the project with high-level participation of representatives from various governmental, non-governmental and private sector institutions. The NIP contains time bound action plans and resource requirements based on the recommendations of the stakeholder institutions and interested parties.

The Ministry of Mahaweli Development and Environment expresses its sincere gratitude to all those who contributed at various levels to develop this document which would help Sri Lanka to implement the Stockholm Convention and facilitate the national and international community to reduce and eliminate the health and environmental impacts arising from POPs. The technical and financial assistance provided by UNIDO/GEF is gratefully acknowledged.

Anura Jayatilake
Project Director/Director (Environment Pollution Control & Chemical Management)
Ministry of Mahaweli Development and Environment

ACKNOWLEDGEMENTS

The preparation of this Updated National Implementation Plan (NIP) was started with an inception workshop held from 25th to 27th June 2014. The Updated NIP preparation process spanned across the tenure of three Ministers of Environment, Hon. Anura PriyadharshanaYapa, MP and Hon. Susil Premajayanth, MP (Minister of Environment & Renewable Energy), and H. E. Maithripala Sirisena, The President (Minister of Mahaweli Development & Environment). It is with deep gratitude that we place on record the unstinted support provided by them in the activities leading to the successful completion of the updated NIP along with Hon. A. R. M. Abdul Cader, MP, Deputy Minister of Environment & Renewable Energy, Hon. Mr. Ranjith Siyambalapitiya, MP, State Minister of Environment and Hon. Anuradha Lanka Jayaratne, the current Deputy Minister of Mahaweli Development & Environment.

Valuable assistance and guidance were provided by former Secretaries of the Ministry of Environment- Mr. B M U D Basnayake (Ministry of Environment & Renewable Energy), Eng. Mr. Nihal Rupasinghe (Ministry of Mahaweli Development & Environment), Mr. Vajira Narampanawa (State Ministry of Environment), Mr. Udaya R. Seneviratne (Ministry of Mahaweli Development & Environment) and our present secretary Mr. Anura Dissanayake (Ministry of Mahaweli Development & Environment) to whom we offer our grateful appreciation. Special thanks are also due to Mr. Gamini Gamage, Former Additional Secretary (Environment & Policy) who has been assisting the project team from the very inception in various ways and providing advice and guidance as well as reviewing project documents.

The Global Environmental Facility (GEF) through the United Nations Industrial Development Organization (UNIDO) provided the bulk of the funding for this project without which the project may not have materialized. We offer our sincere thanks to them. In the provision of managerial expertise and advise on NIP preparation, Dr. Carmela Centino, Project Manager/Industrial Development Officer, UNIDO and the technical advice provided by Dr. Roland Weber, UNIDO expert on POPs were valuable.

The Former Project Director Mr. Ajith Silva, Director, Air Resource Management & International Relations has been a source of inspiration and support for project activities. Mr. S M Werahera, Assistant Director and Ms. Vindya Hewawasam, Research Assistant, provided all the assistance necessary for operational activities of the project along with trainees Ms. U Dilhani Maheshika and Ms. K G Chathuni Malsha, Our thanks are due to all of them.

Finally, we wish to convey our appreciation for assistance provided by the members of the National Steering Committee and officers of numerous other ministries, departments, institutions who provided data and information related the project, the six project experts and individuals who have assisted us in various ways in ensuring that the project activities could be successfully completed.

Anura Jayatilake
Project Director/Director (Environment Pollution Control & Chemical Management)
Ministry of Mahaweli Development and Environment

TABLE OF CONTENTS

Chapter 3

LIST OF TABLES

TABLE OF FIGURES

LIST OF MAPS

LIST OF ACCRONYMS AND ABBREVIATIONS

AFFF	Aqueous Film Forming Foam
APCS	Air Pollution Control Systems
BAT	Best Available Technology
BEP	Best Environmental Practice
BFR	Brominated Flame Retardants
BMI	Body Mass Index
BOI	Board of Investment
C-OctaBDE	Commercial OctabrominatedDiphenyl Ether
C-PentaBDE	Commercial PentabrominatedDiphenyl Ether
CAA	Consumer Affairs Authority
CARI	Central Agricultural Research Institute
CCPI	Colombo Consumers' Price Index
CEA	Central Environmental Authority
CEB	Ceylon Electricity Board
CKDu	Chronicle Kidney Disease of unknown aetiology
CMR	Colombo Metropolitan Region
COP	Conference of the Parties
CP	Cleaner Production
CPC	Ceylon Petroleum Corporation
CRT	Cathode Ray Tube
DL	Dry Zone Low country
DMT	Department of Motor Traffic
DOA	Department of Agriculture
DRE	Destruction and Removal Efficiency
EDC	Endocrine Disrupting Chemicals
EEE	Electric and Electronic Equipment
EIA	Environmental Impact Assessment
ELV	End-of Life Vehicles
EML	Environment and Management Lanka Private Limited
EPL	Environmental Protection Licenses
EPR	Extended Producer Responsibility
ESM	Environmentally Sound Management
EU	European Union
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHS	Globally Harmonised System
GND	Grama Niladari Division
HBB	Hexabromobiphenyl

HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
HLC	Healthy Lifestyle Centers
IDB	Institute of Chemistry Universities
IL	Intermediate Zone Low country
IM	Intermediate Zone Mid Country
IPCS	International Program on Chemical Safety
IPEN	International POPs elimination Network
IPP	Independent Power Producers
ITI	Industrial Technology Institute
IU	Intermediate Zone Up country
LCA	Life Cycle Assessment
LCD	Liquid Cristal Display
LECO	Lanka Electricity Company (PVT) Ltd
LRCC	Lanka Responsible Care Council
LTL	Lanka Transformers Limited
MDG	Millennium Development Goal
MEA	Multilateral Environmental Agreements
MEPA	Marine Environment Protection Authority
MoMDE	Ministry of Mahaweli Development & Environment
MSL	Mean Sea Level
NCC	National Coordination Committees
NCD	Non Communicable Diseases
NCPC	National Cleaner Production Centre
NCPC SL	National Cleaner Production Centre Sri Lanka
NCS	National Conservation Strategy
NEAP	National Environmental Action Plan
NEP	National Environmental Policy
NERD	National Engineering Research and Development Center
N-ETFOSE	N-Ethyl Perfluorooctanesulfonamidoethanol
NGO	Non-Governmental Organizations
NIOSH	National Institute of Safety and Health
NIP	National Implementation Plan
N-MeFOSE	N-methyl perfluorooctanesulfonamidoethanol
NSC	National Steering Committee
NWMSC	National Waste Management Supporting Center
NWS&DB	National Water Supply and Drainage Board
PBDEs	PolybrominatedDiphenyl Ethers
PCBs	Polychlorinated Biphenyls

PCDD	Polychlorinated Dibenzo-p-Dioxins
PCDF	Polychlorinated dibenzofuran
PCs	Personal Computers
PeCBz	Pentachlorobenzene
PFAS	Per- and Polyfluorinated Substances
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluoroctane Sulfuric Acid and its Salts
POPs	Persistent Organic Pollutants
POP-PBDEs	Listed Polybrominated Diphenyl Ethers
PRTR	Pollutant Release and Transfer Registers
PTAC	Pesticide Technical Advisory Committee
RERP	Resource Efficiency and Responsible Production
ROP	Registrar of Pesticides
RPR	Residue Product Rations
SAICM	Strategic Approach to International Chemicals Management
SC	Stockholm Convention
SCP	Sustainable Consumption and Production
SDG	Sustainable Development Goals
SIL	Scheme Import License
SLSI	Sri Lanka Standards Institution
t	Tonnes
TAC	Technical Advisory Committee
TACMIC	Technical Assessment Committee on Management of Industrial Chemicals
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Programme
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
uPOP	Unintentionally produced POPs
US	United States
WCS	World Conservation Strategy
WHO	World Health Organization
WEEE	Wastes of Electrical and Electronic Equipments
WL	Wet Zone Low country
WM	Wet Zone Mid country
WPWMA	Western Province Waste Management Authority
WU	Wet Zone Up country

EXECUTIVE SUMMARY

Sri Lanka became a signatory to the Stockholm Convention on Persistent Organic Pollutants (POPs) on 5th September, 2001 and ratified the Convention on 22nd December 2005. According to the article 7 of the Stockholm Convention, every party for the convention has to submit a National Implementation Plan (NIP) to the Secretariat of the Convention. Accordingly, the initial NIP was submitted to the Stockholm Convention Secretariat by the Government of Sri Lanka in 2007 together with preliminary inventories of PCBs, Pesticides and Unintentional Dioxins/Furans. This is the update to the National Implementation Plan (NIP) for the Stockholm Convention (SC) on Persistent Organic Pollutants (POPs) that addresses 22 Persistent Organic Pollutants(POPs) including the initial 12 POPs.

Initially, 12 chemicals were identified as POPs by the Convention. Eight of these chemicals are pesticides including aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex and toxaphene which are no longer used in Sri Lanka. Polychlorinated biphenyls (PCBs) and hexachorobenzene (HCB)are two industrial chemicals which had extensive usage in Sri Lanka. They are also unintentionally produced POPs together with polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF).They are unintentionally produced in the country in various processes.

In 2009, the Conference of the Parties (COP), listed nine additional POPs for international action out of them, chlordecone, lindane and related waste isomers alpha-hexachlorocyclohexane and beta-hexachlorocyclohexane are pesticides, while hexabromobiphenyl, tetrabromodiphenyl ether, pentabromodiphenyl ether, hexabromodiphenyl ether, heptabromodiphenyl ether (POP-PBDEs), pentachlorobenzene (PeCBz) and perfluorooctane sulfonic acid and related substances are industrial chemicals. PeCBz is also unintentionally produced in various processes. The pesticide endosulfan was included with its related isomers into the convention in 2011.

The POPs listed in 2013 (hexabromocyclododecane (HBCD)) and 2011 (hexachlorobutadiene, pentachlorophenol and polychlorinated naphthalenes) are not addressed in this updated NIP. For the formulation of the updated NIP and determination of the baseline situation, preliminary inventories of the new listed POPs were developed and the inventories of the original twelve POPs were updated. These inventories were the basis to

determine the scope of the POPs issue in Sri Lanka and to develop the respective action plans.

For this purpose, a National Project Coordinator and six sector experts were appointed to evaluate the situation in Sri Lanka in relation to the 22 chemicals designated for international action by the Stockholm Convention (SC). The designated sectors addressed were POPs pesticides, PCBs, unintentionally formed POPs, listed polybrominateddiphenyl Ethers (POP-PBDEs) and hexabromobiphenyl (HBB), perfluorooctanesulfonic acid (PFOS) and related substances. While the socio economic expert addressed the social and economic conditions prevailing in the country that are related to the above POPs. The inventories along with the recommendations of the experts, government and private institutions, Non-Governmental Organizations among others as stakeholders and the findings of the socio economic survey were used in preparation of this updated NIP. The updated NIP is prepared with the financial assistance of GEF and technical support of UNIDO.

The problems and challenges for the individual POPs groups were compiled and adequate action were compiled in the respective action plans.

Problems related to POPs pesticide are:

- Poor user practices of pesticides
- Insufficient regulatory mechanism for monitoring of illegal pesticides accompanied with analytical confirmations in order to spot possible infiltration of banned pesticides including POPs pesticides
- Insufficient information on POPs pesticides and their major degradation products at major use and/or storage "hot spots" in order to delineate potential environmental contamination.
- Poor understanding on the possible correlation between POP pesticides and their biological effects
- Lack of proper storage facility for obsolete pesticides
- Poor attention for the substitution of hazardous pesticides with less hazardous pesticides in vector controlling and also for the use and development of alternative pest management strategies
- Insufficient attention to facilitate organic farming to reduce the overall use of (hazardous) pesticides and to improve biodiversity and healthy soils.
- Poor awareness on hazardous pesticides and alternatives including organic farming/food

and related activities among stakeholder groups (decision makers, farmers, public, NGOs, industry etc.).

- Poor awareness among stakeholder groups including the Customs officials on special chemical groups and pesticides.

Management actions identified for the implementation:

- Implement awareness and control mechanisms to encourage effective and efficient pesticide usage practices in order to minimize waste in order to reduce accumulation of obsolete pesticides at the source.
- Strengthen pesticide regulatory system with improved manpower and laboratory facilities to enhance regulatory monitoring of illegal pesticides accompanied with analytical confirmations in order to spot possible infiltration of banned pesticides including POPs pesticides.
- Designing an analytical monitoring system to sample and analyse for potential POPs and their major degradation products at major use "hot spots" in order to delineate potential environmental contamination (leading to declare Sri Lanka as a "POPs Pesticide Free" country).
- Implement coordinated research network to encourage local analytical laboratories to effectively engage in environmental sampling for POPs pesticides in tandem with establishing possible correlations between their presence and biological effects.
- Establishment of a secured temporary storage facility for obsolete pesticides to avoid any misuse of such pesticides at field level.
- Implement effective regulatory mechanism and control programs to assess current used (highly) hazardous pesticides and substitution by less hazardous pesticides and integrated vector control.
- Promote the use of alternative pest management strategies and, in case they are not available, promote research for development of alternative strategies.
- Policy development and implement strategies and programs to facilitate organic farming to reduce the overall use of (hazardous) pesticides and to improve biodiversity and healthy soils.
- Awareness raising of stakeholder groups (decision makers, farmers, public, NGOs, industry etc.)on hazardous pesticides and alternatives including organic farming/food and related activities on national, regional and local levels.

- Training for Custom officials on identification and management of special chemical groups including POPs pesticides and encourage inter-agency coordination among relevant stakeholders.

Problems related to polychlorinatedbiphenyls (PCBs) are:

- Lack of fully developed inventory of transformers (both power sector and welding) and inventory of capacitors indicating the presence of PCBs
- Poor awareness among the welders and manufacturers of welding transformers on the presence and effect of PCBs
- Lack of adequate legislation to control imports
- Lack of information on some sectors having use of PCB containing oil e.g. grease production
- Lack of complete information regarding island wide possible contaminated sites due to welding transformers, storage and use sites island wide.
- Lack of adequate rules and regulation to address the issue of illegal use of PCB containing or contaminated oil

Management actions identified for the implementation:

- Development of a complete inventory of transformers (both power sector and welding) and development of an inventory of capacitors
- Awareness raising among the welders and manufacturers of welding transformers on the potential presence and effects of PCBs
- Formulation of laws, regulations and guidelines to control import
- Carry out studies to cover all possible uses of PCB containing oil including grease production
- Development of complete inventory on possible contaminated sites due to welding transformers
- Formulation of rules and regulation to address the issue of illegal use of PCB containing or contaminated oil

Problems related to listed polybrominateddiphenyl ethers (PBDEs):

- Sri Lanka does not have a regulatory framework for WEEE management and does not have an adequate recycling facility. Hence much of WEEE is ends up in landfills and the formal sector activities are only confined to dismantling for exportation.
- A considerable amount of WEEE is also being handled by the informal sector collectors and refurbishes with possible pollution by inadequate treatment.
- The transport sector is one of the largest material flows of goods and ultimately becomes a large waste and recycling flow. The end-of-life management of the transport sector is a highly relevant material flow for the recovery of materials and for managing pollutants. POP-PBDE are partly included in polymers in particular polyurethane (PUR) foam.
- POP-PBDE containing wastes (WEEE plastic and polymers from end-of-life vehicles) are used for scrap and the PBDE contents usually end up in landfills.
- Lack of resources to identify presence of PBDE in products and the possible presence in the environment
- Health impacts of PBDEs are not ascertained locally

The inventory study concluded that PBDEs were not used in significant amount in furniture, mattress, textile and carpet industry in Sri Lanka due to lack of flammability standard for specific uses. On the other hand, PUR foam, rubber, PVC and other plastic wastes/scraps/factory off-cuts are imported to the country under the provisions of "import, export and transit of waste listed in the Basel Convention" which may contain POP-PBDEs. However, none of these materials were analyzed for presence of flame retardant (or specifically for PBDEs).

Management actions identified for implementation:

- Review & upgrade relevant legislation/s on solid waste management including WEEE (Wastes of Electrical and Electronic Equipments) and ELV (End of Life Vehicles)
- Strict control of importation of second hand EEE(Electrical and Electronic Equipments)
- Island wide collection network for WEEE to be strengthened
- Implement proper solid waste management/disposal mechanism

- Develop capacity to screen for POPs containing products and waste through institutional strengthening at point of entry
- Laboratory and field testing for PBDE to be developed
- A monitoring mechanism as well as disposal methods to be developed
- Treatment systems using BAT using local and foreign expertise encouraged and facilitated.
- Application of economic instrument for management of WEEE

Problems related to perfluorooctanesulfonic acid (PFOS) and related substances

- Lack of awareness and training of institutions handling point of entry and use
- Lack of adequate legislation to control imports
- Stocks of PFOS containing foams still to be contained and disposed safely
- Various industries are potentially still using PFOS and related substances (plating industry, leather manufacturing and repellent treatments, photography industry, coatings that are used on paper products).
- Environmental impacts and baseline levels not adequately studied
- Lack of sufficient resources for identification and analysis
- Wide area of possible contaminated sites yet to be identified

Management actions identified for implementation:

- Develop necessary legislation for management and prevention of new entry to the country
- Establish appropriate laboratory facilities for PFOS analysis.
- Establish and implement guidelines for phase out, transportation, storage and disposal of stocks of PFOS containing foams and other PFOS containing materials
- Establish progress monitoring mechanisms
- Capacity building for control and management of PFOS
- Safe Disposal of existing stocks and stockpiles
- Establish full assessment of contaminated sites
- Rehabilitation and decontamination of contaminated sites

Problems related to UPOPs

- Lack of complete integrated waste management systems at national, regional and local authority levels.
- Lack of integrated waste management/disposal methods for healthcare facilities.
- Insufficient knowledge on all aspects of waste management among the stakeholders such as local authority officials and general public and school children
- Lack of laws to ban on the open burning of industrial waste and domestic waste including plastics
- Lack of proper industrial waste management system
- Insufficient level of application of BAT/BEP for reduction of emission from industrial processes
- Insufficient level of measuring country specific data on amount of UPOPS released and researches on their economic and health impacts
- Lack of proper data management system including database on hazardous waste and related emission for national level decision making process

Management Actions Identified

- Establishment of proper integrated waste management systems (Based on Waste Management Hierarchy) at national, regional and local authority level that include programmes to avoid and reduce the amount of waste at generation points, waste segregation and recycling, production of biogas and composts, and recover and recycle as appropriate and only disposal of remaining wastes in engineered sanitary landfill
- Establishment of integrated waste management/disposal methods for healthcare facilities including liquid waste and proper maintenance of incinerators also should be ensured.
- Carry out a rigorous awareness campaign for all stakeholders to highlight the adverse effects of burning of wastes and to introduce better waste management practices.
- Introduce laws and regulation for banning of open burning of industrial wastes and explore the possibility of extending it to domestic plastic wastes including burning of waste in waste collection system of local authorities in urban areas.
- Streamlining the industrial waste management practices by improvement of waste

catalogue while giving due attention to residues generated through waste management processes, strengthen the schedule waste management unit of CEA to inspect hazardous waste management facilities and keep record on each facilities and incorporate informal recycling sector into formal scheme

- Establishment of information clearing house mechanism for BAT/BEP and coupled with pollution prevention and control approach.
- Explore the possibility to include the issue of POPs into EPL and enforcement of proposed emission standard after including measures to curb UPOPs emission as already completed for minimizing Dioxin and Furan through operational time and temperature
- Establish long lasting mechanism linked to existing emission standards to collect actual data on UPOPS through stakeholder consultation and encourage research on UPOPS including calculation of related economic and health impact.
- Establish a proper data management system by linking existing data gathering mechanisms such as EPL, VET, NSWMSC and scheduled waste licensing scheme.
- Evaluate the option and challenges to develop a Pollutant Release and Transfer Registers (PRTR) as a frame of the overall emission inventory and related development
- Evaluate the option and challenges to develop a Pollutant Release and Transfer Registers (PRTR) as a frame of the overall emission inventory and related development
- Develop a database on national contaminated sites of UPOPS while linking with other POPs
- Include the data requirement of the issues related to POPs into census activities and increase the frequency.

CHAPTER 1

1. Introduction

Persistent Organic Pollutants (POPs) are organic compounds that resist photolytic, chemical and biological degradation. They are characterized by low water solubility and high lipid solubility, resulting in bioaccumulation in fatty tissues. Their concentration increases at the upper level members of the food chains which is known as bio magnification. These chemicals have a potential to evaporate from one place and appear in another place while transporting through air and water to another distant place. It is known as Grasshopper effect. Further more, the effect of a mixture of POPs can produce result in Cocktail effects.

These properties of high persistence and semi volatility coupled with other characteristics cited above have resulted in the presence of these compounds all over the world and even in regions where they have never been produced or used. Humans can be exposed to POPs through diet, occupational accidents and the environment (including indoors). Exposure to POPs can be acute or chronic and can be associated with a wide range of adverse health effects. Originally 12 chemicals, referred to as the "dirty dozen" were identified to control and manage with the aim to final elimination under the Stockholm Convention.

Those twelve chemicals initially designated for international action by the Stockholm Convention are grouped into 3 categories namely:

- **Pesticides**

  Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Mirex, Toxaphene

- **Industrial Chemicals**

  Hexachlorobenzene (HCB) which is also used as a pesticide

  Polychlorinated Biphenyls (PCBs)

- **Unintended by-products**

  Dioxins (Polychlorinated dibenzo-p-dioxins; PCDDs) and Furans (Polychlorinated dibenzofurans;-PCDFs), hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs) were listed as unintended by-products of certain anthropogenic activities within the dirty dozen.

In 2009, the Conference of the Parties (COP), by its decisions SC-4/10 to SC-4/18, adopted amendments to annexes A (elimination), B (restriction) and C (unintentional production) of the Stockholm Convention (SC) including nine additional chemicals to the list of POPs. Further, in 2011, the Conference of the Parties (COP), by decision SC-5/3, adopted an amendment to annex A (elimination) by listing technical endosulfan and its related isomers. The ten additional POPs are:

Pesticides: Chlordecone, alpha hexachlorocyclohexane (HCH), beta hexachlorocyclohexane (HCH), lindane, pentachlorobenzene (PeCBz), endosulfan and its related isomers

Industrial Chemicals: Hexabromobiphenyl (HBB), and certain homologues from commercial pentabrominated diphenylether (c-PentaBDE) and commercial octabrominated diphenylether (c-OctaBDE) namely tetrabrominated diphenylether, pentabrominated diphenylether, hexabromodiphenyl ether and heptabromodiphenyl ether, PeCBz, perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF), and

Byproducts (Unintentionally produced): PeCBz. alpha-HCH and beta-HCH (unintentionally produced in Lindane production)

All these substances are designated as POPs and are toxic, persistent and can be transported over great distances and accumulate in organisms.

1.1 Management of Persistent Organic Pollutants

Sri Lanka became a signatory to the Stockholm Convention on Persistent Organic Pollutants (POPs) on 5th September, 2001 and the Ministry of Mahaweli Development & Environment then Ministry of Environment was designated as the focal point for the Convention. In order to meet the obligations towards the Convention, then Ministry of Environment prepared the first NIP which was published in 2007 and submitted to the Stockholm Convention Secretariat.

Considering the SC and being a Party to the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal, Sri Lanka is obliged to find environmentally sound solutions for all POP chemical wastes. Sri Lanka also became a party to

the Rotterdam Convention in January 2006, on the "Prior Informed Consent procedure for certain Hazardous Chemicals and Pesticides in international trade". Some POPs are included as hazardous chemicals and pesticides under this Convention. Hence, implementation activities of both Basel Convention and Rotterdam Convention will also support the activities of this updated NIP.
To facilitate the global management of POPs, the Convention had introduced three annexes:

- **Annex A (Elimination)** – where the production and use of the substances listed in need to be eliminated, except for those substance for which a specific exemption/acceptable purpose was allowed;

- **Annex B (Restriction)** – where the production and use of the substances listed in are restricted only to some specific exemptions/acceptable purposes;

- **Annex C (unintentional production)** – where the releases of substances listed need to be reduced, with the goal of their continuing minimization and, where feasible, ultimate elimination.

For the substances listed in Annexes A and B for which alternatives exists but parties in developing countries have challenges in substitution the Conference of Parties established specific exemptions that have a limited timeframe and shall expire five (5) years after the date of entry into force of the Convention with respect to that particular chemical, unless an earlier date is indicated in the Register by the Party or an extension is granted by the Conference of the Parties. This interval must be seen as a transitional period to switch to safer alternatives.

For the substances listed in Annexes A and B for which no alternatives exists yet the Conference of Parties established acceptable purposes which are not time limited but for which Conference of Parties conducts reviews of the continued need of that particular chemical at every 4 years. Sri Lanka had registered for an exception for Lindane which was withdrawn in 2012. The existing specific exemptions/acceptable purposes listed in the Convention for each POPs are summarized in Table 1 below.

Chemicals	Annex	Specific exemptions/Acceptable purposes
Hexabromodiphenyl ether and Heptabromodiphenyl ether	A	Production: none Use: recycling of articles that contain or may contain Hexabromodiphenyl ether and Heptabromodiphenyl ether, in accordance with provisions of Part IV of Annex A
Lindane	A	Production: none Use: human health pharmaceutical for control of head lice and scabies as second line treatment
Technical Endosulfan	A	Production: As allowed for the parties listed in the Register Use: Crop-pest complexes as listed in accordance with the provisions of part VI of this Annex
Tetrabromodiphenyl ether and Pentabromodiphenyl ether	A	Production: none Use: recycling of articles that contain or may contain Tetrabromodiphenyl ether and Pentabromodiphenyl ether, in accordance with provisions of Part V of Annex A
Perfluorooctane sulfonic acid its salts and Perfluorooctane sulfonyl fluoride	B	Production: for the use below Use: several acceptable purposes and specific exemptions in accordance with Part III of Annex B
DDT(1,1,1-trichloro-2,2-bis (4-chlorophenyl)ethane)	B	Production: Disease vector control use in accordance with Part II of this Annex Use: Disease vector control use in accordance with Part II of this Annex

Table 1 - Acceptable purposes/specific exemptions for POPs listed in the Convention
Source: Stockholm Convention website

1.2 Need for preparation of a National Implementation Plan and updates

Paragraph 1 of Article 7 of the Stockholm Convention states that each Party shall develop and endeavour to implement a plan for the implementation of its obligations under the Convention, which needs to be transmitted to the Conference of the Parties within two years of the date on which this Convention enters into force. Therefore, the SC requires all Parties to develop a National Implementation Plan (NIP). Article 7 also calls for a review and update of the plan on a periodic basis and in a manner the Conference of the Parties specify.

To determine whether a Party has a need to review and update its National Implementation Plan, the Party concerned should assess whether it is affected by any external or internal factors, such as those referred to in paragraphs 4 and 5 of the annex to decision SC-1/12. According to paragraph 7 of the annex to decision SC-1/12, for those changes in the obligations arising from amendments to the Convention or its annexes, a Party will review and update its implementation

plan, and transmit the updated plan to the Conference of the Parties within two years of the entry into force of the amendment for it, consistent with paragraph 1 (b) of the Convention.

In the NIP the parties to the SC must specify what strategies they will be developing to meet the obligations of the SC. For an instance, among others, Sri Lanka is required to formulate strategies to phase out the use of PCBs by 2025 completely and dispose of any stocks of PCBs in an environmentally sound manner by 2028 under the provisions of the SC.

1.3 NIP update preparation process

With funding support from the Global Environmental Facility (GEF) and technical assistance of United Nations Industrial Development Organization (UNIDO), NIP update process commenced in mid 2014 by considering the newly added ten POPs. This project was titled as ***"Enabling activities to review and update the National Implementation Plan (NIP) under the Stockholm Convention on Persistent Organic Pollutant in Sri Lanka".***

Accordingly, to guide and monitor the project activities, a National Steering Committee (NSC) was constituted under the chairmanship of the Secretary, Ministry of Mahaweli Development and Environment then Ministry of Environment & Renewable Energy. The NSC comprised representatives from regulatory, implementing and monitoring agencies including line ministries and Non-Governmental Organizations (NGO) as well as private sector organizations.

The project was planned to set up a practically workable NIP update integrated with Basel and Rotterdam Convention implementation plans, including satisfactory execution of following activities related to management of POPs:

i. Establishment of a coordinating mechanism
ii. Formulation of POPs inventories and assessment of infrastructure and capacities
iii. Priority setting and determination of objectives
iv. Formulation of the updated NIP
v. Endorsement of the updated NIP by the stakeholders

A National Project Coordinator and six experts, including a socio-economic expert, were appointed under the project. These experts were designated to prepare the relevant inventories and analyse the socio-economic factors related to management of POPs. The National Project

Coordinator was supposed to coordinate and assist in preparation of the updated NIP under the following categories:

i) POPs Pesticides
ii) PCBs
iii) Unintentionally produced POPs (uPOPs)
iv) Perfluoroctane Sulfonic Acid and its Salts (PFOS)
v) Listed polybrominated diphenyl ethers (POP-PBDEs)
vi) Socio-economics of POPs use and management.

It was necessary to compile the updated POPs inventories, which would help to determine the status of the POPs issues in Sri Lanka and develop action plans accordingly. In particular, inclusion of inventories of the ten new listed POPs was performed, while also updating the status of the inventories of the original twelve POPs. The methodology used to develop the updated NIP includes; social survey related to POPs and regular meetings of the NSC and stakeholder consultations through meetings and workshops for data collection.

The NIP update process has followed by the SC Guidance for Developing a National Implementation Plan. Also during the NIP updating process the different guidance developed for developing inventories and others were considered and used.

CHAPTER 2

2. Country Profile

2.1. Geography and Climate

a) Geography of the country

Sri Lanka is made up of three peneplains namely lower, middle and highest. The coastal belt and its surrounding area extended up to 300m from Mean Sea Level (MSL) is known as low country. While the middle area defined as mid country which lies between 300m to 900m of MSL and the highest peneplain or the upcountry is located above 900m from MSL. These physiographical differences between the regions is one of the very important determinants of the diversified climate experienced by the country in terms of rainfall characteristics, temperature, soil and vegetation. On account of the geographical location within tropics between 5^0 55'to 9^0 51' North latitudes and 79^0 42' to 81^0 53' East longitude, the climate of the country could be characterised as tropical.

b) Rainfall

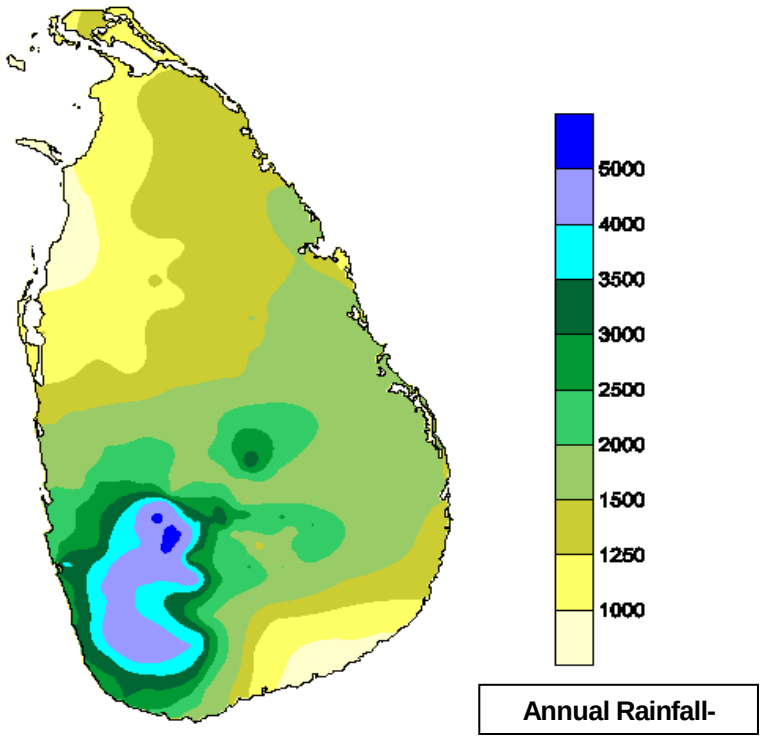
The mean annual rainfall of the country varies from 900 mm in the driest and 5000 mm in the wettest places. The country is having four rainfall seasons namely First inter-monsoon season that occurs from March to April, Southwest monsoon season that occurs from May to September, Second Inter-monsoon Season that occurs from October to November and Northeast - monsoon Season that occurs from during December to February. Details of the spatial distribution of annual rainfall in Sri Lanka is shown in the Map 1.

c) Temperature

Temperature differences exist in the country is primarily governed by altitudes. Slight differences of the temperature is influenced by seasonal movement of the sun and effect of the rainfall. The mean annual temperature of the lowland, up to an altitude of 100-150 m remains in average of 27.5 ^{0}C while it rapidly decreases towards the highland. In the central highlands, the temperature falls drastically as the altitude increases. For an instance, the mean annual temperature of Nuwaraeliya town, which locates at an altitude of 1800 m above Mean Sea Level is 15.9 ^{0}C.

The coldest month with respect to mean monthly temperature in the island is generally January, and the warmest months of the year are April and August.

Map 1: The spatial distribution of annual rainfall in Sri Lanka



d) Humidity

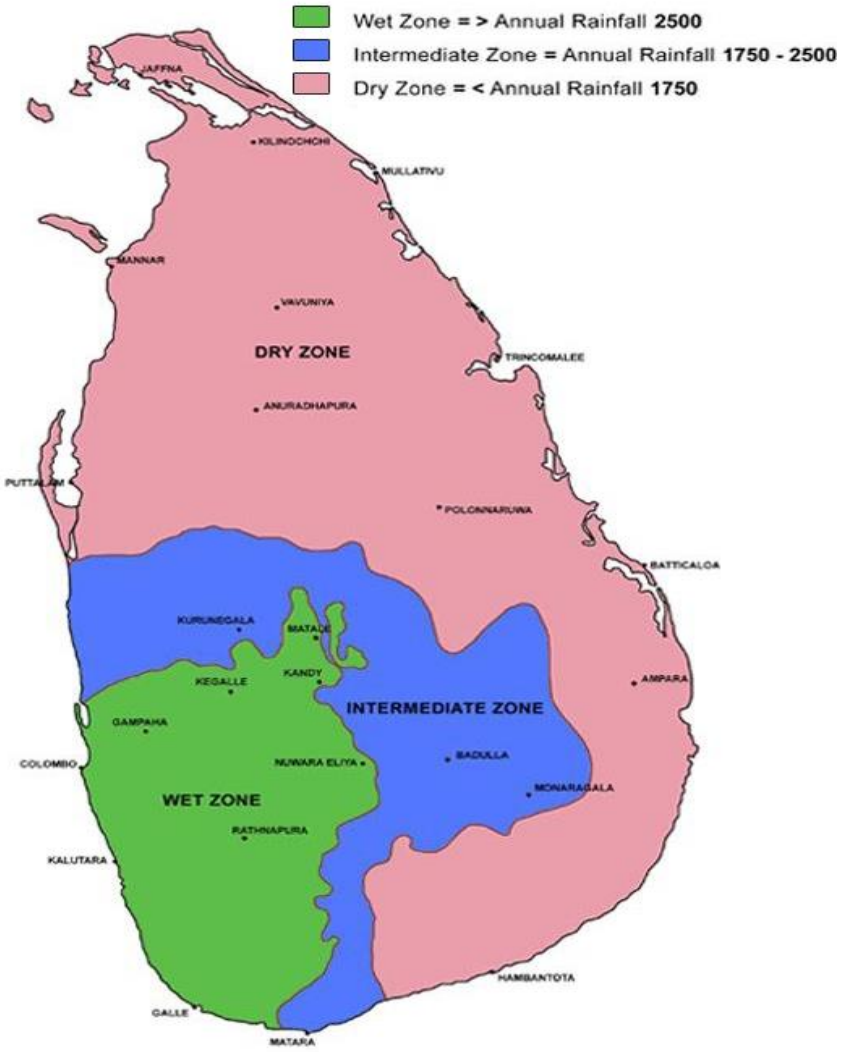
The country experiences an array of humidity levels that mainly depend on the seasonal rainfall and altitudes. For example, humidity in Colombo that locates in coastal area in day time remains above 70 percent year round rising to almost 90 percent during the monsoon season in June. While Anuradhapura experiences a daytime low humidity of 60 percent during the inter-monsoonal month of March, but a high value of 79 percent of humidity during November and December rainy months. In the highlands, daytime humidity usually ranges between 70 and 80 percent.

e) Climatic and agro-ecological zones of Sri Lanka

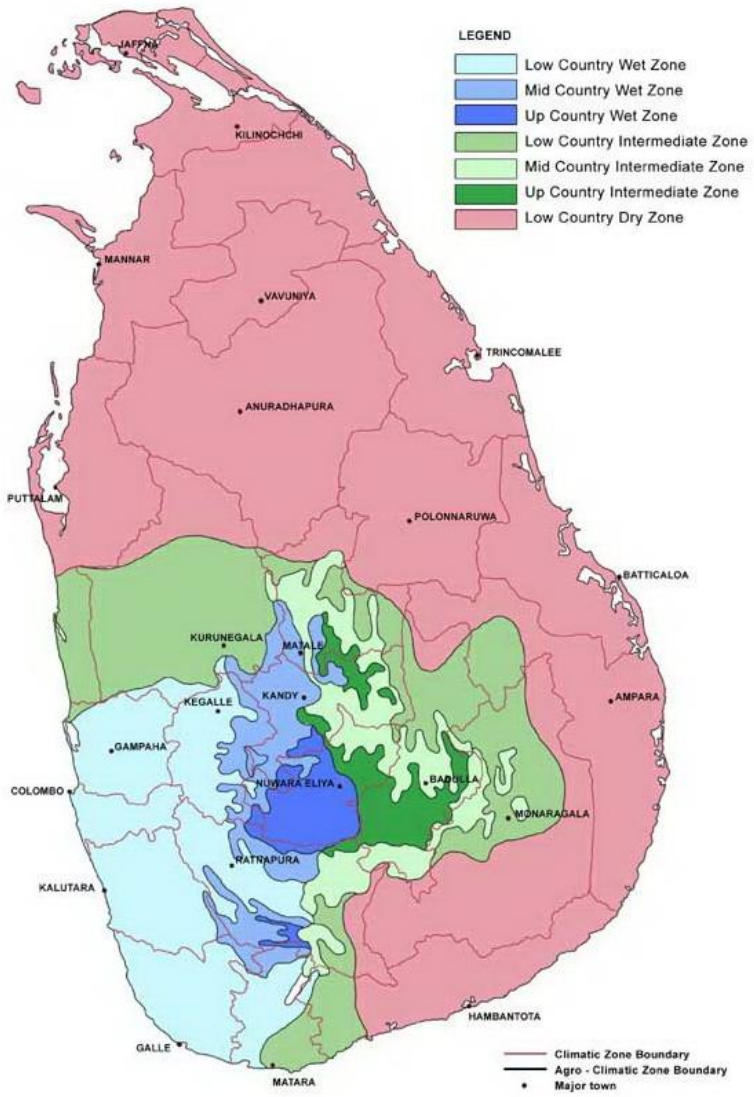
Based on the total annual rainfall, the country has been divided into three climatic zones namely Wet zone, Intermediate zone and the Dry zone. The Wet zone and Intermediate zone

receive a mean annual rainfalls of above 2500 mm and 1750-2500 mm respectively (Map: 2). While the mean annual rainfall of the Dry zone remains below 1750 mm. Seven agro-climatic zones namely Dry zone Low country (DL), Wet zone Low country (WL) Intermediate zone Low country (IL), Wet zone Mid country (WM), Wet zone Up country (WU), Intermediate zone Mid country(IM) and Intermediate zone Up country (IU) have been delineated in the country depending on the climatic zones (Department of Agriculture, 1979).

The elevation classes mentioned above namely low country, mid country and up country which are located below 300 m, between 300-900 m and above 900 m of MSL respectively. These seven agro-climatic zones have been further divided into 46 agro-ecological zones based on the rainfall distribution within the year (Map 3). This map is the basis for crop selection and management in different areas and it is widely used in development work of the country.



Map 2: Climatic Zones in Sri Lanka



Map 3: Agro-ecological zones of Sri Lanka

2.2 Political and Economic Profile

a) Economic growth

With the successful ending of the 30 year war in Sri Lanka in 2009 and the return of peace and political stability throughout the country, the economy has shown steady positive growth. During the year 2014 the country was able to maintain a real economic growth of 7.4 percent compared to 7.2 percent in 2013. The favourable macroeconomic conditions supported by relaxed monetary policy stance on par with low and stable inflation rate contributed towards sustaining the economic growth on the domestic front.

The recovery in United States (US) economy and gradual recovery of Eurozone supported export growth from the external front. However, fall in global commodity prices promoted imports and thereby growth in net external demand was affected economic growth unfavourably. As per the estimates of production approach, economic growth of the country was mainly governed by the growth in the Services sector followed by the healthy performance in the Industry sector, while the contribution from Agriculture sector remained low consequent to negative impact of the unfavourable weather conditions.

On the expenditure front, increased domestic expenditure was due to growth in both consumption and investment, while net external demand slowed down during the year, both in nominal and real terms. Expenditure on government consumption grew with the increase in expenditure on salaries and wages, and purchases of other goods and services while expenditure on private consumption expanded, encouraged by low interest rates and the increase in disposable income.

The increase in investment expenditure was a combined effect of the growth in both the government and the private sector investments mainly on account of construction activities. Consequently, investment increased to 29.7 percent of the Gross Domestic Product (GDP) in 2014. Meanwhile, both domestic and national savings of the country have increased to 21.1 per cent and 27.0 percent of GDP, respectively. The GDP at current market prices was calculated at Rs. 9,785 billion (US dollars 75 billion) in 2014 compared to Rs. 8,674 billion (US dollars 67 billion) in 2013.

Accordingly, GDP increased by 12.8 percent during the year with a slight deceleration compared to 14.5 percent growth recorded in 2013. This was mainly caused by deceleration in the overall price level of the economy, as measured by the GDP implicit deflator which declined to 5.1 percent during the year from its 6.7 percent growth in 2013, albeit the real economic growth held above the previous year's growth. GDP per capita was estimated at Rs. 473,261 for 2014, compared to Rs. 423,484 in 2013. GDP at current market prices (Rs. billion) was 4,835 in the year 2009 more than doubled to an estimated Rs. 9,785 billion in 2014. Per capita GNP at market prices in 2000 was US$ 852 and has risen to US$ 3,536 in 2014 (Central Bank Annual Report 2014).

Sri Lanka's Human Development Index remain at 0.740 while, ranking at 96th among 177 countries in 2002 when compare to the value of 0.715 in 2012 positioning the country at 92nd. Inflation, as measured by the change in the Colombo Consumers' Price Index (CCPI) (2006/07=100), which is compiled by the Department of Census and Statistics, declined to -0.3 percent in September 2015, compared to -0.2 percent recorded in the previous month, on an year-on-year basis. Annual average inflation declined to 0.7 percent in September 2015 from 1.0 percent in August 2015 (CBSL- 2015).

b) Agriculture

The contribution from agriculture, industry and service sectors for the GDP in year 2013 were 10.8 percent, 31.1 percent and 58.1 percent respectively. Adverse weather conditions slowed the growth of agricultural sector by 0.3 percent in 2014 when compared to 4.7 percent in 2013. As a result, the share of the Agriculture sector decreased from 10.8 percent of GDP in 2013 to 10.1 percent of GDP in 2014.

Compared to the previous year, the paddy and rubber sub sectors declined drastically, while the tea sub sector slowed marginally. While both minor export crops and other agricultural crops sub sectors contracted during the year, favourable expansions in sub sectors of other food crops, coconut and fishing contributed positively towards the growth in the Agriculture sector. The decline in paddy sub sector was the combined effect of the decrease in production in both the Yala and Maha seasons. Tea sub sector was also moderated due to unfavourable weather conditions which prevailed during the year and also the decline in demand from some of the major export destinations.

Positive growth in highland crops and vegetables is mainly attributed to the growth in the other food crops sub sector. This was supported by the farmers shifting from paddy cultivation to supplementary crops due to limited supply of water during the first half of the year. Moreover, the substantial recovery of the coconut sub sector also restrained the negative impact of the other sectors within the Agriculture sector.

In the meantime, growth in the sub sectors of livestock, plantation development, and firewood and forestry also contributed for positive growth in the Agriculture sector. The paddy production in 2014 declined by around 27 per cent to 3.38 million tonnes. It is attributed to

drought weather conditions decline in extent cultivated which resulted in a decrease in the quantity of rice produced during the Yala and Maha seasons of the year.

Meanwhile, the government encouraged farmers to cultivate other crops, which require less water in paddy lands, in order to reduce water usage from depleted reservoirs during the Yala season. Consequently, the government introduced several measures to avoid the increase in rice prices including the reduction of tariff on rice imports and the maintenance of a buffer stock of rice under the Department of Food Commissioner.

In terms of land use, the area used for Paddy, Tea, Rubber and Coconut cultivation in 2010 were 734, 967ha 222,000 ha, r 116.000 ha, and 395,000 ha respectively. There are a number of other crops serving the domestic and/or export markets, such as cinnamon, coffee, cloves, pepper, cocoa, cardamom, maize, chilli, onions and potatoes. The labour force in agriculture sector is on average the more impoverished among the population.

c) Industry

The Industry sector of the country recorded a significant growth of 11.4 per cent in 2014 compared to 9.9 percent in 2013. This growth was due to the positive contribution from all major sub sectors, thereby increasing the Industry sector share to 32.3 percent of GDP, from 31.1 percent of GDP in the previous year. The subsectors of construction and manufacturing grew significantly during the year contributing to the high growth in the Industry sector.

Meanwhile, growth of mining and quarrying sub sector benefited from the expansion in construction activities. In the meantime, the subsectors of electricity, gas and water decelerated compared to the previous year, primarily due to the decline in the high value added hydro based power generation. In terms of value addition, compared to 7.9 percent in 2013 the manufacturing industry which accounts for around 16 percent of Gross Domestic Product (GDP) recorded a substantial growth of 8.5 percent in 2014.

The growth of manufacturing industry was largely attributed to increased domestic and international demand and the favourable domestic macro-economic environment which prevailed during the period. Substantial growth of 11.5 percent and 8.5 percent respectively were observed in export market oriented industries, such as textile, wearing apparel and leather products category as well as chemical, petroleum, coal, rubber and plastic products category respectively in 2014.

The food, beverages and tobacco products category, the major contributor to domestic market oriented industries showed a notable performance and recorded a growth of 8.1 per cent benefiting due to lower interest rate, low inflation and enhanced business and consumer confidence in 2014 (CBSL 2014).

d) Services

The Services sector is the largest sector of the economy with a share of 57.6 percent of GDP. The sector grew by 6.5 percent in 2014 compared to 6.4 percent increase in 2013. This growth was mainly due to the expansion in wholesale and retail trade sub sector, largely on account of the growth in the domestic trade along with import trade activities. Furthermore, the banking, insurance and real estate sector also grew at a higher rate compared to the previous year.

The sub sector of wholesale and retail trade, which accounted for 39.5 percent of the Services sector, recorded an 8.0 percent growth during 2014 when compared to 5.5 percent growth in 2013. The sub sector of import trade grew by 9.4 percent during 2014 compared to the slower growth of 2.9 percent recorded in 2013. This improvement was reflected by 9.5 percent growth in the import volume index in 2014, compared to the contraction of 1.5 percent experienced in 2013. Consequently, import of consumer goods increased significantly by 20.2 percent during the year compared to the growth of 6.6 percent in 2013, due to higher demand for both food and drink, and other consumer goods.

The surge observed in the import of vehicles was the main contributor to the growth in other consumer goods imports. Moreover, intermediate goods imports, the major contributor in import volumes, grew by 10.6 percent in 2014 recovering from 6.1 percent contraction in 2013. The exports volume index that grew by 6.7 percent in 2013 declined to 4.3 percent during 2014, mainly due to the contraction of exports in the fourth quarter of the year.

Industrial exports, the major contributor to the country's goods exports, grew by 3.6 percent in volume terms during the year compared to 7.0 percent in 2013. Exports of Coconut and Tea recorded a higher growth in 2014. But the exports of Rubber continued to reduce in volume terms. However, in contrast to the contraction in the previous year, the mineral export volumes rebounded during 2014.

Further, the supply side impetus towards the continuous growth in the domestic trade sub sector was governed by the higher industrial production observed during 2014. Further, development of communication and road and networks facilitated the required trade linkages thereby supporting the value added in the domestic trade sub sector (CBSL 2014).

e) Fisheries

The total fish production in 2014 grew by 4.3 per cent to 535,050 tonnes supported by an increase in marine and inland fish production by 3.0 per cent and 13.2 per cent respectively. In marine fish production, offshore sector fishery increased by 1.4 per cent while coastal fish production including the lagoon fisheries, grew by 4.1 per cent. The lower than expected growth of the offshore fish production was largely attributable to unfavourable weather conditions that decrease the fishing activity in the seas.

Consequently, the share of deep sea fish production in total marine fish production which was 40 per cent in 2013 declined to 39 per cent in 2014. . In the meantime the average daily production of canned fish increased to about 14,200 fish cans per day by 16.9 per cent from 12,150 fish cans per day in 2013 whilst imports of canned fish declined by 14.9 per cent to 18,591 tonnes in 2014 from 21,835 tonnes in 2013.

f) Energy

Hydropower, biomass and petroleum are the three primary sources of energy supply in Sri Lanka. The relative proportions of these three sources of energy in the year 2005 were 8, 47 and 45 per cent respectively. Biomass fuel is the primary source of energy used for household cooking. Even though the number of households using biomass fuel for cooking has been progressively decreasing, it was estimated that as much as 82.8 per cent of households still use biomass fuel in 2004.

It must be noted that, besides the three sources of energy mentioned above, other sources such as solar power and muscle power of draught animals have traditionally been used to a considerable extent. The solar energy is used for drying agricultural and other products. While the muscle power of draught animals are used for hauling goods and for some agricultural practices.

But they do not generally enter into reckoning when considering the energy balance of the country. Right up to the late 1980s, electricity generation was carried out predominantly through the use of hydropower while thermal generation mainly serves as a standby source. Since then, much of the remaining potential sources of hydropower generation being tapped as the demand for electricity increased drastically.

The thermal power generation had to be resorted to cater the increasing demand. The annual hydroelectricity power generation which depends on rainfall in the island fluctuated around 3000 GWh between the period 2000 and 2005. Total Electricity generated in 2005 for supplying the national grid was 8769 GWh. Of this total 39.4% and 56.6% were generated from Hydro and thermal sources respectively. While the total power generated in 2013 was 12,019.66 GWH showing a 27% increase since 2005.

According to the National Energy Balance 2013 (SEA, 2014), about 50% of the total energy generation came from thermal sources. Table 2 and table 3 are respectively indicates the total energy generation from different sources and the contribution of different fuel types to the thermal power generation in 2013.

Table 2 - Total electricity generation (GWh) in 2013

Mode	Quantity (GWh)
Conventional Hydro Power	6,010.10
Thermal Power Plants	4,819.72
Small Hydro Power	908.39
Wind Power Plants	234.58
Biomass Power Plants	26.39
Solar Power	1.68
Off-Grid, Non-Conventional	18.80
Total Gross Generation	12,019.66

Source: National Energy Balance, 2013

Table 3 -Thermal electricity generation in 2013 according to the fuel type

Fuel type	Gross Generation	
	(GWh)	(TJ)
Fuel Oil (HSFO 180 CST, FO 1500)	1357.792	4888.051
Diesel	422.580	1521.288
Coal	1465.393	5275.415
Residual Oil (HSFO 380 CST, FO 3500)	721.225	2596.410
Fuel Oil (LSFO 180 cst)	460.213	1656.767
Naphtha	388.527	1398.697
Biomass Power Plants	26.390	95.004

Source: National Energy Balance, 2013

Rural electrification through the expansion of the national grid into rural areas has received special attention by successive governments. Total coal power generation capacity of the country increased to 900 MW with the addition of the second phase of the Norochcholai coal power plant of 600 MW to the national grid while, strengthening the low cost power generation capacity.

The subsector of electricity, gas and water expanded by 4.5 per cent in 2014, compared to 10.3 per cent growth in 2013. Electricity, which has the largest share within the sub sector, recorded a growth of 4.2 per cent compared to the growth of 11.3 per cent in the previous year. The contraction is due to the reduction in hydropower generation by 34.3 per cent due to dry weather conditions prevailed in the catchment areas, particularly during the first half of the year.

Meanwhile, the total thermal based power generation, which has a lower value added compared to hydropower generation due to higher input cost recorded a significant growth of 58.8 per cent. However, the addition of the second phase of the Lakvijaya coal power plant to the national grid, which is relatively cost effective to other thermal power generations, supported positively to the growth within the sub sector during third quarter of the year.

Diesel consumption during the first four months of 2014 increased considerably mainly due to higher oil based power generation needs as a result of the irregular coal power generation and the drought conditions at the beginning of the year. Meanwhile, the kerosene sales fell by 3.2 per cent during the year following the decline of 11.9 per cent in 2013 due to the continued increase in the level of electrification of households in the country.

Meanwhile, the gas sub sector expanded by 9.3 per cent in 2014 over the 1.6 per cent growth in 2013. This was reflected by 6.4 per cent increase in total gas sales in volume terms compared to 3.2 per cent growth in 2013. Meanwhile, growth of the water sub sector in 2014 is 5.1 per cent, compared to the 3.8 per cent growth in 2013. This growth was largely attributable to the increase in the volume of water, distributed by the National Water Supply and Drainage Board (NWS&DB) by 9.0 per cent. Consequently, the number of consumer accounts of NWS&DB also increased by 7.3 per cent in 2014 reflecting the growth in the water sub sector.

g) Transport

Transport sector has shown rapid growth in recent years. The registration of new vehicles increased from 82,401 in 1995 to 229,665 in 2005 and by 2014 another 3,105,854 additional vehicles have been registered. The highest rates of increase have shown in the categories of motor cycles, three wheelers and private cars. The growth trend is expected to continue. The total vehicles registered now including buses, dual purpose vehicles, goods transport vehicles, land vehicles, and others stand at 5,633,234.

With regards to the fuel consumption by the transport sector, petrol consumption has shown increases but diesel has shown decreases and has increased again by 2014. Petrol use increased sharply from 224,000 to 463,000 tonnes during the period 2000 to 2005 and for motor vehicles alone rose to 722,218 tonnes by 2013. During the same period, Diesel consumption decreased from 1,762,000 tonnes to 1,690,000. But the Diesel consumption rose to around 1,900,000 tonnes by 2014 (Ceylon Petroleum Corporation). As shown in Table 4, the consumption of petroleum products grew in 2014 with increased fuel oil power generation and increased demand from the transportation sector. During the year, local sales of Petrol and Diesel grew by 6.0 per cent 14.4 per cent respectively.

Table 4 - Estimated fuel usage by petrol vehicles

Engine Type	Vehicle Type	Fuel economy (km/l)	With Catalytic Converter		Without Catalytic Converter	
			Number of vehicles	Fuel use (tonne)	Number of vehicles	Fuel use (tonne)
4-Stroke engines	Motor cars	12	118,756	58,422	359,319	168,692
	Motor Tricycle	25		0	794,495	179,039
	Dual purpose	8	10,312	7,609	91,789	64,640
	Lorries	3	3,353	6,598	16,783	31,517
Total			132,421	72,629	467,891	443,888
2-Stroke engines	Motor Cycles	75			2,738,429	205,701

Source: Department of Motor traffic, 2014

h) Construction

Significant growth is observed in construction sub sector by 20.2 per cent during 2014, in comparison to 14.4 per cent growth during 2013. Increased public investments in infrastructure development activities partly reflected the growth in the construction sub sector. Southern Expressway (Phase II), Colombo Outer Circular Highway (Phase I and Phase II), Northern railway line and Multi-purpose Deduru Oya Reservoir Project were some of the major public investments progressed during the period.

Further, the public sector housing development projects for providing permanent houses for the families living in temporary structures were also perform during the period. The private sector involvement in the construction sub sector was reflected by 22.3 per cent increase in credit to the private sector by commercial banks for construction activities during 2014, compared to 16.6 per cent in 2013. Meanwhile, the credit granted by the commercial banks for personal housing has also increased by 28.7 per cent during 2014, compared to 9.1 per cent in 2013 showing the increase in the personal housing construction activities.

i) Health

Although Sri Lanka enjoys a remarkably high life expectancy for a developing country, control of vector borne diseases need attention. Countrywide surveillance on vector borne diseases such as Dengue, Malaria, Filariasis, and Japanese Encephalitis is in operation successfully in Sri Lanka. As one of the strategies for controlling the spread of vector borne diseases the authorities

are compelled to use insecticides on a regular basis.

Another matter of importance in the context of environmental pollution is the improper management of hazardous clinical waste, a matter that should receive the attention of the health authorities in collaboration with other concerned institutions. However, during the last few years, a lot of attention has been given to this area by the Ministry of Health resulting in considerable improvement.

The government continued its efforts to improve the human resource and physical infrastructure base of the health sector during the years. By end 2014, there were 601 government hospitals with 76,918 beds, recording 3.7 beds per 1,000 persons. There were 17,903 qualified doctors in the state health sector by end 2014 recording a doctor for every 1,155 persons, and 31,964 qualified nurses, a nurse for every 647 persons. Meanwhile, there were 95 government Ayurvedic Hospitals with 4,906 beds, while the number of registered Ayurvedic physicians was 21,505 as at end 2014. Total Govt. Expenditure on Health was Rs 119.5 billion.

Increasing incidence of Non Communicable Diseases (NCD), particularly due to the ongoing demographic transition and epidemiological transition, also continued to attract the attention of health authorities. More than 70 per cent of annual deaths in Sri Lanka are estimated to be due to chronic NCD such as cardiovascular diseases, diabetes, cancers and chronic respiratory diseases, which are also leading causes of morbidity and disability.

The National Policy on chronic NCD prevention addressing minimising the occurrence of and strategies for the reduction of shared modifiable risk factors such as smoking, alcohol, obesity, unhealthy diet and sedentary lifestyles has already been adopted. “Healthy Lifestyle Centres” (HLCs) have been established across the country at the primary healthcare level, which provide services to check fasting blood sugar, Body Mass Index (BMI), total cholesterol and blood pressure.

In addition, a National Policy on Cancer Prevention and Control was formalised during the year with the objective of addressing the leading causes of preventable cancers such as oral, breast and cervical cancer. Several digital and print media awareness programmes have been held in view of reducing preventive cancers through early detection.

To address the prevalence of the Chronic Kidney Disease of Uncertain Origin (CKDu), the

government strengthened screening and haemo dialysis facilities in high risk areas while taking steps to prohibit the importation of three agrochemicals suspected to cause the disease**.** Currently the most likely cause is the effect of the mixtures of chemicals, people in these areas are exposed. The case highlights the need to better the control of hazardous chemicals and to consider the toxicity of chemical mixtures. Furthermore the case show the importance of the precautionary approach for chemicals.

j) Poverty and Unemployment

Poverty in Sri Lanka is primarily a rural phenomenon; about 85 per cent of the poor households live in rural areas. The incidence of poverty is highest among casual labourers, small farmers, estate workers and rural women. The average income per household is lowest in the Uva Province.

Sri Lanka has a long tradition of providing income support and economic advancement assistance to the poor. The level of poverty has continuously declined over the years with the country achieving the Millennium Development Goal (MDG) of halving poverty between 1990 and 2015. The unemployment rate estimated by the Special Labour Force Survey declined to 7.7 per cent in August 2005 from 8.3 per cent in 2004. In absolute terms, the number unemployed increased from 517,000 to 684,000 between 2000 and 2004.

2.3 Overview of Major Environmental Problems in Sri Lanka

Though Sri Lanka makes considerable effort to conserve the existing natural environment, the country is experiencing several environmental problems at present. Among them, land degradation and forest cover depletion, fresh water pollution, haphazard disposal of garbage and air pollution can be considered as main problems.

2.3.1 Land degradation

In simple terms, the land degradation means the lowering of productive capacity of the land temporarily or permanently through natural phenomena or through human interference. Nayakekorala in 1998 identified 12 processes of soil degradation in the country, which are associated with land degradation that include; soil erosion, fertility decline, dystrification or lowering of soil pH by increasing acidic compounds in the soil, eutrophication, salinization

/alkalization, sealing and crusting of soil, compaction, water logging, soil subsidence, aridification, pollution and conversion of agricultural lands/ loss of agricultural lands.

In addition to the above processes, excessive ground water extraction, water pollution and loss of lands due to landslides have also been identified as important degradation processes in the context of Sri Lanka. Soil erosion and fertility decline are the two most widely spread land degradation processes among them. However, even though soil erosion problem in Sri Lanka has been studied to great extent, the other processes have not been given due recognition.

Review of literature on land degradation in Sri Lanka reveals that there is dearth of information on certain aspects to fully comprehend the process of land degradation in the country and plan for a successful mitigation program. For instance, it is seen that the problem of soil erosion has been sufficiently studied in terms of rates, hazards, land use effects, erodibility, erosivity, erosion hazard potential etc.

However, information on root causes of soil erosion, its severity, affected extents, spatial distribution and impacts on productivity etc. are very scanty. But, incidence of these processes appears to be increasing and attention is being paid to them since recent times. Biological aspect of land degradation is another category which has not been given due attention in the country.

Landfilling and dumping of waste leads to contamination of soil. Furthermore open burning of waste and releases of pollutants and ashes that can contain Dioxins and other unintentional POPs and other pollutants such as heavy metals impact soil quality and lead to soil pollution and soil quality degradation. Soil pollution can also result from application of fertilizer and use of pesticides (pesticides and degradation products as well as unintentional POPs contained in the pesticides).

2.3.2 Forest cover depletion

The natural forest cover of Sri Lanka at present is a little less than 25 percent of total land area. This percentage increases to 30 percent when the planted forest cover is included. The main reason for the forest cover destruction is the increment in population that is tripled in a time span of 64 years after independence. Deforestation can result in many other problems including soil erosion, landslides, floods, fauna and flora degradation etc. that ultimately disturb the environment and livelihood of people. Therefore, the country's aim is to restore the forest cover up to 32 percent of the total land area during 2016-2018.

2.3.3 Freshwater pollution

Being a country having an average rainfall of 2000 mm throughout the year, there are 103 natural river basins in Sri Lanka. In addition, there are a significant number of reservoirs in the country including ancient and recently constructed water bodies. The total area allocated for these reservoirs is 169,941 hectares. The groundwater resources in the country are estimated at about 7,800 million m^3 per year and it is estimated that about 72 percent of the rural population relies on groundwater for domestic use.

It is difficult to comprehend the trend of water quality in public water bodies in the country due to insufficient data. However, the Sri Lanka National Water Development Report (2006) pointed out a variety of quality concerns in Sri Lanka, including contamination by nitrate and bacteria in underground and surface waters mainly due to poor sanitation and untreated wastewater or insufficient wastewater treatment, toxic chemicals (partly including POPs and POPs like chemicals and hazardous pesticides) from industrial and agricultural activities, and eutrophication in lakes/reservoirs (UNESCO and MoAIMD 2006).

The contamination of groundwater used as drinking water with heavy metals such as Cadmium may contributed to the causation of Chronic Kidney Disease of unknown aetiology (CKDu) that is critical in some areas of the country. Table 5 gives the number of patients affected due to CKDu up to the January 2016.

Table 5- Chronic Kidney Disease of uncertain aetiology –patient counts

District	Number of patients (up to the January 2016)
Anuradhapura	13032
Polonnaruwa	6046
Kurunegala	1706
Trincomalee	76
Ampara	389
Badulla	943
Vauniya	1684
Matale	1706
Mulatiu	131
Monaragala	268
Hambanthota	488
Total	**26,469**

Source : Ministry of Health, Nutrition and Indigenous Medicine

Furthermore, plastic is released to surface waters and cause serious pollution and impact to biota. In addition to inland water, such pollution reaches coastal water and even the open sea. In particular, plastic debris contaminate the surface water and today plastic is several times more prevalent in sea water compared to plankton. Due to accumulation of POPs in such plastic debris and the ingestion of plastic by fish and marine mammals, such mechanism can lead to the transfer of POPs to wildlife and the food chain.

2.3.4 Haphazard disposal of waste

Sri Lanka is developing with increasing population that is generating wastes in the urban centres and rural villages. These generations are now exceeding the capacities of the respective local authorities. Further, general waste collected from the hospitals and industries are sometimes mixed with hazardous waste. Government and private entities have already taken many initiatives to address this issue. However, this condition still remains as one of the main environmental issues in the country.

a) Disposal of municipal waste and open burning

Haphazard disposal of municipal waste can be observed in main municipality areas such as Colombo, Moratuwa, Kandy, Matale, Gampaha and Negombo. Among other reasons, lack of proper landfilling facilities or recycling methods associated with poor attitude of the household are the main causes of the problem. Many drainage channels in urban areas are blocked due to non-degradable waste such as polythene and plastics that slow water-flow and provides breeding places for disease vectors such as rats and mosquitoes. The open dumping sites (e.g., Gohagoda in Kandy) cause pollution of ground and surface water sources too.

Open burning of waste is widespread in the country and cause bad odour and air pollution including releases of unintentional POPs, PAHs and other pollutants in neighbourhoods. It contributes to atmospheric pollution (PM_{10}, $PM_{2.5}$, Dioxin/UPOPs, PAHs, carbon black) and is known to cause serious health issues.

b) Disposal of hazardous waste including e-waste and other POPs containing waste

Due to the lack of proper waste management practices, not only ordinary waste but also

other hazardous waste is dumped and partly burned in the open. Open burning of waste including the burning of e-waste to recover precious metals releases unintentionally not only POPs but also other POPs included in such waste such as listed brominated flame retardants (POP-BFRs PBDEs, HBCD) and other chemicals, small particles and heavy metals in the remaining ashes.

c) Initial activities to reduce such waste dumping

The Government of Sri Lanka has paid special attention to address the problem through environmental projects such as 'Pilisaru" waste management project and policy interventions including attempt for application of economic instrument for management of e-waste and pesticide containers and banning the use of lunch sheets and shopping bags under 20 µm in gauge. These activities have to be streamlined and strengthened in the future to overcome the problem completely.

2.3.5 Air Pollution

Unlike in many of our Asian neighbours, we are fortunate that Sri Lanka has not yet experienced acute air quality problems as a result of industrial expansion, increasing vehicular traffic and thermal power generation and rapid urbanization. Emissions from motor vehicles is the most significant contributor to air pollution in Sri-Lanka. That contributes around 55-60 percent of total emissions of the country.

Other common sources of emissions industries, open burning and household emissions. They contribute around 20-25 percent and 20 percent to total emissions respectively. The transport sector accounts for about 60 percent of total fuel consumption in Sri Lanka. The Western Province in Sri Lanka (area including the districts of Colombo, Kalutara and Gampaha) commonly refered to as Colombo Metropolitan Region (CMR), along with Kandy town area, Galle, Kurunegala, and Puttlam have been identified as higher air pollution areas mainly due to vehicular air pollution. Pollutants include fine particles, PAHs, unintentional POPs and further pollutants.

Indoor air pollution (IAP) from combustion of solid fuels for cooking and space heating is one of the ten most important risk factors contributing to the global burden of disease. It is estimated to account for over 1.5 million premature deaths and 38.5 million Disability-Adjusted Life Years (DALYs). The World Health Organization (WHO) estimated that the number of deaths attributable to IAP in Sri Lanka in 2004 was 4300.

2.4 Institutional, policy and regulatory framework

2.4.1 Introduction

The Constitution of Sri Lanka (1978) recognizes both the responsibility of the State as well as the individual in Environmental Management and Protection by the following statements; *"The state shall protect, preserve and improve the environment for the benefit of the community"* and "*It is the duty of every person in Sri Lanka to protect nature and conserve its riches"*. The pledge given in the 1978 constitution to safeguard the environment was formally institutionalised with the enactment of the National Environmental Act No. 47 of 1980. In 1990 a separate line Ministry was established by the government giving priority to the subject of environment.

Sri Lanka was also among the first few countries to recognize the objectives of the World Conservation Strategy (WCS) of 1980. An important recommendation of the WCS was that each country should prepare its own National Conservation Strategy (NCS) to guide the management and rational utilization of its natural resources in achieving the development objectives of the country. Work on the preparation of a NCS for Sri Lanka was initiated in 1982 and was completed in 1988. It identified priority areas and a strategy to deal with the problems of environmental degradation in Sri Lanka.

Strategic planning for environment commenced in the 1980s with the formulation of National Conservation Strategy (NCS). The original NCS has been regularly updated in the form of a National Environmental Action Plan (NEAP). The NEAP first published in 1991 covered the period 1992 – 1996 and the first update published in 1993 covered the period 1995 – 1998. The third update of the NEAP covered the period 1998 – 2001.

A National Environmental Policy (2003) has been developed by the Ministry of Environment and many sectoral policies have been developed to integrate environmental concerns and to facilitate implementation of environmental policies in the journey of sustainable development. The recently developed Cleaner Production (CP) Policy and strategy make the approach of CP practices throughout the life cycle of products, production processes and services. Implementing this policy will facilitate meeting the objectives of the Stockholm Convention.

The first legislative Acts relating to the environment were passed by the British colonial government to assert authority and control over natural resources. The Crown Lands Encroachment Ordinance (1840) declared "all forests, waste, unoccupied and uncultivated lands

shall be presumed to be the property of the Crown until the contrary thereof be provided". Subsequently a number of conservation and protection oriented Acts were passed to mitigate the environmental damage this Act encouraged such as the Forestry Ordinance (1907), Fauna and Flora Protection Ordinance (1937) and the Soil Conservation Act (1951).

Several other legislative Acts were introduced in the 1980s. The Coast Conservation Act was passed 1981 and amended in 1988. The National Heritage Wilderness Area Act No. 3 of 1988 is cited as the national heritage Act. The National Environmental Act No. 47 of 1980 is the most comprehensive Act relating to environmental management and protection. This Act has been amended in 1988 and in 2000. From the late 1980s to the mid-1990s, several environments related Acts were revised to focus on a more participatory approach to environmental management. The revisions in 1995 to the Fisheries Act envisaged setting up of fishery management committees, the 1988 revision to the Irrigation Ordinance mandated farmer organizations, and the Forest Ordinance revision of 1988 contained provisions for participatory forestry.

2.4.2 Roles and responsibilities in chemicals management

a) Governmental authorities

Sri Lanka being predominantly an agricultural country had never embarked on a major industrialization drive, though in sixties and seventies there were a few attempts towards industrialization with a view of import substitution such as production of Sulfuric acid, Caustic soda etc. In recent years, the emphasis has been on the provision of services. However, today there is some evidence of an inclination towards moving into manufacturing including advanced IT manufacturing, automobiles, some equipment etc.

Almost all chemicals that are used in the country are imported and basically none are produced at present. They do come in as finished or intermediate goods through sea and air ports in Sri Lanka. The existing laws, regulations are more focused on regulating the import at the points of entry in the first instance and to minimize the adverse impacts thereafter.

The first NIP has substantially discussed the institutional, legal and administrative structure related to chemical management in Sri Lanka. Therefore, the current NIP basically focuses on summarizing the related content in the first NIP while including the changes that

happend from that time by providing the findings of the report on Capacity Building for Promoting Synergistic Implementation of Basel, Rotterdam and Stockholm Convention in Sri Lanka that was made through a series of detail discussions among all stakeholders including sectors of government, non-governmental organizations and private sector participation.

The tables 6 and 7 indicate legal instruments and related organizations and the type of products imported to country and the relevant authorities for regulating the import respectively. While table 8 summarizes the administrative activities related chemicals and government institutes involved in their management.

Table 6 - Legal instrument and related authority

Legal Instrument	Related Organization
National Environmental Act	Ministry of Mahaweli Development and Environment Central Environmental Authority
Disaster Management Act	Disaster Management Centre
Factories Ordinance	Department of Labour
Control of Pesticides Act Regulation of Fertilizer Act	Ministry of Agriculture Fertilizer Secretariat
Customs Ordinance	Sri Lanka Customs
Petroleum Ordinance Ceylon Petroleum Corporation Act	Ceylon Petroleum Corporation
Chemical Weapons Act Precursor Act	National Authority for Chemical Weapons Convention
Explosive Act	Ministry of Defense
Mines & Minerals Act	Geological Survey and Mines Beure
Urban Development Act	Urban Development Authority
National Medicines Regulatory Authority Act	National Medicines Regulatory Authority Ministry of Health
Atomic Energy Authority Act	Atomic Energy Authority
Import and Export Control Act	Department of Import and Export Control
Consumer Affairs Authority Act	Consumer Affairs Authority
Excise Ordinance	Department of Excise

Source; National Chemical Profile, 2015

Table 7 - Recommended authorities for import of various products

Type of import	Relevant Authority
Insecticides and pesticides substances	Pesticide Control Registrar's Office
Crude Oils, gas and petroleum products	Petroleum Ministry
Non-pesticides chemicals	Ministry of Industries /State Trading Corporation
Radioactive substance	Atomic Energy Authority
Spirits (Alcohol)	Excise Department
Chemicals listed under the "Convention against illicit traffic in Narcotic drugs and Psychotropic substances, Act No.1 of 2008	Precursor Control Authority
Chemical under BRS Convention (except pesticides) and also disinfectants and mosquito repellent (temporary until a clear decision on the authority is made)	Central Environmental Authority

Source; National Chemical Profile, 2015

Table 8 - List of state bodies and their activities with relevance to chemicals management *(this is not to be mapped on one to one)*

Administration Activities	***Government Bodies***
Labour Protection	Board of Investment Sri Lanka
Environmental Protection	Central Environmental Authority (CEA)
Protection of public health	Ceylon Petroleum Corporation
Trade and Industry	Department of Customs
Safety of food and natural resources	Department of Import and Export Control
Safety and supply of energy resources	Department of Labour
Safety of ports	Disaster Management Centre
Dangerous cargo management	Industrial Technology Institute
Fire protection and Emergency response	Marine Environment Protection Authority (MEPA)
Civil Defense	Ministry of Agriculture
Land use planning	Ministry of Defense & Urban Development
Transport of Hazardous goods	Ministry of Environment and Renewable Energy
Disaster Management	Ministry of Health, Nutrition and Indigenous Medicine
National Physical planning	Ministry of Industry & Commerce
Occupational Safety and Health at workplaces	Ministry of Transportation
	National Authority for Chemical Weapons

Administration Activities	***Government Bodies***
Standard setting – i.e. limits of chemicals in consumer products Approval of Specific chemicals for use Regulating chemicals import and exports Implementation of GHS system Monitoring and measurement Trade and Industry Waste Management Hazardous waste management Regulation of trade Investment Promotion and facilitation Awareness creation	Convention National Physical Planning Department Ports Authority Department of the Registrar of Companies Registrar of Pesticides (ROP) National Fertilizer Secretariat Sri Lanka Standards Institution (SLSI) Poisons Information Centre Industrial Development Board National Medicines Regulatory Authority Precursor Control Authority Waste Management Authority of Western Province Local Authorities North Western Province Environmental Authority Consumer Affairs Authority (CAA) Government Media

Source; National Chemical Profile, 2015

There are several projects that started recently to streamline the chemical management in Sri Lanka. Their key projects and activities are included as follows:

1. **Project on Strengthening National Capacities for Sound Management of Priority Industrial Carcinogens with special emphasis on Asbestos and upgrading National Chemical Profile in Sri Lanka under SAICM**

This project will jointly be carried out by the Ministry of Health and the Central Environmental Authority with the assistance of other relevant stakeholders, where some specific activities have been identified for each sector. This project will contribute to strengthening the capacities of Sri Lanka to manage industrial carcinogens in a sound manner.

It will also provide technical assistance to enable Sri Lanka to set priorities, identify core preventive measures, and develop programme with the aim to reduce risk to workers' health arising from the use of carcinogenic substances. This project will also help to decide on suitable substitutes for Asbestos. This will be funded by the World Health Organization (WHO). The project is expected to carry out the following activities;

- Upgrading the National Chemical Profile
- Setting up priorities for sound management of industrial carcinogens including carrying out estimate of burden of diseases attributable to industrial carcinogens with WHO assistance
- Identification of preventive interventions for sound management of priority industrial carcinogens
- Development of a national program for sound management of priority industrial carcinogens

It is important to note that Ministry of Health was unable complete the activities related to industrial carcinogens as the funding from World Organization has not been released. But the activities assigned for Central Environmental Authority namely formulation of National Chemical profile was completed as scheduled.

2. National Chemical Profile Sri Lanka

The Agenda 21 which is a comprehensive document outlining the responsibilities of states towards the achievement of sustainable development was adopted by the Heads of States or the Governments at Rio Conference on Environment and Development termed as United Nations Conference on Environment and Development (UNCED) held in 1992 in Rio de Janeiro, Brazil.

Development of the National Chemicals Management Profile which strengthens national capabilities and capacities for the management of chemicals is one of the items in this document. The first National Chemical Profile of Sri Lanka had been completed in 1997 and another report on the National Chemical Profile of Sri Lanka has been presented in 2002 prepared by the Environment and Management Lanka Private Limited (EML) under the coordination of Central Environmental Authority.

This project had been funded by the United Nations Institute for Training and Research (UNITAR). An updated National Chemical Profile of Sri Lanka has been completed. Table 9 summarized data indicated in the National Chemical Profile which has been extracted from the report of the Chemical Accident Prevention Project.

Table 9: Summarized data on chemical import per year

Chemical	Name	Total
A	Crude oil	4424299000
B	Acetone	103385.5
C	CaNo3	3710700
D	Methyl Ethyl Ketone	15000
E	Toluene	158285.5
F	HCL	301250.9
G	Pottasium Permanganate & related	203804
H	Triethanolamine	183602.7
I	Methanol	25323099
J	nitric acid	400
K	Pottasium hydroxide	51280
L	Sulfuric acid	1670200
M	Toluene Diisocyanate	4110
N	Phenolformaldyhide	10090003
O	Reactive dyes	776100
P	Azo dyes	806030
Q	Caustic soda	1670000
R	Formaldyhide ,	174000
S	Sodium hydrosulfite	250000
T	Chlorine	72540
U	Aqua ammonia	14050
V	Petroleum naptha	11832
W	Mixtures (toluene/PVC)	15619
X	Chloroform	1000
Total (KG)		**4469905292**

Note: The data on crude oil is in 2012 and the rest of the data is on 2013. Data from the original source is summarized, Source: Chemical Accident Prevention Project

a.1) Ministry of Mahaweli Development and Environment

At present the Ministry of Mahaweli Development and Environment is the focal point for management of chemical related conventions including the Basel Convention on trans-boundary movement of hazardous waste and Stockholm convention on the Persistent Organic Pollutants in Sri Lanka. In addition, it has signed the Minamata Convention on control of Mercury and has received the necessary funding support for ratification of the Convention.

The focal point for the Rotterdam Convention is Ministry of Agriculture while the Central Environmental Authority that comes under the Ministry of Mahaweli Development and Environment functions as the technical focal point for the industrial chemicals addressed by the Convention. However, the hazardous pesticides belonging to the same Convention are managed under the Registrar of Pesticides.

In addition to the above conventions, the Ministry of Mahaweli Development and Environment is co-chairing the meetings of the "National Platform for Solid Waste Management" (informally known as Apex body), established through a cabinet decision No08/0177/359/009 dated 14/02/2008 in Sri Lanka with the Ministry of Local Government and Provincial Councils and other stakeholders. Ministry is about to complete the overarching policy on waste management. The policy is expected to cover all types of waste including clinical waste, household waste, electronic waste and industrial waste.

As all these types of waste contain POPs the proposed policy will be helpful for the management of Persistent Organic Pollutant addressed by the Stockholm Convention too. Furthermore, the Central Environmental Authority manages one of the largest investments of municipal waste management in the country, namely “Pilisaru” project since 2007. It is important to notice that the total fund utilization of the project is Rs. 2,334 Million from Rs. 5,633 Million of the design project cost and thus having a financial progress of 41 percent. Further the project shows 16 percent for the period of January-March 2016. However, it was possible to implement the project on 123 local authorities out of the total of 336 Local authorities while covering 37 percent of local authorities during the period of 2007-2016. Table 10 shows the details and the status of the project as at March 2016.

Table 10- Details and status of the Projects implemented by Pilisaru Project as at March 2016

Project	Completed	On going	Total
Compost plants	104	26	130
Biogas plants	1	11	12
Incinerators	0	1	1
Resource Centres	16	115	131
Total	121	153	274

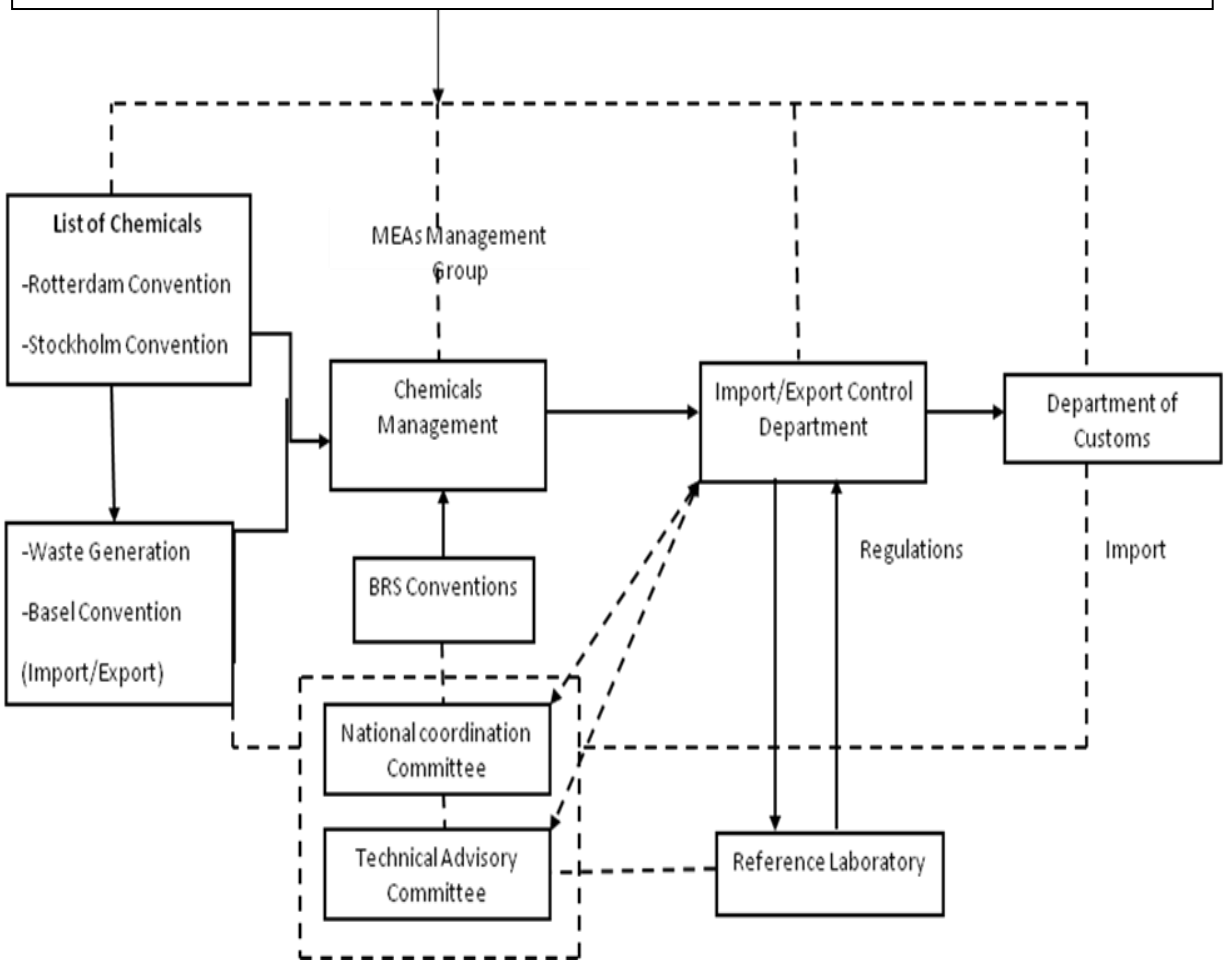
Source: Pilisaru Management Project

The Ministry of Mahaweli Development and Environment handles the meetings of National Coordination Committees (NCC). Matters related to the BRS Conventions are addressed together in the meetings considering the synergies among the Conventions. Following the same principle all national stakeholders related to BRS Conventions are attending to NCC. At present, it is the highest level of policy making body related to the chemical management in the country.

In addition to these management aspects, the Ministry of Mahaweli Development and Environment has already scheduled four main projects on chemical management of Sri Lanka namely *"Regional Project on PBDEs", "Environment sound management of PCBs contained and contaminated equipment in Sri Lanka", "Project on building policies for the ratification of Mercury Convention and sound management of Lead in batteries".* The Cabinet has already given approval for the programme consisting of the above projects to implement it through the Chemical Secretariat already established in the Ministry of Mahaweli Development and Environment.

These chemical management systems and their practical implications have been studied in depth under the report on *Capacity Building for Promoting Synergistic Implementation of Basel, Rotterdam and Stockholm Convention in Sri Lanka*. This report analyses the chemical management institutional structure for the BRS Conventions of the country incorporating inputs from participating institutions. The proposed chemical management structure for the BRS Conventions in the country is given in Figure: 1. In addition the following section describes different roles played by relevant stakeholders related to chemical management.

Figure 1: Proposed chemical management structure for BRS Conventions in the country



It is noteworthy that the National Environmental Act is an overarching law of the country related to management of the environment. It has an influence on all sectors by formulating required regulation for management of environment including chemicals management. On the other hand, the NCC of the BRS Conventions is represented by all stakeholders that are formulating the laws and regulations related to import, and use of chemical`s in the country.

Therefore, if a need arises introducing new laws or changing exiting laws, the NCC can be useful. In fact it has shown in the past by issuing several Gazette notifications through the Import and Export Control Act of 1969 to manage chemicals under Stockholm, Basel and Rotterdam Conventions. Also the control Ozone depleting substances comes under the

Montreal Protocol for which the focal point is the Ministry of Mahaweli Development and Environment.

a.2) The Office of the Registrar of Pesticides

The Registrar of Pesticides is the Authority vested with the responsibility of controlling the importation, use and disposal of pesticides. The Registrar of Pesticides functions under the provisions framed under the Control of Pesticides Act No. 30 of 1980 as amended by the Acts of No. 06 of 1994 and No. 31 of 2011. Under this Act, all pesticides are required to be registered with the Registrar of Pesticides prior to being sold in the market.

Pesticide registration is a scientifically-based, legal, and also administrative process, where a wide variety of effects associated with the use of a pesticide product and its potential effect on human health and the environment is assessed. The registration is an important step in the management of pesticides as it enables authority primarily to determine which pesticide products are permitted to be used and for what purposes, and also to exercise control over quality, usage rates, claims, labelling, packaging and advertising of pesticides, thus ensuring that the best interest of end-users as well as the environment are well protected.

Compulsory registration & re-registration on a regular schedule (3-year term) are considerable undertakings for pesticide management in the country. In addition, the registration process is restricted on the assumption that pesticides are only used for their intended function and envisages proving that such use does not promote unreasonable effects either on human health or the environment.

Before any pesticide can be used commercially, several tests are conducted (or based on scientifically-accepted data assessment submitted by the registrant from most authoritative sources) that determine whether a pesticide has any potential to cause adverse effects on humans and wildlife, including non-target organisms, or potential to contaminate surface waters and groundwater from leaching, runoff, and spray drift.

The Registrar of Pesticides is advised on all matters relating to technical and policy aspects of the enforcement of the Act by the Pesticides Technical and Advisory Committee (PeTAC) comprising of ten *ex-officio* members and another five members appointed by the Minister of Agriculture under the provisions of the Act.

a.3) Customs Department

Customs department is the main government agency controlling exports and imports at the boarder of the country. The Customs department is empowered by Customs ordinance no 17 of 1869 (last major amendment in 1988). The main function of this department is collection of government revenue. Enforcement of other laws, stipulated to protect the country at the border is one of the other important functions of this department. Facilitation of trade and implementation of social protection measures are another main functions of this department.

At present, almost all chemicals utilized in the country are imported. There is no chemical manufacturing industry in the country, although some chemicals (mostly pesticides) are formulated using technical grade materials. The role played by the department of customs in respect of importation of chemicals is not collection of customs duty and other levies but rather implementation of regulatory function of other government agencies like Import Control Department, Registrar of Pesticides and Ministry of Health, etc. In this exercise, Customs department plays the role of collector of external trade statistics of the country in respect of chemicals. This is usually carried out, by using the information available in the documents produced for the clearance of cargo from the Customs.

The purpose for which each commodity, including chemical imported is not recorded under the current procedural requirements applicable in processing documents at the Customs. It is mandatory only when goods are imported for specific purpose like importation of goods for manufacture- in bonds for exportation. Therefore, there is no possibility of preparing an informative inventory of chemical usage in the country with the help of information available in customs database.

There is no practice of having laboratory tests for confirmation of content of chemical consignment before the release of cargo to the importer, unless there is valid reason to suspect irregularities. Hence, it is preferred to have preliminary test of each and every chemical shipment imported into the country for identification purpose at the Customs , before releasing to the consignee in order to create sound controlling and monitoring system of chemical usage in the country.

a.4) Central Environmental Authority (CEA)

The Central Environmental Authority is the National Level Government Agency vested with the responsibility of Environmental Management and Protection & functions under the provisions contained in the National Environmental Act no 47 of 1980 and its Amendment Acts no 56 of 1988. It is primarily a regulatory agency and the major regulatory functions of the agency are the implementation of the Environmental Impact Assessment (EIA) process for new, large scale development projects and the issuing of Environmental Protection Licences (EPL) for the control of waste discharges from industry.

The CEA does not directly control the import and use of chemicals by industry through regulatory measures. However, it does have a mandate to control waste discharges from industry which may contain chemicals. The CEA has already gazetted wastewater quality standards which are required to be met by industry when discharging their wastewater into the environment. These standards are concentration based standards which specify the maximum levels of polluting chemicals which may be discharged into the environment.

CEA has initiated activities to implement load based licensing system to promote industries to take preventive measures rather than concentrating on end of pipe treatment. Even though the CEA has no direct role to control the import or use of chemicals at present, it has presently identified a preliminary list of chemicals which are deemed to be hazardous to human health and / or the environment and require to be brought under some form of control through licensing. PCBs have also been included in this preliminary list of chemicals which are being proposed to be restricted and / or banned.

On the other hand, the Central Environmental Authority which comes under the purview of the Ministry of Mahaweli Development and Environment chairs the technical committees namely BRS Technical Committee and Technical Assessment Committee on Management of Industrial Chemicals (TACMIC) that addresses the issues related to the industrial chemicals comes under Rotterdam Convention.

Further, officers of the same Division of the Central Environmental Authority are representing the Pesticides Technical Advisory Committee (PETAC), which is the mechanism for control of hazardous pesticides under the Rotterdam Convention chaired by

Department of Agriculture. Therefore, this facilitates the management of all chemicals that come under this Convention.

a.5) Imports and Exports Control Department

The Imports and Exports Control Department functions under the provisions in the Import and Export Control Act No.1 of 1969 (last amended in 1987). The Act has introduced a "Special Import License Scheme (SIL) under which chemicals that come under the scheme cannot be imported without a license issued by the Controller of Imports and Exports. The license is issued on recommendations / certification given by the relevant regulatory Authority. (e.g. The Registrar of Pesticides in the case of chemicals classified as pesticides and Central Environmental Authority in the case of industrial chemicals comes under Rotterdam Convention).

On arrival of these chemicals to the country, clearance from the Imports and Export Control Department must be obtained before the Customs officials can release the goods to the importer. The Imports and Exports Control Act has provisions for further additions to the dangerous chemicals to the control list by publishing regulations under the act on policy decisions made by the government.

a.6) Board of Investment (BOI)

The BOI was set up by "Greater Colombo Economic Commission Law, No. 4 of 1978. From 1978 up to 1992 BOI was known as "Greater Colombo Economic Commission". In 1992, by amendment to the GCEC Law, GCEC was re-named as the Board of Investment of Sri Lanka (BOI).

The main objective of this body is to promote and to facilitate both foreign and local investment projects in Sri Lanka. These projects are located inside export processing zones/parks administered by the BOI and outside export processing zones/parks as well. There are 12 export processing zones administered by BOI located in various parts of the country. At present, approximately total of 1700 BOI projects are in commercial operation in Sri Lanka both inside and outside export processing zones/parks. These projects belong to manufacture, apparel, service, tourism, agriculture, information technology and infrastructure sectors.

The BOI facilitates import/export clearance and custom procedure for import of capital goods, raw materials, chemicals and the export of the final product. In this exercise, in respect of imports

of any raw material or product having a bearing on the environment are referred to the "Environment Department" of the BOI for clearance. This Department checks whether the imports are complying with National Environmental requirements and also International Environment related Convention requirements prior to granting clearance.

By recent (2013) amendment to Import & Export (Control) Act, now it is necessary to obtain an Import Control Licence (ICL) to import any item listed under this amendment. Hence, Environment Department also checks whether Importers are in possession of the ICL prior to granting clearance for import of any environment related item listed under this amendment. Further, Environment Department of BOI serves in all the National Co-ordinating bodies set up for implementing environment related Conventions requirements for which Sri Lanka is signatory including the BRS Technical Committee and the BRS National Coordinating Committee. By this, it is ensured that BOI projects are complying with the Convention requirements.

b) Non-Governmental Organizations

An overview of the activities done by nongovernmental organizations in Sri Lanka in relation to chemical management is also presented in this report. NGOs are registered under the Company Act No 07 of 2007 or Under Voluntary Social Services Organizations. The National Secretariat for Non- Governmental Organizations (NGOs) ensures that all NGOs which are functioning in Sri Lanka, are registered and are functioning within the frame of Government Policies. The Secretariat maintains a directory of registered NGO's in Sri Lanka and it is available in the website (http://www.ngosecretariat.gov.lk). There are many non-governmental organizations active in environmental management. People's report on Sustainable Development – Sri Lanka 2012 researched, compiled and presented is an example of NGO contribution.

b.1) National Cleaner Production Centre Sri Lanka (NCPC SL)

The National Cleaner Production Centre is one of the most active NGOs in Sri Lanka engaged in work related to chemicals. NCPCSL is a project of UNIDO carried out under the Ministry of Industry and Commerce and the member of UNIDO/UNEP global network of Resource Efficient and Cleaner Production Centers. It was initially funded by Royal Norwegian Government through UNIDO, under UNIDO/ UNEP programme of National Cleaner Production Centers.

NCPC is involved in chemical management activities such as pilot application of chemical leasing (UNIDO Project), forming and hosting Lanka Responsible Care Council etc. The Centre conducts chemical and material audits at firm level on the requests of companies in Sri Lanka. NCPC hosted the Regional Training for Asia on Resource Efficient and Responsible Production in 2010.

Resource Efficiency and Responsible Production (RERP) training programs are conducted by NCPC to educate people in Sri Lanka on chemicals and associated hazards. UNEP Responsible Production methodology has been applied and assessed in two enterprises from two industrial subsectors of Rubber and Paint as a pilot project application from 2010 to 2011. Having realized the success of the 1st pilot application, NCPC implemented the 2nd pilot application of the project with the support of UNEP in 2012/13 period covering 7 companies in supply chain of paint subsector. NCPC regularly engages in in-house training, walk through and comprehensive audits etc.

b.2) Lanka Responsible Care Council (LRCC)

Lanka Responsible Care Council (LRCC) is a voluntary association initiated in 2012 with the technical assistance of the New Zealand Responsible Care Council. The members of this association includes corporations who are chemical manufacturers, chemical users, government organizations, universities and certifying bodies operating in Sri Lanka. The National Cleaner Production Centre (NCPC) and New Zealand Responsible Care Council helped with the initiation process of this association.

LRCC represents the common interests of chemical suppliers and major chemical users in Sri Lanka. It takes the leadership in promoting safer workplace and protecting the environment, through safer management of chemicals. Industry is audited and upon satisfactory standards being present the companies can carry the 'Responsible Care' logo. At present there are around 29 industries that have undergone auditing and have become eligible under this scheme.

c) Private sector involved in chemical management

The Sri Lanka Association of testing Laboratory (SLATL) was established in 1998 as directed Swedish International Development Agency. According to the information available in the website of the SLATL there are 86 members in the association. SLATL is committed to

provide all possible support to member laboratories in achieving quality of the testing services provided through various programmes. It conducts various training programs and seminars and proficiency testing programs to develop the human resources with their clients (www.slatl.com).

c.1) Geocycle Sri Lanka

Geocycle Sri Lanka is an organization which provides solutions for industrial waste management for both hazardous and non-hazardous in Sri Lanka. It was established in 2003 as a member of Holcim Group. Geocycle Sri Lanka aims to provide industrial waste generators a sustainable final destination to their waste by converting diverse waste streams into a compatible material for their cement production process while conforming with the local and international environmental standards.

Their work includes participation in enforcing of waste management policies for the country and creating awareness about environment protection. Further Geocycle provides waste exchange facility to industries. A waste product from one industry can be a raw material for another industry. Geocycle diverts waste of one industry to another through a network of competent parties.

Sri Lanka's first recorded trial of PCB destruction in a cement kiln was supported by Geocycle. Geocycle is certified for integrated management standards that comprises of ISO 9001, ISO 14001 and OHSAS 18001. The analytical laboratory of Geocycle is accredited for ISO 17025.

c. 2) Asia Recycling (Pvt) Ltd

The plant run by this company own and operate a CFL recycling plant. The process recovers both phosphorous and mercury. The introduction of this plant is a major step forward in mercury management as it was quite usual to see used CFL bulbs reaching the common dump sites thus polluting both soil and water with waste mercury discharges. It has the capacity to recycle up to 30,000,000 bulbs per annum, which at present represent three times the annual usage of CFL bulbs in Sri Lanka.

The company expects that with their further investment in this plant, it can serve regional needs as well. The mercury once recovered as stabilized mercury is finally processed in Germany. Further it is being reported that the total sales of CFL bulbs in Sri Lanka is around 1.5 million and of which 400,000 are produced by (assembled) by the Orange Electric, which is the parent company of Asia Recycling (Pvt.) Limited. However, total amount of bulbs collected by Asia recycling per month is only 100,000 of which 75,000 are Orange bulbs and 25,000 belong to other brands. If it is assumed that the mercury content a bulb is 3-5 mg, the annual amount of mercury added to environment due to use of CFL bulb in Sri Lanka is range from around 54 to 90 t. This shows that Sri Lanka has to take necessary steps to collect these bulbs and direct them for recycling.

d) Non Regulatory Mechanisms in Chemical Management

d.1) National Institute of Safety and Health (NIOSH)

The National Institute of Safety and Health (NIOSH) is an establishment operating under the Ministry of Labour and Labour Relations Sri Lanka. NIOSH is committed to provide better working conditions for all people through increasing awareness of and adherence to proper health and safety measures (http://niosh.gov.lk/). NIOSH activities include the dissemination of updated information and provision of advisory and consultancy services.

In addition, they educate and train employers, employees and all other categories of people who will benefit from such training. Other services provided includes environmental monitoring, health examinations, identifying existing occupational safety and health hazards in any industry, risk assessments and ergonomic audits. Among various training programmes conducted at NIOSH, 'safe chemical handling' is one possible course identified that can be extended to address issues related to chemical accident prevention and preparedness. Also, every year, second week of October is declared as the National Safety Week. The National Occupational Safety and Health Conference and many other activities were organized by NIOSH. Award schemes are also available for best performers in this sector.

d.2) The Directorate of Environmental and Occupational Health of the Ministry of Health, Nutrition and Indigenous Medicine

The Directorate of Environmental and Occupational Health (E&OH) is responsible for the implementation of the following public health programmes of the Ministry of Health.

1. Environmental Health
2. Occupational Health and Safety
3. Food Safety and Hygiene

This Directorate functions under the Deputy Director General (Public Health Services) and is responsible for planning, coordination, direction, monitoring and evaluation of environmental health, occupational health and food safety programmes. Additionally the Directorate liaises with the Ministry of Mahaweli Development and Environment, Central Environmental Authority, Ministry of Labour and Labour Relations and other relevant stakeholders in addressing environmental, occupational health and food safety related issues. The roles and responsibilities of the Directorate of E&OH can be broadly classified as follows.

- Advocate and provide technical guidance to the Ministry of Health and other relevant ministries on policy and international conventions in relation to environmental health, occupational health and food safety
- Develop strategies based on national policies on E&OH
- Formulate national medium term and annual action plans on E&OH
- Develop E&OH programmes based on evidence
- Strengthen inter-sectoral coordination between government, private and nongovernmental agencies by providing technical guidance in the areas of environmental and occupational health and food safety
- Direct, guide, coordinate, support and monitor the provincial/district system/managers to implement activities on E&OH and food safety
- Build capacity of relevant health staff at pre service, in service and post graduate level on E&OH
- Creating awareness among general public in the areas of E&OH
- Conduct operational research in the areas of E&OH

The Environmental Health Programme focus on health aspects of major areas such as air pollution, waste management including hazardous waste, water sanitation, climate change etc. The occupational health programme aims at improving the overall health of workers and reducing occupational injuries and diseases. The main objectives of the Occupational Health programme are

- The promotion and maintenance of the highest degree of health among workers
- The prevention of adverse effects on health caused by the working conditions among workers
- The protection of workers from occupational risks resulting from factors adverse to health
- The adaptation of work to humans

The occupational health programme specifically focuses on sound management of chemicals at workplaces and prevention and preparedness for chemical accidents at workplaces.
All workers in Sri Lanka have access to free health services at the curative as well as preventive health sectors. Treatment of occupational diseases and injuries and rehabilitation of occupational injuries are integrated into the existing curative health system.

The implementation of occupational health activities in the preventive health sector are carried out mainly through the well established MOH offices which cover the whole of Sri Lanka. The Medical Officers of Health (MOOH) and the Public Health Inspectors (PHII) carry out occupational health activities at the grass root level and they can reach even the informal sector workers and it is considered one of the best systems in providing preventive health services. The MOOH and PHII are expected to visit workplaces and informal sector workers and identify occupational health issues and hazards including chemical hazards, advice on remedial measures, carry out activities to promote health of the workers.

2.4.3 Existing Legislation and Regulations addressing POPs

With regard to the legislation presently available in the country for the control of POPs chemicals, as far as the POPs pesticides are concerned there is adequate legislation in the form of the Control of Pesticides Act No. 33 of 1980, for the control of manufacture, importation through use and disposal. At present, regulatory control under the provisions in the Control of Pesticides Act No. 33 of 1980 has resulted in the banning of all of the POPs pesticides which had been imported and used in Sri Lanka.

As far as the entire chemical industry is concerned, the import and use of pesticides, pharmaceuticals and fertilizers are being controlled through separate legislative enactments. Importation of all the pesticides, pharmaceuticals and organic fertilizers categorized in HS 3101.00 are being controlled through the Legislations published under the Import and Export Control Act. Gazette (Extra ordinary) No.1813/14 dated 05.06.2013.

With respect to the legislation required for the management of PCB and PCB containing equipment, new regulations are required in order to compel anyone having in their possession, PCB or PCB containing equipment to report the exact quantities they hold and how they plan to phase out the use of these chemicals by 2025 as stipulated in the Stockholm Convention.

Although draft legislation has already been developed under this project, there is still a need to discuss these regulations with the stakeholders concerned, particularly with the Ceylon Electricity Board who own the majority of the PCB stocks as well PCB containing chemicals. LTL Transformers (Pvt) Ltd (LTL), the sole manufacturer of transformers in the country make transformers for CEB. All these transformers do not contain PCB. Further, LTL is also involving in repairing of transformers belonging to CEB. All suspected transformers (based on the year/ type & manufacturer) received from CEB for repair are tested for PCB before attempting any repair. If they found that PCB is present, those transformers are kept separately with proper identification without proceeding to any repair and there by LTL assures no any contamination of PCB in their premises.

In the case of vehicle emissions, Standards have been in force since 2003 by Gazette Notification for Diesel and Petrol vehicles and the standards are to be revised soon. Carbon Monoxide, Hydrocarbons, Sulphur, Density, Cetane Index etc emissions have been controlled under this act.

As far as the control of unintentionally produced POPs such as dioxins and furans are concerned, at the present time there is no legal requirements to control such emissions. However, Waste Management Authority of Western Province (WPWMA) has introduced Municipal Solid Waste Management rule No.01 of 2008 to prohibit open burning. This law is to be adopted by the 48 local authorities in the Western Province.

It is only recently that standards for the control of common air pollutants such as Sulphur Dioxide, Oxides of Nitrogen and particulate matter have been drafted. These standards are

however being imposed on new industries which are being established and such industries are required to install the necessary equipment for pollution control.

In view of the above situation it is difficult to imagine a situation whereby industries and/or other sources of unintentionally produced POPs would be required to meet stipulated standards. A more practical suggestion would be to recommend the adoption of Best Available Technology (BAT) and Best Environmental Practice (BEP) by such sources and control emission by effective temperature control and particulate emissions in the processes.

2.4.4 Adequacy of present Legislative Acts relating to chemicals management with particular reference to POPs

There is hardly any chemical manufacture taking place in Sri Lanka. As such almost all chemicals whether they be pesticides, pharmaceuticals or industrial chemicals are being imported into the country. In view of this situation, any scheme to control the import and use of chemicals would be most effectively implemented at the point of entry. As such, the Imports and Exports control Department and Customs Department would play a crucial role in chemicals management in view of the fact that these departments would play a crucial role in determining the types and quantities of chemicals which would enter the country.

In addition to these two Departments the other government agencies which play a crucial role in chemical management are the Office of the Registrar of Pesticides and Central Environmental Authority. The Registrar of Pesticides is the Authority vested with the responsibility of controlling the importation, use and disposal of pesticides. The Registrar functions under the provisions contained in the Control of Pesticides Act no 30 of 1980, and its amendment Act no 6 of 1994.

Similarly, the CEA has no direct role at present to control the import or use of chemicals, it has presently identified a preliminary list of chemicals which are deemed to be hazardous to human health and/or the environment and require to be brought under some form of control. PCBs have also been included in this preliminary list of chemicals which are being proposed to be restricted and/or banned.

There are several legislative enactments which specifically regulate the import, use and disposal of certain categories of chemicals in Sri Lanka.

a) The Control of Pesticides Act No 33 of 1980, and its Amendment Act No 6 of 1994

The control of Pesticides Act No 33 of 1980, and its Amendment Act No 6 of 1994, aims at controlling the import, use, transport, storage and disposal of pesticides in the country. This Act contains adequate provisions in it for the control of the import and use of any pesticide. Under this Act, all pesticides which are being imported or used in the country are required to be registered, including its physical and chemical properties, toxicological data, amount of isomer impurities and other by products, methods of analysis etc has to be submitted to the Registrar of Pesticides prior to registration. Under this Act almost all of the POP pesticides have already been banned in Sri Lanka. Stockholm Convention Article 3; No. 1, 3 & 4 could be dealt under Control of Pesticides Act.

b) Customs Ordinance

The Customs Ordinance which was last amended in 1988, is being implemented by the Customs Department. Under this Act, there is a gazetted list of restrictions, bans, enactments, laws and regulations already enacted, or to be enacted in the future by any agency/authority pertaining to imports and exports which are to be enforced, monitored or regulated by the Director General of Customs. Since many of the POPs pesticides are already banned /not registered for use in Sri Lanka, it would be possible to take necessary actions against any violations in this regard. However, the situation regarding non-pesticide POPs is different, as presently there are no restrictions in place.

c) Import and Export Control Act

The Imports and Exports Control Act, which was last amended in 1987, is an act to provide the control on importation of goods, for the regulation of standards of exportable goods and for matters connected therewith or incidental thereto. It is being implemented by the Department of Imports and Exports Control. Under this Act, a special import licence scheme has been introduced for selected chemicals.

Chemicals which fall under this scheme such as pesticides and organic fertilizers categorized under HS 3101.00 cannot be imported into the country without a licence issued by the Controller of Imports and Exports. But some chemicals such as fertilizers are directly controlled by other institutes e.g. National Fertilizer secretariat. The licence issued by the Controller of Imports and Exports is based on the recommendations/ certification/ registration given by the relevant statutory authority for the respective chemicals.

Many restrictions can be introduced in the Management of POPs through Customs Law and Import & Export Law using the framework of its existing provisions.

d) The National Environmental Act No 47 of 1980 and its Amendment Act No 56 of 1988 and Act No. 53 of 2000

The National Environmental Act No 47 of 1980 was introduced to make provision for the Protection, Management and Enhancement of the Environment that will be supervised by Central Environmental Authority. Therefore, the use and disposal of chemicals as well as the control of emissions arising from industrial processes is within the mandate of the CEA. As such, it is possible for the CEA to control the emissions of unintended POPs such as Dioxins and Furans through appropriate regulations, as and when required. On the other hand, Article 3.2 of the Stockholm Convention on import of chemicals in Annex A and B, can be dealt under the Hazardous Waste Regulations 924/13 gazetted under the powers of the NEA.

When a gap study is done considering the POPs separately, the pesticides in common can be dealt within the Pesticides Act and the Industrial chemicals should be controlled by Customs Law and Import and Export Law. Hazardous Waste Regulations under the NEA also can be made useful in the chemical management process.

Chemical waste management including the disposal of chemical waste and controlling the emission arising from the industrial activities is covered under the mandate of the CEA. As such emissions of the **unintentional POPS** from the industrial activities are regulated by the **Interim Regulations** stipulated by the CEA under the NEA.

Importation of the chemicals in the Annex A and B of the Stockholm Convention are controlled under the Regulations in the Gazette Extra Ordinary, No. 1813/14 dated 05.06.2013 published under the Imports and Exports (control) Act No. 01 of 1969. Waste of these chemicals are regulated by the Scheduled Waste Management Regulation published in the Gazette Extra Ordinary No.1534/18 dated 01.02.2008 stipulated under the National Environment Act (NEA)

Under the existing available provisions under the NEA, they are inadequate to address the entire life cycle management of chemicals except the chemical waste. However the amendment of the NEA is in progress to include the required provisions to address the total lifecycle management of the chemicals sufficiently.

e) Consumer Affairs Authority Act No 9 of 2003

The Consumer Affairs Authority (CAA), under the Ministry of Co-operatives and Internal Trade has been established by Consumer Affairs Authority Act No 9 of 2003. The Consumer Affairs Authority has been established with various objectives. One of the objectives is to protect consumers against the marketing of goods or the provision of services which are hazardous to life and property of consumers.

CAA protects the consumers through regulation of trade and regulation of prices of goods and services while protects the traders and manufacturers through fair trade practices and restrictive trade practices. The CAA is empowered to issue directions to manufacturers and traders and ensure that the goods and services they provide meet all agreed or legally required standards for consumer health and safety.

2.4.5 Priority problems and objectives for institutional and regulatory strengthening

a) Objective

Develop and put in place legal and institutional tools for POPs management to achieve targets stipulated in the Stockholm Convention

b) Priority problems

Importation

- Continued importation of POPs other than pesticides;
- Importation of active ingredients of pesticides as chemicals;
- Lack of monitoring facilities at the point of import for pesticides contaminated with POPs;
- Lack of analytical facilities with regulating authorities to monitor/validate submitted claims.

Regulatory Issues

- Inadequate of legislation for management of PCBs /POPs within the country (Gazette No : 1813/14 dated 05 June 2013 of the Import and Export Control Act No.01 of 1969 and Control of Pesticides Act No 33 of 1980)

- Absence of legislation to control dioxin and furans emission.
- Life cycle approach not in policy and regulatory development
- Circular economy and waste management hierarchy approach are not yet included in the regulatory frame
- Inadequate or limited monitoring frame for pollution release (including (U)POPs)

Disposal and treatment

- Limited capacity for treatment and destruction of POPs waste
- Inadequate or limited capacity for management or recycling of e-waste
- Limited funds for phasing out PCBs and PCB contaminated material;
- No technological capacity to introduce BAT/BEP in processes.

2.5 Assessment of the situation in Sri Lanka with respect to the Stockholm Convention

The first inventories of the POPs were prepared in 2006 for the initial NIP. The current NIP update aims to update the inventories of the first NIP developed for the Dirty Dozen and develop the inventories of the new listed POPs introduced to the Convention in 2009 and 2011. Accordingly, five sector experts were recruited for the assessment of groups of POPs namely, PCBs, PBDEs UPOPs, PFOS and Pesticides. Respective guidance developed by United Nations Environmental Programme (UNEP) were used to develop the inventories of PBDEs, UPOPs and PFOS. Meanwhile the estimates of PCBs and POP pesticides were made through UN approaches and the latest available secondary data and field studies conducted by the respective experts.

2.5.1 POPs Pesticides (Annex A chemicals)

The use of POPs pesticides in Sri Lanka had been commenced with the use of DDT in 1946 during the World War II. The history of Malaria in Sri Lanka is a success story on near eradication of the main vector, a member of the *Anopheles culicifacies* complex, by residual spraying of DDT in households. After a history of severe epidemics in the 1930s (2–3 million cases and 80,000 deaths in 1934–35), DDT in Sri Lanka had dramatic effects in reducing Malaria mortality in the 1950s. It was successful in achieving eradication – only 17 recorded cases in 1963.

Then its use spread to the agricultural sector. The other Organochlorine pesticides entered the crop production sector during the next decade. The benefits accruing to crop production is well documented in small scale field studies but was not as spectacular as the phenomenal success DDT had in combating malaria as depicted in Figure 2. With the buildup of vector resistance, DDT had to be replaced by Malathion in 1976.

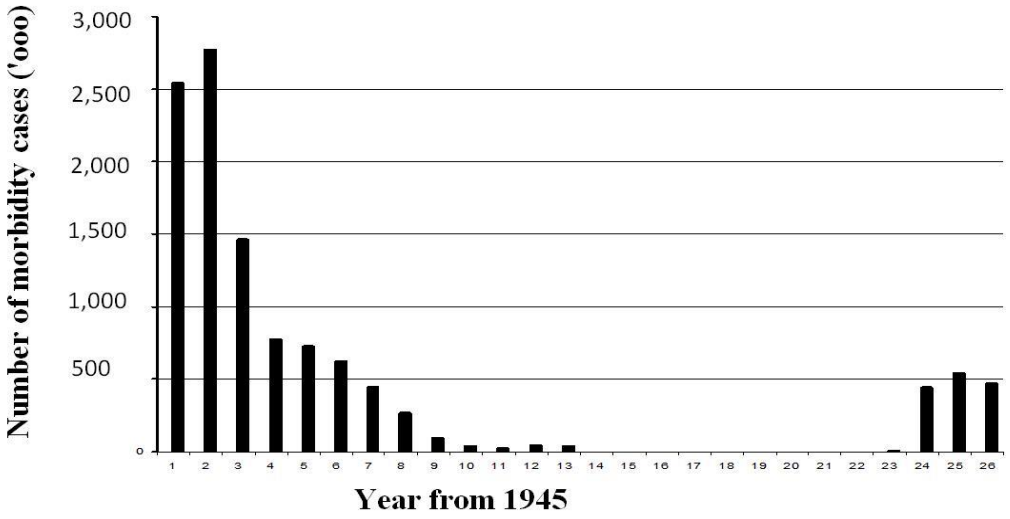


Figure 2- Incidence of malaria morbidity in Sri Lanka during 1945–1970 (modified from Wickramasinghe, 1981)

Mounting scientific evidence from the international community on the ubiquitous nature of the POPs pesticides and the concomitant adverse environmental and health impacts alerted the attention of the entomologists at the Central Agricultural Research Institute (CARI) of the Department of Agriculture (DOA) in the 1970's on the need to replace them especially in the rice ecosystem and for vegetables and subsidiary crop production.

In the absence of regulatory control prior to 1984[1] and the constraints in monitoring health impacts on farmers and on trends in environmental pollution, the only pragmatic approach was to reduce the market demand for these products. The entomologists tested alternatives with different mode–of–action and revised the official DOA recommendations for the control of various pests. With effective extension campaigns by the DOA to promote the recommended alternatives the demand for the former was appreciably reduced. By 1980, imports of DDT, Dieldrin, and Aldrin had dwindled so that the total volume of POPs pesticides (organochlorines) and synthetic pyrethroids imported for agriculture was reduced to 4.2%.

[1]The Control of Pesticides Act No. 33 of 1980 was institutionalized after 1984.

The agricultural use of POPs pesticides was only eminent before 1998; during which the last member of organochlorine pesticide – endosulfan (listed under Annex A of the Stockholm Convention in May 2009) - had been recommended for general crop use. Endosulfan 35% EC was not a key insecticide during late 1980s although it had been recommended for several key pests of paddy, viz. brown plant hopper (*Nilaparvata lugens*), rice gall midge (*Orseolia oryzae*), paddy bug (*Leptocorisa varicornis*) and rice leaf folders (*Tryporiza incertulas* and *Cnaphalocrocis medinalis*). It became apparent that rice farmers relied upon more toxic compounds such as monocrotophos, methamidophos and gamma–HCH for rice pest control.

Consequently, it was reported that 114, 150 and 540 tonnes (a.s.) of methamidophos, monocrotophos and gamma–HCH had been dispersed annually (during 1987–1989) over a cumulative area of 270, 600 and 36 ('000) hectares, respectively. Impending severe restrictions imposed upon highly hazardous pesticides had dramatic demand for alternative substances in WHO Hazard Class II organophosphates (e.g. dimethoate, fenthion, trichlorfon) and endosulfan in early 1990s. A similar shifting was apparent in selection of lethal tools for deliberate poisonings (e.g. suicides) as shown in Figure 3. This graph shows that Endosulfan 35% EC had been prominent as a lethal tool in consequent to gradual banning of WHO Hazard Class I organophosphate compounds (Modified from Roberts et al. 2013).

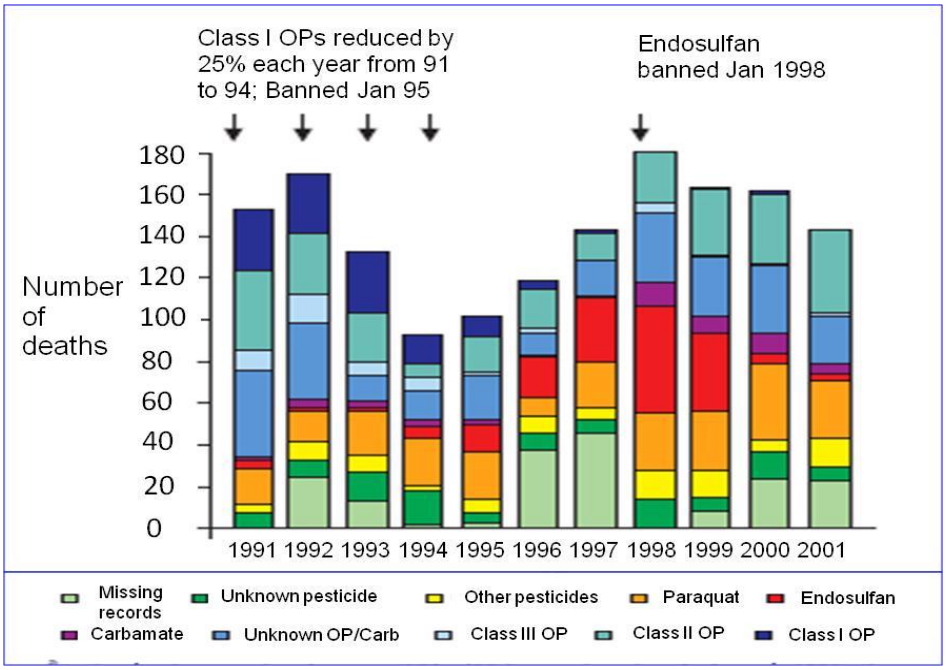


Figure 3 - Selection of lethal tools for deliberate poisonings (e.g. suicides)

Alternatively, tea had been one of the major sectors of POPs pesticide use in the past but it was limited to few members, such as Aldrin, DDT, Dicofol (a candidate POPs pesticide[2]), Dieldrin, Heptachlor, and Pentachlorophenol (listed as POPs in 2015). The past records of pesticide usage confirms that 1998 was the last year of using POPs pesticides in tea (Table 11).

The current status of POPs pesticides in Sri Lanka as stated below reveals a 15–30 year history of non–use for individual POPs pesticides. The following analysis in Table 10 is taken from import statistics available with the Registrar of Pesticides (ROP) and by other pertinent sources, highlighting the magnitude and diversity of POPs pesticides at their respective last years of import and/or use in Sri Lanka.

Table 11 - The magnitude and diversity of POPs pesticides used in Sri Lanka at their respective years of last import and/or use

POPs pesticide (CAS No.)	**Last imports[#]**	
	***Amount (kg a.s.)*[§]**	***Year***
Aldrin (309–00–2)	1,408	1986
	327.4	1988
Alpha–hexachlorocyclohexane (319–84–6)	37,800 (technical HCH, *gamma*–HCH 10%)[*]	1987–1989
Beta– hexachlorocyclohexane (319–85–7)	6,480 (technical HCH, *gamma*–HCH 10%)[*]	1987–1989
Gamma–hexachlorocyclohexane (58–89–9) = Lindane	800 (in Lindane 99%)	1989
	8,100 (as *gamma*–HCH 10%)[*]	1987–1989
	14 (*gamma*–HCH 1%)[**]	2012
Chlordane (57–74–9)	3,400	1986–1993
	1,840	1994
Chlordecone (143–50–0)	No history of use	Not applicable
DDT (50–29–3)	4,342,000[##]	1954–1975
	158,000[##]	1976
Dicofol (115–32–2)	420	1988
	455.3	1989–1992
Dieldrin (60–57–1)	3,209	1983–1990
	338	1988
	1,100	1991
Endrin (72–20–8)	Not available	Not available
Heptachlor (76–44–8)	Not available	Not available
Endosulfan (115–29–7)	49,210	1997
Hexachlorobenzene (118–74–1)	No history of use	Not applicable
Mirex (2385–85–5)	No history of use	Not applicable
Pentachlorobenzene (608–93–5)	(in 125.4 kg PCNB 75%)	1989

[2] www.pop.int

Pentachlorophenol (87–86–5)	Not available	Not available
Sulfluramid (4151–50–2)	No history of use	Not applicable
Toxaphene (8001–35–2)	Not available	Not available

Unless specifically mentioned, the imported/use amounts are based on import statistics available with the Registrar of Pesticides. § Conversion factors used for estimation of the amount of active substance, i.e. aldrin 20%, *alpha*–HCH 70% , *beta*–HCH 12%, *gamma*–HCH 15%, chlordane 40%, DDT 50%, dicofol 42%, dieldrin 40%, endosulfan 35% * Jackson , 1991

** Drug Control Authority, Ministry of Health

Anti-Malaria Campaign, Ministry of Health

Legal provisions related to pesticides are provided by the Control of Pesticides Act No. 33 of 1980, which contains 27 Sections covering instructional, procedural and risk reduction aspects. The licensing authority is the Registrar of Pesticides (ROP) for the enforcement of regulatory provisions for the control of pesticides in Sri Lanka.

Getting rid of most problematic pesticides under the local conditions was one of the earliest measures adopted by the country even prior to enactment of the regulatory mechanism, i.e. Control of Pesticides Act No. 33 of 1980 (Table 12). It is important to stress that the pesticides were carefully chosen according to the local scenario based on international and local experience. Table 13 shows the foreign exchange spent on the import of pesticides.

Sri Lanka has been prodigious in making decisions well in advance of the announcement of international actions on POPs pesticides under the Stockholm Convention; the current status is spectacular as that almost all POPs pesticides have been de–registered and/or banned from major uses at least earlier than 15 years; the only exception is Lindane, which had been used until 2012.

Consequently, the levels of biotic and abiotic contamination by POPs pesticides previously determined and reported in the NIP–1 are lower than those data published from some of the regional countries in South Asia where there have been reports of current use. In this context, a further reduction of environmental residue levels would be expected in this Island nation. There is currently no science base to link environmental contamination with any of the biological and/or epidemiological effect on biota in Sri Lanka.

Table 12 - List of banned and or severely restricted pesticides in Sri Lanka with the year of implementation and the year of legal declaration

Year (regulatory) banned	Year (legally) banned	Name of Pesticide (a.s.)
1970	2001[a]	Endrin*
1976	2001 [a]	DDT*
1980	2001 [a]	Chlordimeform
1980	2001 [a]	Dieldrin*
1980	2001 [a]	Phosphamidon
1980	2001 [a]	Thalium sulphate
1984	2001 [a]	2,4,5–T
1984	2001 [a]	Ethyl–parathion
1984	2001 [a]	Methyl–parathion
1986	2001 [a]	Aldrin*
1986	2001 [a]	Lindane*
1987	2001 [a]	HCH (mixed isomers)*
1987	2001 [a]	Mercury compounds
1988	2001 [a]	Arsenic (arsenites & arsenates)
1988	2001 [a]	Heptachlor*
1988	2001 [a]	Leptophos
1989	2001 [a]	Captafol
1990	2001 [a]	1,3–dichloropropane
1990	2001 [a]	Aldicarb
1990	2001 [a]	Quintozene (PCNB)
1994	2001 [a]	Pentachlorophenol*
1994	2001 [a]	Chlordane*
1995	2001 [a]	Methamidophos
1995	-	Monocrotophos (60% SL restricted to use on red weevil in coconut)
1998	2001 [a]	Endosulfan (35% EC)*

Year (regulatory) banned	Year (legally) banned	Name of Pesticide (a.s.)
2008	2014¶	Paraquat (20% SL)
2011	2014¶	Paraquat (6.5% SL)
2011	2014¶	Dimethoate (40% EC)
2011	2014¶	Fenthion (50% EC)
2011	2014¶	Cyromazine (75% WP)
2012	2014¶	Alachlor (36% EC)
2013	2014†	Propanil (36% EC)
2013	2014†	Carbofuran (3% GR)
2013	2014†	Carbaryl (85% WP)
2013	2014†	Chlorpyrifos (20% EC & 40% EC)
2014	2014†	Glyphosate (36% SL)
2015	2015 §¤	Glyphosate (36% SL)

* Classic organochlorine pesticides (POPs pesticide) listed under the Stockholm Convention

[a] Ban of registration by the government extraordinary gazette No. 1190/24 of 29.06.2001 under the Control of Pesticides Act No. 33 of 1980.

¶ Ban of registration by the government extraordinary gazette No. 1854/47 dated 21.03.2014 under the Control of Pesticides Act No. 33 of 1980.

† Regional restriction for sale, offer for sale and use as per thegovernment extraordinary gazette No. 1894/4 of 22.12.2014 under the Control of Pesticides Act No. 33 of 1980.

§ Ban of importation by the government extraordinary gazette No. 1813/14 of 05.06.2013 under the Import and Export (Control) Act No. 01 of 1969.

¤ Ban of registration by the Government Extraordinary Gazette No. 1937/35 dated 23.10.2015 under the Control of Pesticides Act No. 33 of 1980

Table 13 - Foreign exchange spent for import of Pesticides: 2000-2014

Year	Technical Material (volume, mt)			Formulations (volume, mt)		
	Insecticides	Herbicides	Fungicides	Insecticides	Herbicides	Fungicides
2000	111.93	256.80	6.78	1182.60	1881.09	564.09
2001	90.25	270.40	5.30	848.50	2055.70	553.40
2002	132.47	238.20	6.05	892.90	1994.10	743.50
2003	216.39	193.90	6.78	1468.01	2731.20	785.40
2004	103.00	237.74	4.62	1256.68	3036.00	745.00
2005	222.14	259.6	7.98	1699.67	3623.50	891.60

2006	128.38	207.94	0.40	1576.41	3197.06	847.06
2007	115.65	88.3	1.5	1193.74	4143.69	722.25
2008	199.3	178.12	0.9	1585.74	3808.39	872.64
2009	107.43	274.78	0.25	1036.74	2749.75	599.8
2010	144.38	1605.58	2	1843.95	5366.63	1048.02
2011	90.5	1118.94	0.4	1712.58	5031.05	949.40
2012	63.32	377.8	0.75	959.37	4753.01	776.44
2013	88.22	197.06	0	1243.46	5958.32	987.15
2014	34.48	705.4	0	702.91	4081.83	935.92
Total	***1847.84***	***6210.56***	***43.71***	***19203.26***	***54411.32***	***12021.67***

Source: Office of the Registrar of Pesticides

Obsolete Pesticide stocks

Obsolete pesticide stocks have been inventoried in Sri Lanka. On top of the identified POPs pesticides represented by 0.17% of the entire stock. In total there are obsolete pesticides that require proper disposal, including, over 41 tonnes that includes about 26 tonnes in government farms and research institutions of the Department of Agriculture. Some of the substances are being stored under inappropriate conditions and are deteriorated from being segregated and/or being identified.

These amounts were inventoried in the 2006 NIP and remain to date without disposing as there are significant barriers that prevent obtaining efficient services of approved disposal facilities (e.g. incineration by co–processing at cement plants) for the management of obsolete pesticides such as financial and technical deficiencies including feeding (of solids), segregation and odour management. Therefore, secure storages of obsolete pesticides would be one of the highest priorities until there is an amenable solution for safe disposal.

2.5.2 Polychlorinated biphenyls (PCBs) (Annex A chemical)

a) Legal provisions available for regulating PCB containing or contaminated oil in Sri Lanka

As per the Gazette extraordinary No. 1534/18, February 01, 2008 stipulated under the National Environmental Act No. 47 of 1980 (Section 23A), following PCB containing waste has been prescribed as a Hazardous or "Scheduled Waste" under SCHEDULE VIII Part I – Scheduled waste from non specific sources

- Waste containing Polychlorinated Biphenyls (PCBs) or Polychlorinated Triphenyls (PCTs)
  - Spent oil contaminated with PCB and/or PCTs
  - Electrical equipment or parts containing or contaminated with PCBs and /or PCts
  - Retro filled transformer contaminated with PCBs and/or PCts
  - Containers and all waste materials contaminated with PCB and/ or PCTs

According to the respective regulation a person who operates a facility for Generation, Collection, Storage, Recovery, Recycle or Disposal should obtain the Scheduled Waste Management License from the Central Environmental Authority.

A mechanism must be in place to detect the PCB/PCT for the persons who are handling the Devices/Equipment those likely to contain or be contaminated with PCB/PCT

Under the National Environmental Act, standards have been proposed for inland water bodies. Proposed maximum acceptable levels of organic micro-pollutants in 'Inland surface waters where fisheries and aquatic life are to be protected' gives a limit of 1 nano grams per litre of PCB (total) as the maximum acceptable level.

b) In service PCBs equipment

The Ceylon Electricity Board (CEB), Lanka Electricity Company (Pvt) Ltd (LECO) and LTL Transformers (Pvt) Ltd (LTL) can be considered as the three main agencies that deal directly with transformers and capacitors, which may be contaminated with PCBs. These institutions import and handle all transformers used by the state sector and by the power utilities in the country. Another important sector that needs to be taken into account is the informal recyclers of transformer oil. Informal recyclers of transformers/oil are small scale operators that are scattered throughout the country. Recyclers are engaged in recycling of oil and scraps from transformers, especially the metal and porous parts.

The preliminary inventory of PCB compiled in 2005 assessed uses of PCB containing equipment within the country, likely quantities, equipment types, holders, their operational practices, health and safety management and end of life treatment of PCB containing equipment. The primarily inventory focuses on the transformers existent within the power sector.

In today's context, the Ceylon Electricity Board (CEB) covers majority of total electricity generation, transmission and distribution of electricity throughout the country. In 2014, CEB has generated 69% of the total Electricity generation of the Country, while the contribution to that from the Private Power Producers (P.P.P.) was 31% (Statistical Digest published by CEB). In year 2015, said contribution by CEB has increased to 79%, while that from the Private Power Producers amounted to 21%.

Although Private Power Producers may have their own transformers, the possibility of such containing or contaminated with PCB is very less, since most of those Power Stations have been established after 1986. Lanka Electricity Company Ltd (LECO) covers fraction of the distribution system of the power sector. LTL Transformers Pvt Ltd (LTL) is the sole manufacturer of Transformers in Sri Lanka. Therefore those agencies are considered as the main entities that deal directly with transformers and capacitors, which may be pure and contaminated with PCBs. Additionally transformers and capacitors can be found at energy consuming industries such as metal industries and cement industry.

In 2005 it was assessed that a total amount of 18,616 transformers (Distribution, Generation Aux, Gen interbus, Generation, Transmission, and Transmission-Aux) managed by the CEB, LECO and Independent Power Producers (IPP) were connected within the power supply network in Sri Lanka while it is 24009 in year 2015 (Table 13).

"The population of transformers investigated has been limited to transformers manufactured before 1986 for the following reasons

- *Sri Lanka started the production of distribution transformers since 1983*
- *Electrical industries in most industrialized countries stopped*
- *To limit the scope of the preliminary inventory"*

The preliminary inventory estimated total number 2010 of transformers which have been manufactured on or before 1986. The percentage of positive transformers (manufactured on or before 1986) for the test population was 48%. Accordingly it was estimated that there are 1060 transformers in Sri Lanka containing transformer oil with over 50 ppm of PCBs.

Electricity generated in 2015 for supplying the national grid was 12357 GWh (8769 GWh in 2005). Total number of transformers connected to the national grid was 24009 units in 2015

(18356 units in 2005). 83.4% of transformers (20043 units) in the national grid belong to the CEB (table 14).

A questionnaire was developed to compile both in-service and out of use transformers belonging to CEB. The Assets Management Unit of CEB compiled the data received into an Excel database covering Branch, Section, Location, Serial Number, Year of manufacture, Capacity and Seal type or not for both in-service and out of use transformers belonging to the CEB.

Table 14 - Composition and Ownership of Power sector Transformers in Sri Lanka, 2015

Type of Transformers	CEB		LECO		IPP		Total number of transformers in service	
	2005	2015	*2005*	2015	*2005*	2015	*2005*	2015
Distribution	*15261*	**19398**	*2708*	**3885**	*None*	**None**	*17969*	**23283**
Generation	*107*	**316**	*None*	**None**	*74*	**90**	*181*	**406**
Transmission	*206*	**320**	*None*	**None**	*None*	**None**	*206*	**320**
Total	*15574*	**20034**	*2708*	**3885**	*74*	**90**	*18356*	**24009**

c) Transformers in the tea sector

A survey was conducted to collect the information of transformers at Tea factories in Sri Lanka with the help of Sri Lanka Tea Board. Only 26 Tea factories responded to the survey questioner. Out of 26, only 6 Tea factories own transformers and rest belongs to the CEB. The survey received less percentage of responses but old transformers are being reported in the limited responses. These facts shows a necessity of a comprehensive survey on the transformers owned by the Tea sector in order to complete the PCB contaminated or contained transformers in the power sector of Sri Lanka. Table 15 summarized the information received from the survey on the transformers owned by Tea factories.

Table 15 - Summary of the findings of sample survey on transformers used in the tea sector

Tea Factory	Serial Number	Name of the Manufacturer	Year of manufature	Capacity
No:9	T-09-U0100-3409	LTL, Sri Lanka	2009	100KVA
No:13	1.08.210 250.30100	LTL, Sri Lanka	2008	250 KVA
No:11	99 UO 1603266	LTL, Sri Lanka	1999	160 KVA
No.19	87650	Crompton Greves England	1971	250 KVA
No:22	1.07.U0400 300-23	LTL, Sri Lanka	2007	1000KVA
	1.08.U0400 30057	LTL, Sri Lanka	2008	400KVA
No :23	05.U01030105	LTL, Sri Lanka	2005	100Kva

d) Use of decommissioned transformers (oil and scrap) in Sri Lanka.

The preliminary PCBs inventory identified that the decommissioned transformers across the country are supposed to be stored at LTL transformer yards at Western Province in recent past. In real practice in past the transformers located suburb and other parts of the country sold at site.
It was verified from informal recycler that majority of transformers obsolete at CEB yards disposed on open tender procedure until the recent intervention from the Ministry of Environment to sell after verifying those transformers are free from PCB oil.

Local welding transformer manufacturers were the main buyers of discarded Transformers. Transformer oil and metal parts used to manufacture welding plant. The small scale welding manufacturing facilities that were established over 40 years ago obtain raw material from discarded transformers belonging to CEB and other owners sold directly or by third party. The old transformers that belong to the category may be a significant amount. Therefore necessary actions need to be taken to identify PCB contaminated welding transformers within the secondary user sector for safe disposal.

e) Informal transformer recyclers

An informal network exists to make value out of decommissioned /discarded transformers for decades. Once transformers are bought by informal recyclers, they are keen to dismantle the unit for total extraction of valuable material (i.e. oil and metal parts). However, the insulation

papers and other laminating papers inside the transformers, which do not have significant monetary value are burned at their site while releasing pollutants including uPOPs to the environment.

e.1) Former studies related to welding transformers

According to the study done by the People To People Volunteers (a local NGO) in 2007, they collected 75 oil samples of welding transformers form Badulla district and Colombo area and PCB was screened using DEXSIL CLOR-N-OIL 50 PCB Screening test kits and GC analysis were carried out for a selected quantity to confirm the positive ones. The details about the total number of samples collected from Divisional Secretariat division and the number of samples test for PCB is summarized in the table 16.

Out of the 37 samples tested in 2007 for PCB, 26 samples (70%) were collected from refilled welding plants and 11 samples (30%) were collected from new welding plants. Twelve samples (46%) out of 26 refilled welding plants contained more than 50 ppm PCBs and the rest was negative (54%). Further, out of 11 samples tested for new welding plants, Six samples (55%) were positive for more than 50 ppm PCBs and five samples were negative (45%). The findings of the study suggest that considerable number of welding transformers in the study area is contaminated with PCB and the contamination in old transformers is higher than new counterparts. Therefore, the regulatory frame and the control need to be strengthened to stop the reuse and recycling of waste oils which need proper management.

Table 16: Divisional Secretariat Divisions of Badulla district where samples were collected.[3]

No	Divisional Secretariat Division	No of samples collected	No of samples sent for test
01	Walimada	09	03
02	Uva paranagama	07	03
03	Ella	05	03
04	Bandarawela	09	03
05	Mahiyanganaya	03	02
06	Meegahakiwula	08	03
07	Rididimaliyadha	03	03
08	Soranatota	02	01

09	Kandekatiya	02	01
10	Badulla	07	03
11	Haldumulla	05	03
12	Haputale	03	02
13	Haliela	06	03
14	Colombo*	06	04
Total		75	37

*According to the information given in the questionnaire, most of welders stated that they purchase used transformer oil from some places new Panchikawatta and Kelaniya (Addresses were not given). Also, welder's purchase new welding plants from Elk arc (PVT) Limited (welding plants manufacturing company). So total of six samples, five from Panchikawatta and Kelaniya area and one from ELK ARC (pvt) Ltd were collected and 4 samples were analyzed. It was found that the oil collected from the ELK ARC (pvt) Ltd also was positive for PCBs.

The results obtained from this study revealed that the contamination of PCBs in welding plants were considerably high. It is important to highlight that the sample collected from the welding plant manufacture company was also contaminated with PCBs and there is a high possibility to get the contaminated coolant to welders via new plants. Discussion made with the company revealed that the coolant oil for welding plants was purchased from the electricity board through the tender procedure. Thus, the present survey recommends carrying out a detail study to confirm the way to get the PCBs contaminated coolant oil to welders.

This study clearly shows that old transformer oil is used as coolant oil in welding plants. The possibility of exposure and self contamination among welders and cross contamination of their families and the environment are high due to lack of knowledge on the properties and toxic effects of the PCB contaminated transformer oil. Poor personal hygiene practices and not wearing personal protective equipment during refilling of welding plants with coolant oil and during maintenance operations and incorrect storage and disposal of the oil may subject the workers, their families and the environment to exposure and contamination. The eye and skin problems being the commonest health problems seen among the participants which could be due to PCB exposure. Substandard health, safety and welfare facilities prevailing in these work places contribute to the situation further.

e.2) Updated screening of waste oils in recycling

For the 2015 NIP update process, credible information were gathered on other applications of discarded transformer materials from those who operate in the informal network. It was found that transformer oil is sprayed as a penetrating oil to clean bottom surface of vehicles during vehicle services for a long period. Transformers oil is also used in formulating high temperature grease locally. Therefore transformers oil sold for service stations and grease formulations (both non PCBs and PCBs) by the informal recyclers ends up in environment.

To improve the situation recently three licenses were issued by the Central Environmental Authority to two welding transformer manufacturers and one to Grease formulator to use discarded transformer oil (tested and assured for none PCB oils as a raw material). Awareness given in recent past to the sector encourage to get approval from CEA to avoid future liabilities. But there are more small scale entrepreneurs this sector who have still not got licensed from CEA. Therefore, urgent actions need to be taken to capture all of the recyclers into the regulatory frame work.

Total 101 samples from welding transformers and penetrating liquids used for vehicle service centres were collected from almost all the provinces in Sri Lanka to assess and verify PCB contamination levels. From 101 gathered samples 68 samples were analysed for PCB confirmation. The samples were tested against PCB 1260, PCB 1242 and PCB 1254. The rest of the samples 33 (mainly collected from services centres) were not tested for PCB as those were detergent liquids or detergent powder. Five 5 samples out of 68 was confirmed for PCB contamination by GC- ECD analysis with levels below 50 ppm (table 17).

The above data reflects that 7% of the tested samples were contaminated with PCB but below 50 ppm. The previous studies discussed later also identified level of contamination of PCB transformer oil in locally manufactured welding plants.

Table 17 - Summary of the test results on the survey of welding transformers and penetration oil for PCB

ITI Identification Number	PCB 1260 standards, ppm	PCB 1242 standards, ppm	PCB 1254 standard, Ppm
17	1.21	None	None
19	1.16	None	None
54	11.50	12.71	10.25
61	1.83	None	None
90	1.08	None	None

f) Import of PCBs contaminated equipment

The first NIP from June 2006 addressed the need of regulatory framework to prevent entry of pure PCB and PCB containing substances into the country. In 2013, legislation was enacted to prevent importation of pure PCB and PCB containing products under "Mineral fuels, mineral oils and products of their distillation" under HS Code 2710.91. Further, the HS Code 2903.99.13 covers PCB containing substances (PCB, PCT, and PBB).

While the Extraordinary Gazette No. 1813/14 dated 5th June 2013 issued under the import and export control Act No 01 of 1969 specifically declared the banning of importation of pure PCB's. (HS Code 2710.91).

However, the information collected from Sri Lanka Customs for the period of 2013-2015 March by over 300 importers reveals that importation of PCB containing, consisting and/or contaminated equipment are not currently regulated and are not under licensed or banned category of the relevant HS codes (see table 18 for more details). Therefore, possibilities exist to accumulate those equipment in waste streams which requires to be disposed as hazardous waste materials to prevent possible hazard on human health and to the environment.

Table 18: Import Summary - Items Contaminated with or containing PCB

		2013	2014	2015 Jan-Mar
HS Code	**HS Description**	**Net Mass(Kg)**	**Net Mass(Kg)**	**Net Mass(Kg)**
85041010	Ballats for discharge lamps: contaminated with or containing PCB	1,455	1,733	266
85042110	Contaminated or containing PCB Liquid dielectric transformers > 650 kVA	149	127	75
85042210	Contaminated with PCB, not exceeding 2000 KVA transformers	9,808	9,601	3,139
85043110	Transformers, nes, contaminated or containing PCB	30,525	1,220	292
85043210	Transformers.. Contaminated or containing with PCB	6,955	282	87
85043310	Contaminated with or containing PCB	156		389
85044010	Uninterrupted power supply unit, containing PCB	46,059	28,909	14,807
85044030	Other, static converters contaminated with PCB	7,626	15,494	799
85045010	Inductors contaminated o containing with PCB	150	1,476	468
85049010	Parts of transformers, inductors, convertors including PCB	27,259	35,083	10,533
85321010	Capacitors designed for 50/60 Hz contaminated or containing with PCB	6,996	1,042	145
85322210	Aluminium lectrolytic Contaminated or containing with PCB	7	38	34

85322310	Ceramic capacitors containing PCB		1	
85322410	Ceramic capacitors containing or with PCB	3	8	10
85322510	Dielectric paper or plastic capacitors with PCB	13	13	
85322910	Other capacitors containing or with PCB	104	400	19
85323010	variable or adjectable capacitors with PCB	6,184	140	12
85329010	Parts containing or contaminated with PCB		3	37
Grand Total		**143,451**	**95,570**	**31,113**

Information available in the Customs data base, create greater concerns on the actions to be taken to prevent entering of PCBs containing equipments and accessories into the country and hence immediate actions has to be taken to inform relevant regulatory agencies (Customs and Import Control Department) to introduce a licensing system on importation of PCB containing and contaminated equipments into the country.

According to Dept of Customs, eight digit HS codes has been created for statistical purposes (for collecting data on any importation of such items). Customs has to rely on declaration made by importers since this department has no facilities to check as to whether these equipments are contaminated with or containing PCBs or not. Further this department has no way of checking the veracity of information declared by importers in respect of content of chemical shipments. And there is no essentiality of verifying reliability of such information as there is no regulatory measures on importation of these commodities and no revenue losses are involved in the event of classifying even in any other HS codes.

In the absence of substantial duty differences and import control regulation in place, Customs Department has no control on the importation of PCB containing and contaminated equipments and parts thereof. Hence introduction of import control regulation on the import of commodities classifiable in HS codes containing PCBs and mixtures containing PCBs is essential for effective control of introduction of PCBs into the countries environment.

g) PCB destruction test performed in Sri Lanka

Three test burning experiments have been conducted for PCB destruction of transformer oils at a Cement kiln belonging to Holcim (Lanka) Ltd with 99.9999% destruction at Puttalam and this could be a positive development in PCB management. Currently Geocycle the waste management unit of Holcim (Lanka) Ltd states that it can give end solution for PCB contaminated transformer oil through its co- processing facility at Puttlam. Dismantling of

transformers and dismantled items can be treated through its overseas partnerships. This is subjected to the amount of material and the other legislative clearance to be obtained.

h) Progress made towards the disposal of PCBs

Recognising the importance of the issue, the Ministry of Mahaweli Development has formulated the project on environmentally sound management of PCB and PCB contaminated oil in Sri Lanka with the technical assistance of UNIDO and through GEF financing. The development is based on the findings of the inventory report on PCB for the National Implementation Plan and the Country Assessment report on PCBs under the Regional project on Capacity Strengthening and Information Exchange on Polychlorinated Biphenyls Management in Selected Asian Countries (SAICM/BCRC) and taking into consideration that every party for the Stockholm Convention has to stop the use of PCB by 2025 and dispose the PCB in their own countries.

Sri Lanka started to formulate a project on environmentally sound management of PCB containing and contained equipment in Sri Lanka in the latter part of 2012 with the technical assistance of UNIDO. The project was approved by the relevant authorities in Sri Lanka and also the GEF. The investment for the project is USD 4,725,000 which add the USD 18,989,752 as co-financing from main stake holders such as CEB, LECO, Ministry of Power and Energy, Central Environmental Authority. The project is to be implemented during the period of 2016-2020. The project will help in elimination of a considerable share of PCB stock in Sri Lanka in an environmentally sound manner.

At present some activities such as awareness creation among main stakeholders and building the inventory of the equipment (Power generation distribution and transmission transformers, and welding transformers) related to the project has already started with the help of financial allocation made for the project in its PPG phase. In addition, arrangements have being made through the project to test transformers for the presence of PCB before they are released to informal recyclers through IDB. These project activities are going hand in hand with the activities of current NIP preparation.

Overall, it is clear that a more comprehensive survey (including specific testing of suspected transformers) has to be carried out in order to know which oils to dispose and to

determine the exact number of transformers which contain PCBs and the total volume. In addition to this, other priority sectors such as electronic manufacturing plants, future railroad systems, transformer repair facilities, heavy industry and residential and commercial buildings and capacitors should be surveyed in order to complete the survey and make a complete inventory of the PCB stocks in Sri Lanka. Further informal recyclers and users of the discarded transformer oils for other purposes may have compounded the problem by contamination across the country if they had been tainted with PCB containing oil, if any and there is a need to investigate further on possible contamination.

Under the provisions of the Stockholm Convention, Sri Lanka is required to completely phase out the use of PCBs by 2025 and dispose of any stocks of PCB in an environmentally safe manner by 2028. In order to do this it is vital that more precise information is available regarding PCB containing equipment including transformers and capacitors. For elimination of PCB several alternatives are currently available.

2.5.3 Polybrominated Diphenyl Ethers (PBDEs) and Hexabromo Biphenyl (HBB) (Annex A)

PBDEs are organic chemical compounds, which were and partly are extensively used as flame retardants in products such as electronic equipment, plastic housings, textiles and polyurethane (PUR) application. PBDEs are mixed with polymers as plastics are being made. PBDEs were produced and used as mixtures with different degree of bromination. PBDE congeners may differ in the total number or position of Bromine atoms attached to the ether molecule. Congeners with equal numbers of Bromine atoms are known as homologs. There are three types of commercial PBDEs.

i. Commercial Pentabromodiphenyl ether (c-PentaBDE) (global production 100,000 t)
ii. Commercial Octabromodiphenyl ether (c-OctaBDE) (global production 110,000 t)
iii. Commercial Decabromodiphenyl ether (c-DecaBDE) (global production approx. 1,200,000 t) (c-DecaBDE is not listed as POPs but suggested for listing at next Stockholm COP 2017)

Global production of c-PentaBDE and c-OctaBDE containing the listed POP-PBDEs (tetraBDE, pentaBDE, hexaBDE and heptaBDE homologues) has stopped around 2004. However, they are still present in consumer products in articles and products where PBDEs have been used in the past as Brominated Flame Retardants (BFRs). Because they are additive flame retardants in

plastic, they leach continuously to some extent out of the final product and still continue to release these toxic chemicals into the environment including indoors.

As Sri Lanka has never ventured into basic and fine chemical industry, almost all chemicals used in industry or by consumers had to be imported to the country. This means that the production of POP-PBDE in Sri Lanka was effectively zero. Even though POP-PBDEs are considered to be no longer produced, the main challenge for their elimination is the identification of existing stockpiles and articles containing POP-PBDEs and their disposal at end-of-life.

Large volumes of these materials are in the global recycling flow and will continue to be used in consumer articles. While POP-PBDE production and use is not allowed for Parties, there is an exemption for recycling of POP-PBDE containing products. Major products and articles containing POP-PBDEs include following sectors:

i. Electric and Electronic Equipment (EEE) and related Wastes (WEEE; e-waste)
ii. Polyurethane (PUR) foam and other plastics in transportation
iii. Foam in furniture and recycled carpet padding, (minor use in most countries)
iv. Insulation in construction (minor use)
v. Textiles (minor use)

The above major products and articles imported to Sri Lanka has a potential to contain PBDEs. Due to the complexity and magnitude of usage of POP-PBDEs, eliminating them represents a challenge for many Parties including Sri Lanka. In the view of enabling the policy formulating and implementing agencies to promote measures designated to reduce exposure and risk to human health and the environment to POP-PBDE, the preliminary inventory and action plan for sound management of POP-PBDE in Sri Lanka was prepared. This is the first comprehensive inventory study on POP-PBDE in the country. However, the study was limited to estimate the amount of POP-PBDE in EEE/WEEE and transport sector.

Note: *Due to the lack of flammability standards for specific uses in Sri Lanka, it can be assumed that POP-PBDE uses in furniture, mattress, textile, and carpet industry are not significant. On the other hand; PUR, PVC, rubber and plastic wastes/ scraps/ factory off-cuts are imported to the country under the*

provisions of "import, export and transit of waste listed in the Basel Convention"[4], which may also contain POP-PBDEs. However none of these materials were analyzed for presence of flame retardants (or specifically for PBDEs).

a) Inventory of PBDEs in EEE and WEEE

Technological innovations in a number of product categories including mobile phones, personal computers (PCs), digital televisions (TVs and video players), drove demand and boosted retail value growth in consumer electronics in Sri Lanka. Availability of 3D digital TVs and tablets, launch of the 'smart TV' concept, growing functionality of 'smart phones' and offer of cheaper alternatives encourage consumers to replace their existing old models with newer technologies. In addition to shortened replacement cycles, the consumer demand for advance technologies created revenue growth in consumer electronics. The market mainly depends on the imported EEE.

Proper recycling of WEEE is not taking place in the country. However, there had been much awareness being generated on the need for proper WEEE management. WEEE collection mechanism is currently established by some main EEE suppliers. The collected WEEE are shipped abroad (Singapore, Malaysia, Korea, Hong Kong, Belgium, Germany and UK) for processing. The existing WEEE collection mechanisms usually serve institutional customers, while household WEEE reaches the informal sector. Gradual phasing-out of the cathode ray tube (CRT) type monitors and television sets in Sri Lanka would be significant contributor to the generation of PBDE containing WEEE. The rapid entry of Liquid Crystal Display (LCD) and plasma type computer monitors and TVs have expedited this.

Based on the above information, the imported second hand EEE and related WEEE could be considered as potential contributors for presence of POP-PBDEs in Sri Lanka. The largest c-OctaBDE content is found in polymers that are used in EEE and WEEE in which, the major amount of c-OctaBDE is in the polymer fraction of casings from CRT computer and TV monitors. Therefore the priority were given to CRT type computer and television monitors during

[4] Implementation of the national obligations on import, export and transit of waste listed in the Basel Convention is carried out by the Central Environment Authority (CEA) as the National Competent Authority for the Basel Convention in Sri Lanka. For the importation of List B wastes of the Basel Convention, a proposal should be submitted by the importer (industrialist) to the CEA/BOI).

preparation of the inventory of POP-PBDE in EEE/WEEE.

The inventory of stocks and flows of EEE/WEEE address three stages in the life cycle of EEE namely; import of new and second hand EEE (i.e. CRT computer and TV monitors) during the period of 2007-2014 (8 years), EEE entering the waste streams (i.e. WEEE) and stocks of WEEE.

The amount of c-OctaBDE in stockpiled CRT computer and TV monitors (2007-2014) within Sri Lanka is estimated at 4415.36 kg, which is contained in approximately 5820 tonnes of EEE having about 1750 tonnes of polymer fraction. Another 551.92 kg of c-OctaBDE is estimated to be present in about 728 tonnes of CRTs that have entered in to waste stream in 2014 containing 218 tonnes of polymer fraction.

Table 19 - Sum of POP-PBDEs present in EEE and WEEE

Sum of POP-PBDEs (c-OctaBDE)	Amount of c-OctaBDE in kg
Stockpiled CRT computer and TV monitors (during 2007-2014)	4415.36
CRT computer and TV monitors entering the waste stream (in 2014)	551.92
Total c-OctaBDE in EEE and WEE (for the inventory year 2014)	4967.28

Further, the amount of listed POP-PBDEs (HexaBDE and HeptaBDE) was calculated from the estimated c-OctaBDE quantity (refer Table 20) considering the respective percentage of homologues present in the c-OctaBDE mixtures. This information is indicated in the Table 20.

Table 20 - POP-PBDEs homologues (HexaBDE and HeptaBDE) present in EEE and WEEE for the relevant life cycle stages in the inventory year 2014

PBDE Homologues	Distribution of PBDE homologues in c-OctaBDE (%)	POP-PBDE in EEE stocks for inventory year 2014 (kg)	POP-PBDE entering the waste stream for inventory year 2014 (kg)
HexaBDE	11	485.69	60.71
HeptaBDE	43	1898.60	237.33

N.B.: The above inventory was prepared by considering stocks of EEE during last 8 year period (2007-32014). However, as per National Implementation Plan for Electrical and Electronic Waste Management in Sri Lanka (published in March 2008), the estimated life spans of CRT type new PC

and old PC are 8–10 years and 4–6 respectively. The same for TVs is 15-20 years. Hence, CRT type PCs imported during 2005-2006 and TVs during 1995-2006 can be still in use in Sri Lanka (i.e. in EEE stocks). Further, WEEE stocks were not considered during preparation of this inventory due to the absence of systematic database/inventory of the WEEE stockpiles and WEEE exports in the country.

Furthermore, the POPs Review Committee has proposed to list DecaBDE to the SC on POPs at the Conference of Parties in 2017. Usage of DecaBDE in plastics (including EEE) is more than ten times higher compared to that of c-OctaBDE. Accordingly, if DecaBDE is considered, the total amount of POPs and contaminated polymer fraction in EEE is much larger (Waeger et al. 2010). Hence, this fact needs to be considered in present and future management of EEE/WEEE plastic.

Currently the Sri Lankan government is in the process of strict control of second hand EEE imports with the view of that 'Sri Lanka should not be a recipient nor should be an end destination for out-dated, problematic EEE from elsewhere'. This will prohibit further inflow of POP-PBDEs in EEE and WEEE into the country. Furthermore, Sri Lankan government has implemented special programmes to establish island-wide WEEE collection network with the objective of improving private and public sector involvement in formalized WEEE management.

a. Inventory of PBDEs in Transport Sector

A large proportion of c-PentaBDE use has been within the transport sector; the major use was for treatment of flexible PUR foams. The main applications of PUR in vehicles include; seat foam, cushion overlay (fabric backing), carpet backing, door panels, sound absorption and vibration dampening, dashboards, steering wheels, bumpers, energy absorbers, headliners, airbag covers, and window encapsulation.

Even though motor cycles and motor tricycles posses larger fraction of total vehicle population in Sri Lanka (altogether 70%), they are not considered as major POP-PBDE containing vehicles. Cars, trucks and buses are the major portion of the transport sector containing the largest volume of POP-PBDEs. (Secretariat S. C., July 2012) Hence only motor cars, buses (commercial), dual purpose vehicles (include vans and cabs) and motor lorries were considered as the major contributors for the inventory of POP-PBDE in Sri Lankan transport sector.

Data on total registered vehicles in Sri Lanka during the period of 2002–2014 is illustrated in Figure 4 which depicts a significant growth in Sri Lankan transport sector during the last decade. However, being a developing country, vehicles manufactured within the period of 1970-2004, which may contain c-PentaBDE are still in operation in Sri Lanka. Cars, buses and trucks could be considered as major contribution for POP-PBDE in the transport sector.

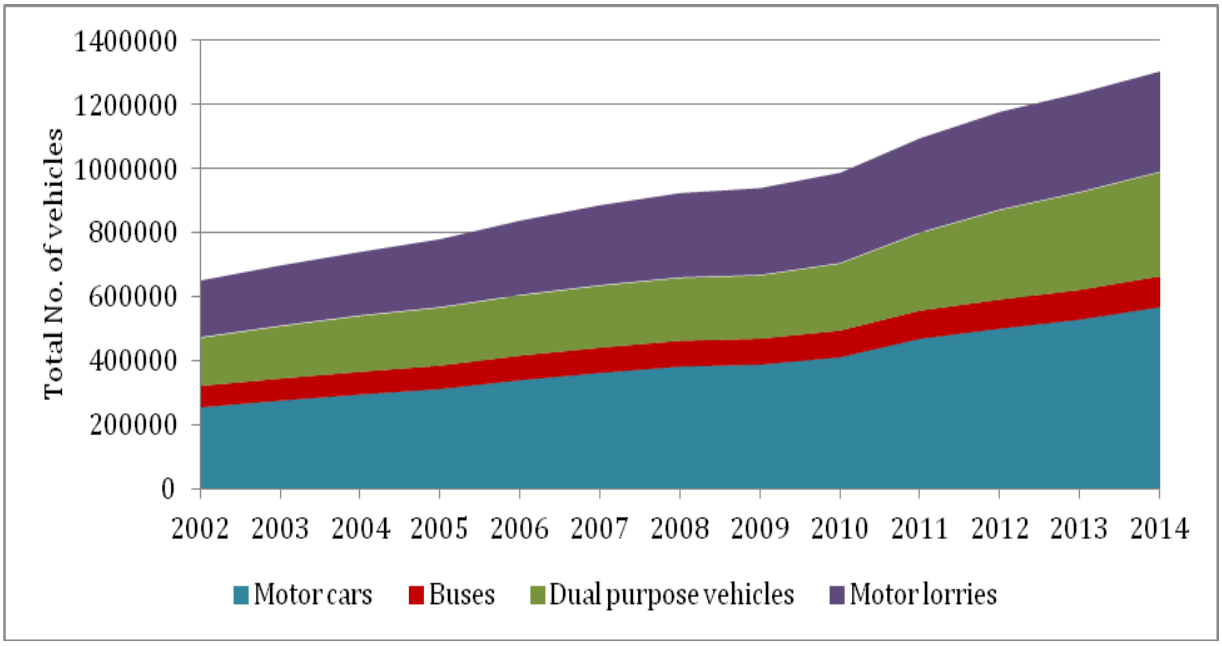


Figure 4: Total amount of motor cars, buses, dual purpose vehicles and motor lorries during the period of 2002–2014

Currently Sri Lanka does not have a proper End-of-Life Vehicle (ELV) program. Vehicle deregistrations are also not taking place in a proper manner. Garages, rail yards, bus depot, court premises and insurance yards are the places where accumulation of end of life vehicles are visible. Removal mechanism also does not get developed as orderliness and cleanliness of such environmental setting are a low priority. However, components of ELV's are imported to the country in large quantities.

Once, there was an enterprise named 'Metal Recyclers" under the Board of Investment of Sri Lanka (BOI) that brought in crushed ELVs and process of dismantling and segregation for separate export sale was in place. As per BOI, the factory was in operation from September 1997 to March 1999. Similar operation had been recently proposed to the 'Proposed Industrial Zone in Hambanthota but had not been approved by the BRS committee. However, vehicles manufactured

in US are very rarely imported to Sri Lanka, mainly the imported cars, buses, dual purpose vehicles and motor lorries originate from India and Japan while a considerable amount originate from Sri Lanka[5], UK and China.

Since POP-PBDEs were produced and used in the period from approximately 1975-2004, only vehicles (i.e. motor cars, buses, dual purpose vehicles and motor lorries) produced during this period are inventoried for POP-PBDEs. The amount of c-PentaBDE in vehicles in current use or sale within Sri Lanka is estimated to 5445 kg (table 21), which contained in approximately 10215 tonnes of PUR form contained in potentially impacted vehicles; approximately 164000 cars, 36600 busses, 131800 dual purpose vehicles and 113800 motor lorries.

Table 21- Total amount of c-PentaBDE (Kg) in PUR foam depending on vehicle type in use or sale

Vehicle category	**c-PentaBDE (Kg)**		
	Originated from US region	**Originated from regions other than US**	**Total**
Motor cars	38.04	1307.92	1345.96
Busses	113.54	1819.95	1933.49
Dual purpose vehicles	3.16	1054.32	1057.49
Motor lorries	219.36	888.29	1107.65
Total	**374.11**	**5070.48**	**5444.59**

N.B.: The vehicles that excluded from this preliminary inventory may contain flame retardants in varying degrees. However as the POP-PBDE content in these vehicle categories has not yet been estimated, preliminary plans for monitoring of brominated POPs has to be developed. Accordingly, the related POP-PBDE in impacted vehicles could be higher than the estimated values given in Table 21.

Further, the amount of listed POP-PBDE homologs (etraBDE, pentaBDE, hexaBDE and heptaBDE) was calculated from the estimated c-PentaBDE quantity (refer Table 22) considering the respective percentage of homologues present in the c-PentaBDE mixtures. This information is indicated in the Table 22.

[5] Sri Lanka does not have a single vehicle manufacturing plant. Currently, there are 7 vehicle assembling plants for which all vehicle parts (including engine) and interior materials are imported.

Table 22 - POP-PBDEs homologues (TetraBDE, PentaBDE, HexaBDE and HeptaBDE) present in vehicles currently in use or sale

PBDE Homologues	Distribution of PBDE homologues in c-PentaBDE, [%]	POP-PBDEs in vehicles currently in use or sale, [kg]
TetraBDE	33	1796.71
PentaBDE	58	3157.86
HexaBDE	08	435.57
HeptaBDE	0.5	27.22

b) POP-PBDE in other uses in Sri Lanka

Furniture, mattresses, re-bond materials, textiles and rubber could be identified as significant potential uses of c-PentaBDE contaminated products/ consumer articles in Sri Lanka. The magnitude of their use is comparatively low due to relative low overall usage in most of these applications and lack of flammability standards for specific use areas.

Second-hand articles containing *polyurethane* (PUR) foam, polyvinyl chloride (PVC), rubber and plastic wastes/scraps/ factory off-cuts are imported from countries with such flammability standards and related stocks (e.g. export of used furniture containing PUR foam produced before 2005 from US and UK) to the country under the provisions of "Import, export and transit of waste listed in the Basel Convention", which may contain POP-PBDEs. As import of these articles to Sri Lanka from US and UK is limited, c-PentaBDE in these applications is considered to be low.

c.a) Import of polyurethane scrap for recycling

A large amount of polyurethane foam wastes/scraps is imported to the country under the provisions of "Import, export and transit of waste listed in the Basel Convention". The imported quantities within the period of 2008-2014 are obtained from the database maintained at CEA and summarized in Table 23. However, none of these imported materials were analyzed for the presence of flame retardants or specifically for PBDE. Hence, it could not be clarified if and to which extent the imported PUR foam might contain POP-PBDEs.

Table 23 – Amounts of PUR foam scrap imported within the period of 2008-2014

Year	PUR foam scrap (tonnes)	Country of origin
2007	77.678	Germany, China
2008	241.976	Italy, China
2009	836.836	Italy, Portugal, China
2010	195.500	Italy, China
2011	172.880	Italy
2012	709.100	Italy, Portugal, Poland, Germany, Turkey, China
2014	657.354	Italy, Russia, Hong Kong, China

c) Considerations on hexabromobiphenyl (HBB)

HBB was not specifically addressed in the inventory since the production volume is considered small (approximately 6000 tonnes) largely used in the 1970s in the US. Due to the small production and limited use, it is likely that most HBB-containing materials were disposed of decades ago. Hence material flow of HBB is of minor relevance for the inventory process in many countries including Sri Lanka.

2.5.4 DDT (Annex B chemical)

a) Description

Technically, DDT (*p,p*'–DDT–the main component– and *o,p*'–DDT) (CAS No. 50–29–3) was used extensively all over the world as a domestic and agriculture pesticide (Ecobichon, 1995). Water solubility of *p,p*'–DDT, *p,p*'–DDD, and *p,p*'–DDE are 0.0055, 0.02, and 0.1 mg/L at 20–25°C. Values of log Kow are 5.7 for *p,p*'–DDT, 6.1 for *p,p*'–DDD and 6.0 for *p,p*'–DDE. Also, the sorption coefficients (log Koc) are 6.3 for *p,p*'–DDT, 5.0 for *p,p*'–DDD, 4.7 for *p,p*'–DDE at 20–25°C. The large ratio of DDD/DDE likely indicates reductive dechlorination of DDT to DDD, which has been observed in sediments under flooded, anaerobic conditions.

Under anaerobic conditions, sediment DDT is mainly metabolized to DDD by reductive dechlorination either by microbial degradation or by chemical reaction. Under aerobic conditions, DDT is metabolized to DDE by dehydrochlorination. Environmental exposure to *p,p*'–DDT and its main metabolite *p,p*'–DDE or dietary sources exposure (especially, food of animal origin, but also through water, outdoor and indoor air, dust and soil) result in the bioaccumulation of these chemicals in the human body (especially, adipose tissue, serum, and breast milk). DDT and its

metabolites are endocrine disrupting chemicals (EDCs); DDT has a very long average–life.

In addition, it is metabolized to DDE, which tends to persist much longer in the body, and this metabolite is of greater concern as regards bioaccumulation, since it is a marker of chronic exposure (Jaga and Dharmani, 2003). DDT is estrogenic and DDE is an anti-androgen (Damstra et al. 2004). Recently, the International Program on Chemical Safety (IPCS) issued a comprehensive report entitled Global Assessment of the State of the Science of Endocrine Disruptors. This report evaluates the science surrounding endocrine disruption in humans and other animals and makes conclusions, (when possible), based on broad bodies of scientific evidence. Parental compounds (*p,p*'–DDT and *o,p*'–DDT) present in technical formulations of DDT are the most estrogenic among all DDT derivatives (Robinson et al. 1985).

b) Production

There is no history of production or formulation of DDT in Sri Lanka.

c) Use

The use of DDT in Sri Lanka is dated far back to 1946 when it was introduced to control malaria vector mosquitoes. Some of the reported DDT formulations were Arkotine® D18, Didimac® 25 EC, Deenol® 25% EC, Sillortox® and DDT 50% WP in public health and agricultural use. The noticeable agricultural uses were on tea (e.g. tea tortrix), floriculture (e.g. cockchafer grub, caterpillars and stem borers) and rice (Hagen and Ekanayake, 1977; Cranham and Danthanarayana, 1971).

The long term use of DDT during 1950 through 1970 on tea lands which had purportedly brought up severe (secondary) pest outbreaks of red spider mites in major tea estates led to its discontinuation (ban) in 1970 (Cranham and Danthanarayana, 1971). Dantanarayana and Fernando (1970) tested DDT (DDT (Deenol® 25% EC; *ex* Baurs) for the control of live wood termites (*Postelectrotermes militaris* (Desneux) in tea but had no effect because of the secretive habits of the termites. In 1971, the use of DDT on tea was banned.

The insecticide, DDT played a significant role in malaria eradication program in Sri Lanka since 1958 through 1977. The strategy adopted during this period was blanket or

carpet spraying of households throughout the dry zone of Sri Lanka including some parts of the western province. There are reports of rampant cases of developing resistance in mosquito populations (e.g. *Anopheles nigerrimus*) since 1969 (Clarke et al. 1974) through 1982 (Herath and Joshi, 1986), covering the entire country. The use of DDT was discontinued in Sri Lanka in 1976 with gradual replacement by Malathion in 1977 in mosquito vector control programs (Wickramasinghe, 1981).

Dicofol (CAS No. 115–32–2) and DDT are chemically closely related. Dicofol is manufactured from DDT. During some manufacturing processes, technical dicofol can be contaminated with 10–34% of DDT like compounds (Qiu et al. 2005). However, under controlled manufacturing processes can produce technical grade dicofol which contains up to 0.5% DDT (Li et al. 2014). Dicofol 42% EC (Kelthane®), an effective miticide, had been recommended for the control of tea mites (*Oligonychus coffeae*) since 1965 through 1994 until its concerns on DDT residues in tea products were recognized.

The contaminants of DDT isomers, which may have originated from the manufacturing of dicofol, were proliferating in tea products due to repeated use of dicofol on severe mite infestations occurred during dry weather conditions in major tea estates. Dicofol was de–registered in 1994 hitherto recommended exclusively for use on tea.

The volume of DDT imported to Sri Lanka in 1971 was about 120 tonnes according to Ramasundaram et al. (1978). However, official statistics of the Ministry of Health, Sri Lanka reported that a quantity of 2,080 tonnes of DDT had been used during 1971–1972, while the total consumption during 1954–1976 was 9,000 tonnes (50% DDT). The last recorded use of DDT by the Health Ministry was about 316 tonnes (50% DDT) in 1976.

The total consumption of Dicofol 42% EC in tea was 2,084 liters during 1988–1992. In the year 1988 alone, 1,000 liters of Kelthane® had been imported to Sri Lanka by M/s Chemical Industries (Colombo) Ltd.

d) Wastes

There are no reported obsolete major stockpiles or wastes of either DDT or dicofol in Sri Lanka. However, only one instance is reported to possess obsolete DDT by a government farm but the total quantity is about 10 liters.

2.5.5 Perfluorooctanesulfonic acid (PFOS) and related chemicals (Annex B chemicals)

a) General considerations

Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) are completely fluorinated (Perfluorinated), organic compounds and both are perfluorinated alkylasted substances (PFAS). PFOS is commonly used as a simple salt (such as Sodium, Potassium or Ammonium) or is incorporated into larger polymers. PFOA is a Perfluoralkyl-carboxylate which produced synthetically as a salt (Anon., 2014).

PFOS and related substances which can form PFOS have been listed in the Stockholm Convention. PFOA is not listed in the Stockholm Convention but is currently assessed by the POP Reviewing Committee. As PFOA is not yet listed in the Stockholm Convention this inventory only focused on PFOS and related substances.

Because of their unique lipid and water repellent characteristics, PFOS and related substances used in a widespread variety of industrial and commercial products such as textiles and leather products, metal plating, the photolithography, photographic industry, semi-conductors, coating additives, paper and packaging, cleaning products and pesticides. PFOS was and is still used to manufacture Aqueous Film Forming Foam (AFFF), PFOS based AFFF is used to extinguish flammable liquid fires (for example, Hydrocarbon fuelled), such as fires involving gas tankers and oil refineries (EPA 2013a). PFOS can be formed by environmental microbial degradation or by metabolism in larger organisms from the large group of related substances or precursor compounds (in total approximately 165).

They include long carbon chains which are stable. PFOS is extremely persistent in the environment due to the Carbon-Fluorine bond which is thermodynamically the strongest bond known making PFOS exceptionally stable. The C 8 F 17 subunit also adds hydrophobicity to it. PFOS also contains a reactive sulfonic group (-SO 3 H) which adds polarity and these two attributes give the PFOS the ability to repel both water and oil.

Even though PFOS can exist in 3 forms (anionic, acid and salt forms) under normal environmental conditions (neutral pH) the anionic form (C 8 F 17 SO 3-) is dominant. This results in very low volatility and high water solubility. Due to this aspect PFOS can be typically found at higher concentrations in water compared to air. However, PFOS precursors such as N-methyl

perfluorooctanesulfonamidoethanol (N-MeFOSE) and N-ethyl perfluorooctanesulfonamidoethanol (N-EtFOSE) are more volatile and can travel through air and subsequently degraded to PFOS.

b) Inventory

PFOS has never been manufactured in Sri Lanka. However, PFOS was and is imported in articles and products to the country. The inventory of PFOS was developed based on 14 categories. The categories comprises of thirteen subdivisions, referred in the Sweden report on PFOS plus the use of pure chemical foam in laboratory. For the calculation of the quantity of PFOS, Stockholm Convention guidance for the inventory of PFOS published in year 2012 (Anon., 2012) was used.

The data related to each category was obtained from the Central Environmental Authority, Sri Lanka (CEA) based on the districts. In addition to that, each category was further divided into three based on the capacities of the industries as indicated by National Environmental Act, No. 41 of 1980. The data collected from all categories based on factory capacities were taken into account when the inventory was formulated. Accordingly, it has been calculated that the total amount of PFOS used in the country is in the range of 8444 to 37596 kilograms for the inventory year (2013).

Estimated amount of imported PFOS (for 2013) is shown in Table 24. Customs data base was used to calculate the amount of PFOS and the concentration of PFOS in products according to the inventory guidance.

Table 24 - Estimated amount of PFOS imported in year 2013

Category of article or preparation	**Year of phase-out**	Process *Steps, if applicable*	**Import (kg per year)**	**Manufacture (kg per year)**	**Export (kg per year)**	**PFOS content** *Approximate values* **(mg PFOS/ kg article or preparation)**	**PFOS quantity (kg per year)**
Photographic sector	2013	• Surfactant • Electrostatic charge control agent • Friction control agent • Dirt repellent agent • Adhesion control agent	43670	0	0	100	43.67
Semiconductor sector		• Etching agent • Photoresist substance • Photo-acid generator Surfactant • Anti-reflective coating agent	0	0	0	200 - 1000	0

Category of article or preparation	**Year of phase-out**	Process *Steps, if applicable*	**Import (kg per year)**	**Manufacture (kg per year)**	**Export (kg per year)**	**PFOS content** *Approximate values* **(mg PFOS/ kg article or preparation)**	**PFOS quantity (kg per year)**
Electronics sector		• Etching agent Dispersion agent • Desmear agent • Surface treatment agent • Photoresist substance • Photo-acid generator • Surfactant; • Anti-reflective coating agent • Solder • Adhesive • Paint	0	0	0	200 - 1000	0
Aviation hydraulic fluids			47250	0	0	500-1000	23.63-47.25
Fire fighting foams			1189156	0	0	5000-15000	5945.78-17837.34
Metal plating Decorative plating of metal, rubber and plastics			0	0	0	50 000 – 500 000	0
Certain medical Devises			0	0	0	150 ng/CCD filter	0
Coating and impregnation of paper and packaging			0	0	0	500-5000	0
Coating and impregnation of synthetic carpets			2577220	0	0	500-5000	1288.61-12886.13
Coating and impregnation of leather and apparel			85007	0	0	500-5000	42.50-425.01
Coating and impregnation of textiles and upholstery			1142278	0	0	500-5000	571.14-5711.39

Category of article or preparation	**Year of phase-out**	Process *Steps, if applicable*	**Import (kg per year)**	**Manufacture (kg per year)**	**Export (kg per year)**	**PFOS content** *Approximate values* **(mg PFOS/ kg article or preparation)**	**PFOS quantity (kg per year)**
Coating and coating additives				0	0	1000-10 000	0
Toner and printing inks			3121200	0	0	100	312.12
Cleaning agents, waxes and polishes			2345291	0	0	50-100**	117.26-234.53
Chemicals			99	0	0	100%	99.0
TOTAL quantity of PFOS kg per year							**8443.71-37596.44**

Since this is the first PFOS inventory, the upper value was taken as a conservative estimate. Meanwhile alternatives for PFOS are in the market since several years (in particular since 3M stopped PFOS production around year 2000). This estimate can be seen as an upper estimate. In phase 2 during NIP implementation the chemicals used for the individual applications need to be individually assessed.

The past use of PFOS in the country has resulted in PFOS contaminated sites. PFOS contamination is considered from fire-fighting foam in Sri Lanka as the country was influenced by a civil war for 26 years during which a lot of fires took place as results of bombings and other war crimes. The related data on these fires is collected from various sources to determine the contaminated areas of the country and has been compiled below in the chapter on POPs contaminated sites.

Most historically imported PFOS is still present in the country since Sri Lanka does not have a destruction capacity but dispose consumer goods, industrial wastes and other wastes to landfills and dumpsites. Therefore the largest stock of PFOS and related substances are in landfills. Furthermore some stock are present in synthetic carpets. This stock has however not been quantified in this first PFOS inventory.

2.5.6 Unintentionally Produced POPs (UPOPs) (Annex C chemicals)

Unintentionally Produced POPs (UPOPs) are a group of persistent organic pollutants, that produced unintentionally due to various anthropogenic activities including different production processes and are listed in the amended Annex C of the Stockholm Convention. They include;

- Polychlorinated dibenzo-p-dioxins (PCDD)
- Polychlorinated dibenzofurans (PCDF),
- Polychlorinated biphenyls (PCBs),
- Hexachlorobenzene (HCB), and
- Pentachlorobenzene (PeCBz).

Out of these compounds, PCDD and PCDF (PCDD/F) have never been manufactured intentionally for any commercial or other applications, except for some laboratory applications, and formed as unintentional by-products of manufacturing and combustion processes that involve chlorine or chlorine containing compounds and organic matter. The largest share of PCBs (approx. 1.3 million tonnes) have been produced as industrial mixtures and used e.g. as coolants and/or lubricants in transformers and other electrical items due to their favourable properties such as fire, heat and electrical resistance (see paragraph on PCBs above).

PCBs are also formed as unintentional by-products of combustion of PVC and other chlorine containing wastes, in certain chemical processes involving organochlorines, such as certain pigments or chlorinated solvents. HCB has been widely used as a pesticide and as an ingredient in making fireworks, ammunition and synthetic rubber. It is also used as a solvent in the production of pesticide (UNEP, 2007). HCB and PeCBz are also produced unintentionally by the thermal processes involving chlorine compounds and in certain processes in the organochlorine industry.

National inventory of unintentionally produced POPs was developed based on the UNEP toolkit for Identification and Quantification of Releases of Dioxins, Furans and other Unintentional POPs (UNEP, 2013) with the objective of ensuring that source inventories and release estimates are complete, transparent, as well as consistent in format and content so that the result can be compared at national, regional and global level as well as progress of the national implementation plans can be consistently.

The inventory methodology used followed the guidelines given in the UNEP toolkit to undertake the source inventories and release estimate for the year 2013 in Sri Lanka. It covered 10

main source groups namely Waste Incineration, Ferrous and Non-Ferrous Metal Production, Heat and Power Generation, Production of Mineral Products, Transport, Open Burning, Production and Use of Chemicals and Consumer Goods, Miscellaneous source categories that do not match the description of any other source group, Disposal and Landfill and Contaminated Sites and Hotspots. From the total 68 source categories within these source groups 57 categories were present in Sri Lanka and only 11 were not addressed in the inventory since they were not present in Sri Lanka or were considered to be insignificant.

The total PCDD/F release in Sri Lanka in 2013 (see table 17) is estimated to 182 g TEQ. The major release (77 g TEQ; 42%) stem mainly from hospital waste incinerators. A second major source is open burning. The major source were intentional and unintentional fires in dump sites and open waste burning from households. It is estimated that a total of 36 g TEQ/year (20% of total release) stems from landfill fires.

Open burning of household wastes, though it is banned by regulations, is a common practice in rural and sub urban areas where there are no proper waste management services available. The release from open waste burning was 15.4 g TEQ/year (8,5% of total). Therefore the total release from open waste burning was estimated at 51 g TEQ/year (28% of total release). Along with PCDD/F other UPOPs and a wide range of other pollutants (PAHs, carbon black, fine particles, heavy metals) were released contributing considerably to the total air and soil pollution.

The total release from metal industries (iron, copper, zinc, lead and aluminium) are estimated to 7 g TEQ/year. Although the contribution to the total release is only 4%, such facilities can be point sources for PCDD/F, other UPOPs and other pollutants in particular heavy metals and need to be considered and controlled. The ashes from these processes are contaminated with PCDD/F, other UPOPs and heavy metals and need environmental sound management.

The baseline emissions estimated in 2002 was recalculated using the new toolkit for comparison purposes. According the new estimate, the emission dropped to 153 g TEQ/a from the initial estimate of 257 gTEQ/a, mainly due to the use of a different emission factor for agricultural waste burning that is more appropriate to the conditions prevailing in Sri Lanka. The other difference being, in 2002 the main source of emission was open burning but this was overtaken in 2013 by health care waste incineration.

a) Waste Incineration

According to the toolkit, main category of Waste Incineration includes municipal solid waste, hazardous waste, medical waste, light fraction shredder waste, sewage sludge, waste wood and waste biomass, and animal carcasses. Even though there are no solid waste incineration facilities in Sri Lanka, one private entity, namely Holcim Lanka Ltd, is involved in co-processing of hazardous waste incineration A total of 12,429 tonnes of hazardous wastes consisting of industrial sludge, waste oil, petroleum waste, hazardous solvents and other hazardous solids were incinerated co-processed at the facility in 2013. However, emission from this will be covered under cement production.

In addition, 1,726 tonnes of hazardous waste are incinerated in a controlled manner, but without proper air pollution control systems (APCS) and another 548 tonnes waste is burnt in incinerators in controlled units with APCS in industrial facilities. These activities resulted in release of 0.601 gTEQ/year and 1.800 g TEQ/year of PCDD/PCDF to air and fly ash, respectively. Medical waste incineration is practiced by both government and private hospitals. Most of the wastes are being incinerated in facilities with minimum air pollution controlled systems in uncontrolled batch operations. Therefore, the total estimated PCDD/PCDF emission from medical waste incineration is 56.730 gTEQ/year and 0.340 g TEQ/year to air and residue, respectively.

There are around 3015 sawmills and 4442 timber depots in operation in the country. It is calculated that about 0.904 million tonnes of sawdust production in Sri Lanka in 2013 from the saw mills assuming they operate 250 days per year. The saw dust generated from these sources is frequently used for industries such as cement, brick and other manufacturing facilities. However, incineration of saw dust at the site in cured incinerators is still practiced to a very lesser extent but the amount could not be estimated.

Thus if mere 2% incineration is assumed a total of 18,000 tonnes per year of saw dust is incinerated resulting 1.8 gTEQ/year emissions to air and 18 gTEQ/year to fly ash. Therefore, total of 79 .271g TEQ of PCDD/PCDF is generated per annum from the incineration activities and of this amount 59 .131 g TEQ is released to air 20.140 contains in residues generated. But the calculation does not take the categories of Light-fraction Shredder Waste Incineration, Sewage Sludge Incineration and Destruction of Animal Carcasses into account as they do not exist in Sri Lanka.

b) Ferrous and Non-Ferrous Metal Production

Main category Ferrous and Non-Ferrous Metal Production addresses 12 categories namely Iron ore sintering, Coke production, Iron and Steel Production and Foundries, Hot-dip Galvanizing Plants, Copper Production, Aluminium Production, Lead Production, Zinc Production, Brass and Bronze Production, Magnesium Production, Other Non-ferrous Metal Production, Shredders and Thermal Wire Reclamation. The information related to these categories were collected either through the data collected from the regional officers of the Central Environmental Authority or Board of Investment.

When these sources do not provide the sufficient data for the calculation, they were gathered though the questioners submitted to industries directly. The validity of the data was cross checked through the site visits. In 2013, the total material produced in Iron and Steel Production and Foundries category with limited air pollution control is 96,484 tonnes. As a result of this amount of PCDD/PCDF released to air was estimated to be 0.965 g TEQ/year, while release to residue was 1.447 g TEQ/year.

The respective amount of PCDD/PCDF released to air from 19,800 tonnes of clean scrap/virgin iron or dirty scrap was processed in foundries equipped with APC was estimated to be 0.198 g TEQ/year. The amount of PCDD/PCDF released to air and residue was calculated as 0.0002 g TEQ/year and 0.01 g TEQ/year for the same period. The copper production is practiced in the factories located in the Board of Investment BOI zones as well as in facilities located outside BOI zones. When the processing is in BOI zones, 95 percentage of purity level of copper is subject for processing in factories equipped with better air pollution control systems and the residues to be re-exported. But such conditions are not applied for the facilities outside the BOI zones and air pollution control systems of these facilities are at a basic level. Accordingly, the total amount of estimated PCDD/F released by copper processing to air and to residue are 0.401 and 0.5 g TEQ/year, respectively.

Aluminium melting can be considered as the most wide spread industry among the metal processing industries. Most of them are small scale and use waste oil fired crucible furnaces with no or minimal air pollution control facilities while 13 aluminium melting plants are operated with proper air pollution control facilities. These operations resulted in estimated PCDD/F release of 0.152 g TEQ/year to air and 2.80 g TEQ/year to residue in 2013. While the estimated amount of PCDD/F released due to lead processing plants both in and outside BOI for year 2013 to air and

residue are 0.055 and 0.3 g TEQ/year respectively. The same values calculated for Zinc producing plants are in 0.146 g TEQ /year and 0.001 g TEQ/year.

Production of Brass and Bronze items is mainly practiced Kandy and Gampaha Districts as a small scale industry. They are pertaining to simple furnace category in the tool kit. Consequently, it is estimated that total amount of 0.004 g TEQ/year is emitted to air in 2013. As the categories of Iron ore sintering, Coke production, Magnesium Production, Other Non-ferrous Metal Production, Shredders and Thermal Wire Reclamation are not related to Sri Lanka, total of 1.912 g TEQ/year and 5.058 g TEQ/year of PCDD/PCDF are added to air and residue respectively from the main category of Ferrous and Non-Ferrous Metal Production.

c) Power Generation and Heating

Main category of Power Generation and Heating consists of five sectors namely power generation, landfill combustion, biogas combustion, Household heating and cooking with biomass and Household Heating and Cooking with Fossil Fuels.

According to the National Energy Balance 2013 (SEA, 2014), about 50% of the total energy generation comes from thermal sources that includes Fuel Oil (HSFO 180 CST, FO 1500), diesel, coal, Residual Oil (HSFO 380 CST, FO 3500), Fuel Oil (LSFO 180 cst), Naphtha and also biogas plants. The total amounts of PCDD/PCDF added to environment in 2013 are 0.328 g TEQ/year to air and 0.074 g TEQ/year to residue respectively. It is also important to notice that the same values re-estimated for the 2002 using the tool kits are 0.296 g TEQ/year to air and none to residues. The main reason for the differences in the years of 2002 and 2013 is mainly due to non-existence of coal power generation in the year 2002.

Biomass is the most dominant type of fuel used in domestic cooking, especially in the rural areas. Central Bank data released in 2014 showed that about 80.5% of households used firewood as cooking fuel. However, the Sri Lanka Energy Balance- 2013 reports the biomass (Fuel wood) consumption data as “Household, Commercial and Other” and hence the estimation of household consumption figures alone is not possible. But, as the biomass in commercial entities are also mostly used for cooking. Hence, it is estimated that total PCDD/PCDF /F released to air and residue due to biomass was to be 13.179 g TEQ/year and 2.5 g TEQ/year, respectively.

Fossil fuels used in household, commercial and other uses include LPG and kerosene oil. LPG is almost exclusively used for cooking purposes, while a fair amount of kerosene is used for

lighting of rural houses. As the emission factor of Kerosene oil used for lightening is not indicated in the tool kit and considering unavailability of separate data on amount of Kerosene oil used for lightening in Sri Lanka, study used the emission factor of kerosene stove for calculation of release of PCDD/PCDF to air due to lightening from Kerosene oil.

However, data on amount of LPG used in Sri Lanka is available and on the other hand emission factor for LPG stove is given in the tool kit. Therefore, the study was able to calculate the amount of PCDD/PCDF to air due to these activities in 2013 as 0.062 g TEQ/year. There is no emission factor for using biogas for cooking in the tool kit. Therefore, the study used the emission factor of LPG to calculate the amount of PCDD/PCDF emission for 2013 using other available data. Consequently, this value is calculated as 0.0001 g TEQ/year.

d) Mineral Products

Main category mineral product includes five production processes namely cement, lime, brick, glass and ceramic. In addition, it also covers the two categories namely Asphalt Mixing and Oil Shale Pyrolysis. All the aforesaid production processes except Oil Shale Pyrolysis can be found in Sri Lanka. There is only one cement clinker manufacturer in Sri Lanka that also engage in co-processing of hazardous waste. The factory use state-of-the- art technologies for air pollution control. The amount PCDD/PCDF from this cement factory to air in year 2013 was calculated as 0.05 g TEQ/year using the other available data.

Lime production is practiced in small scale facilities mainly located at rural areas. These facilities use firewood, especially coconut trunk, as fuel do not have any air pollution control devices and thus contributes to unacceptable level of air pollution in the respective local areas. Hence, the inventory reached a value of 1.671 g TEQ/year of UPOP emission to air for the year 2013 for lime production.

Brick production is also practiced in rural areas using biomass waste material such as sawdust and paddy husk as energy source. There is no air pollution control in these industries. Therefore, the UPOP due to brick production was calculated for year 2013 as 0.151 g TEQ/year to air. While the pollution values associated with products and residue for the same period are 0.045 and 0.015 g TEQ/year, respectively.

There is only one glass manufacturing facility in Sri Lanka producing an array of glass products. The factory uses a good dust abatement system and hence estimated value for the PCDD/PCDF emission to air in year of 2013 with available data is 0.001 g TEQ/year emission. Ceramic production in Sri Lanka is practiced in three levels namely large scale exporters, SME exporters and cottage based manufacturers. The study focused only on the 8 large scale ceramic product manufacturers in the country which uses good pollution abatement units. This resulted in 0.002 g TEQ emission of PCDD/PCDF to air for ceramic production for the year 2013.

Asphalt mixing is steadily increasing in Sri Lanka due to rapid development projects. Ten plants of which two belongs to government are fulfilling the total Asphalt requirement of the country. Most of them are not equipped with air pollution control devices. The total amount of UPOPs emitted due to these facilities in 2013 is 0.035 g TEQ/year. As there is no Oil Shale Pyrolysis facility in Sri Lanka the total amount of UPOPs generated due to mineral production category in year 2013 emitted to air, contains in products and residues are calculated as 1.759 g TEQ/year, 0.045 g TEQ/year and 0.015 g TEQ/year respectively.

e) Traffic

The transport category emits considerable amount of UPOPS annually. As the diversity of vehicle feet is high, various assumptions were made to simplify the calculation. Four types of vehicles namely, Motor cars, Motor Tricycles, Dual purpose and Lorries considered under four stroke vehicles. Only motor cycles were classified under two stroke vehicles. All types of vehicles are grouped into two main categories depending on the availability of Catalytic converter. Considering fuel economics of each vehicle type and total value of diesel and petrol consumed in 2013, calculated emission of UPOPS due to diesel vehicle is 0.165 g TEQ/year and the values for the vehicles with two stroke engines and four stroke engines are 0.044 g TEQ/year and 0.514 g TEQ/year respectively.

f) Open Burning Processes

Main category of Open burning Processes consists of three categories namely Biomass Burning, Forest Fires and Waste Burning and Accidental Fires. At present waste from the rice mills and sawmills are used in industries as fuel. Further, the practice of Chena cultivations has almost ceased to extinct. Therefore, biomass generated due to these activities is not taken into

account when the emission of UPOPs is estimated. But the effect of burning of residues of crop such as Paddy, Sugarcane and Maize is included in the calculation.

As the direct data on amount of waste is not available they were generated through Residue Product Rations (RPR) of each crop. In addition, personal communications with the officers of Department of Agriculture were also made to capture the field conditions of using the crop residues. Using the related emission factors, the total UPOPs emission from straw (Paddy), Sugarcane and Maize to air and land were estimated as 1.321 g TEQ/year and 0.122 g TEQ/year respectively for year 2013. While the PCDD/PCDF emission to air from forest fires were calculated as 0.001 g TEQ/year for the same period with the use of data on forest fire collected from the Department of forest in the same period.

Waste Burning and Accidental Fires covers the two areas namely fires at waste dumps and open burning of domestic waste. Fires in waste dumps can happen either intentionally or unintentionally. But the estimation on how much of waste is burnt due to them is impossible. Therefore, the coefficient used in the previous NIP was used for a rough calculation which assumes that 10 percent of the total waste is in dumps. Finally, it was estimated that a total of 35.713 g TEQ/year and 1,190 g TEQ/year of PCDD/PCDF were released to air and land along with other UPOPs and a wide range of other pollutants respectively.

Open burning of household wastes, though it is banned by regulations is a common practice in rural and sub urban areas. The composition of waste varies with the income level of household as it correlates with the consumption pattern. The study used the available data of the total population in 2014 and the percentage of the household who burnt the waste to calculate the total population related to household waste burning. Then a common waste per capita which equals 0.55 kilogramme is used to calculate the amount of waste burnt. The study assume 30 percent of the total waste including most part of garden wastes, some kitchen wastes, and other combustible materials in residential wastes are burnt by the household.

Using the emission factors given in the toolkit, the estimated release of UPOP to air and to land from burning of domestic waste was 15 g TEQ/year and 0.386 g TEQ/year, respectively for year 2014. Further the study recalculated the UPOPS released to air and land in 2002 using the ratio of total amount of waste available in 2002 and 2013. As a result of that calculation it is concluded that the UPOP to air and to land from burning of domestic waste in 2002 was 12.342

and 0.309 g TEQ/year respectively showing a slight increase in releases of UPOPs during the period of 2002-2013.

g) Production and Use of Chemicals and Consumer Goods

The main category of Production and Use of Chemicals and Consumer Goods includes five Production processes. They are namely Pulp and Paper Production, Chlorinated Chemicals, Petroleum Production, Textile Production and Leather Refining. The data requirement to estimate the emission from these production processed were mainly obtained from the EPL license issued by the Central Environmental Authority. However, when the required data is not available, it is fulfilled through the questioner survey and information collected from the industries. In addition some data were collected from the Board of Investment.

There were no virgin pulp production facilities in Sri Lanka but a recycled paper pulp processing facility is operated in BOI zone that processed 3,480 tonnes of pulp. This resulted in 0.01 g TEQ/year release of PCDD/PCDF to products. Only facility that is available in Sri Lanka belongs to the group of Chlorinated Chemicals is Titanium Oxide production with low end technology and release 0.001 g TEQ/year emission of PCDD/PCDF to residues.

The single petroleum facility in Sri Lanka releases 0.001 g TEQ/year and 0.003 g TEQ/year of PCDD/PCDF to air from flare of the refinery and Catalytic convertor respectively in 2013. In addition, it also releases 0.001 g TEQ/year release of PCDD/PCDF to water treatment during the same period. Sri Lanka has a well-developed textile sector that makes a considerable contribution to its export. The technology used in the textile sector ranges from low end to high tech technology. But the details about the degree of usage of each technology are not available.

The study assumed that the all plant except those uses low end technologies for sure uses midlevel technologies. This results release of PCDD/PCDF to water in 2013 is 0.02 g TEQ/year. According to the available data it is calculated that 0.084 g TEQ of PCDD/PCDF is leased to products from the eleven large tanneries in the country that use midlevel technologies for year 2013. In addition small scale tanneries with low end technology releases 0.087 g TEQ/a of PCDD/PCDF release to products for the same period.

Table 25 - Summary of the annual amounts of UPOPs released

Group	Source Groups	Annual Releases (g TEQ/a)				
		Air	Water	Land	Product	Residue
1	Waste Incineration	58.5	0.0	0.0	0.0	18.6
2	Ferrous and Non-Ferrous Metal Production	1.9	0.0	0.0	0.0	5.1
3	Heat and Power Generation	28.6	0.0	0.0	0.0	2.6
4	Production of Mineral Products	1.9	0.0	0.0	0.0	0.0
5	Transportation	0.7	0.0	0.0	0.0	0.0
6	Open Burning Processes	49.4	0.0	1.6	0.0	0.0
7	Production of Chemicals and Consumer Goods	0.0	0.0	0.0	0.2	0.0
8	Miscellaneous	0.152	0.0	0.0	0.0	1.4
9	Disposal	0.0	0.1	0.0	5.2	6.0
10	Identification of Potential Hot-Spots				0.0	0.0
1-10	**Total**	**141.3**	**0.1**	**1.6**	**5.5**	**33.7**
	Grand Total					**182** (g TEQ/a)

h) Comparison of the updated inventory (2013) with the baseline inventory (2002)

As indicated in table 24a, the baseline inventory of UPOP carried out in 2002 was updated according to the new emission factors given in 2013 UNEP toolkit so that direct comparison can be made. Most of the deviations in the re-estimated emission values are due to the changes in emission factors in new toolkit. Notable difference is in the recalculated emission levels of open burning process. The re-estimated release of PCDD/F to air was reduced to 51 from the 2002 estimate of 121 g TEQ/a.

This was due to the reason that the 2002 estimation had assumed an emission factor of 30 µg TEQ/t of agricultural waste burnt, which corresponded to the conditions of impacted and poor burning conditions. However, the 2013 inventory assumes that the residues are not impacted and hence an emission factor of 0.5 µg TEQ/t was used, which can be justifiable as most of the agricultural activities occur in dry zone of Sri Lanka and residues are very dry when they are burnt. Therefore 2002 figures were recalculated using this emission factor.

Compared to 2002 values, the PCDD/F released from metal production is considerably

less. This is mainly due to less copper products in 2013 due to the gradual phasing out of scrap copper industry in Sri Lanka. Further, the emission due to waste incineration in 2013 has increased mainly due to increased health care waste incineration under poor combustion conditions.

Table 25a– Re-estimated PCDD/F emissions of baseline data in 2002

Group	Source Groups	Annual Releases (g TEQ/a)				
		Air	Water	Land	Product	Residue
1	Waste Incineration	20.3	0.0	NA	NA	1.4
2	Ferrous and Non-Ferrous Metal Production	5.2	ND	NA	NA	50.6
3	Heat and Power Generation	13.3	ND	ND	NA	2.7
4	Production of Mineral Products	0.9	NA	ND	ND	0.0
5	Transportation	0.5	NA	NA	NA	0.0
6	Open Burning Processes	42.0	NA	4.3	0.0	0.0
7	Production of Chemicals and Consumer Goods	ND	ND	ND	0.5	0.0
8	Miscellaneous	2.4	ND	ND	ND	0.1
9	Disposal	ND	0.1	ND	5.2	6.0
10	Identification of Potential Hot-Spots				ND	ND
1-10	**Total**	**84.6**	**0.1**	**4.3**	**5.7**	**60.8**
	Grand Total	**153 (g TEQ/a)**				

i) Emission of other unintentional POPs including new listed PeCBz

Other unintentionally-produced POPs (PCBs, HCB, PeCBz, PCNs) were not specifically inventoried since in the sources present in Sri Lanka they are formed in parallel to PCDD/F and therefore an inventory of PCDD/F and subsequent reduction of releases from these sources also will reduce the emission of the other unintentionally formed POPs.

Since pentachlorobenzene (PeCBz) has been newly listed as POPs in Annex A and C in 2009. PeCBz belongs to the group of chlorobenzenes. This substance has been used in the past as a pesticide. PeCB can be found as an impurity of Pentachloronitrobenzene (PCNB; quintozene) and and other pesticides such as Clopyralid, Atrazine, Chlorothalonil, Dacthal, Lindane, Pentachlorophenol, Picloram and Simazine. PeCBz can be present as an impurity in some organochlorine solvents.

There is no history of production or formulation of PeCBz in Sri Lanka. PeCBz might have infiltrated in to the country as a by–product and/or minor impurity with Quintozene (PCNB) itself and in some of the commercial chlorinated pesticides (e.g. Pentachlorophenol, Lindane and Simazine) in the past. The last quantity of import of PCNB (Terrachlor® 75% WP) recorded was 125.4 kg in 1989 by M/s Anglo Chem Limited but the magnitudes of environmental load is negligible, if not minor.

2.5.7 Information on state of knowledge on POPs contaminated sites and waste

The use and release of POPs to the environment over the last century have resulted in global environmental contamination with POPs. Depending on the extent and duration of local releases or deposition such areas were transformed into contaminated sites with associated risks. Furthermore stockpiles of POPs have been accumulated in particular in countries without destruction capacity.

In this chapter the situation on POPs stockpiles and (potentially) POPs contaminated sites in Sri Lanka are compiled for the individual POPs groups. Remediation measures have not been implemented in Sri Lanka due to the lack of funding. Also the releases to the wider environment from such sites are only documented for a few cases due to the limited monitoring capacity. Currently also no general contaminated site database or national inventory or remediation plans exists for Sri Lanka.

a) POPs pesticides stockpiles, container management and contaminated sites

a.1) Obsolete stockpiles

Though there had been no import of POP pesticides to Sri Lanka in the recent past, a certain amount of obsolete pesticides from the earlier imports are stockpiled at different places due to their withdrawal from use. However, large cumulative quantities of other obsolete pesticides are available in stocks which have become a national problem for disposal.

The current inventory carried out for obsolete pesticides from significant users (e.g. government departments of agriculture and botanical gardens) and the pesticide industry revealed even fewer stocks are available, which accounts for 41.451 tonnes. The inventory also revealed

insignificant amounts of POPs pesticides (e.g. aldrin, DDT, BHC & endosulfan) waiting for disposal, which is estimated to be 71.53 kg (0.17%), available from few locations in government farms of the DOA.

a.2) Pesticide container management

Currently, pesticides containers are being collected by the informal collectors for recycling. There have been unscrupulous attempts in the past to collect & clean empty pesticide glass containers for reuse by the pesticide industry. Meanwhile, glass containers have been also collected by M/s Piramal Glass Company, the sole glasses manufacturer in Sri Lanka, for recycling purposes. Under these circumstances, attempts were taken to formalise the collection of pesticide containers by the Ministry of Mahaweli Development and Environment jointly with the Ministry of Agriculture.

As a result, an island wide survey was conducted for collection of background information for the application of Deposit Refund System (DRS) for pesticide containers which are made of plastic and glass. Even though the proposed DRS system was turned down by the Cabinet of Ministers in year 2013, alternate solutions were invited from the ministries involved (i.e. Ministry of Mahaweli Development and Environment and the Ministry of Agriculture) for sound management of pesticide containers in the country.

In April, 2015, an inter-ministerial agreement between Ministry of Agriculture and the Ministry of Mahaweli Development and Environment was signed on a memorandum of understanding (MoU) on mutually agreed matters in the implementation of the pilot project on sound management of post-consumer pesticide containers. The government consolidated funds through the Ministry of Agriculture granted Rs. 5.6 million to the Office of the Registrar of Pesticides to implement the program through facilitation of container collection and processing of post-consumer plastic & glass wastes. Key actions under the pilot project included:

a. Obtaining commitment from subject ministries concerned;
b. Construction of regional collection centers;
c. Selection of authorized private/government plastic recycling entrepreneur;
d. Purchasing of two crusher machines for “public-private partnership”;
e. Construction of field level “drop-off” centers; and
f. Grass root level awareness programs/awareness materials.

A total of Rs. 4.3 million was allocated for the building of regional collection centers for 3 provinces included in the pilot project. As a result of initial discussions, suitable land slots were selected from government farms owned by the Department of Agriculture; the regional collection center located in Pollonnaruwa government farm will serve for the North-Central Province (NCP) while that of the Seetha Eliya government farm will serve for the Central Province (CP). The regional collection center built at the Pelwehera government farm will be serving for both provinces of above. Due to hindrances of selecting a suitable land slot in the North-Western Province (NWP), the construction of a regional collection center for NWP had to be abandoned for the current year. The total budget dedicated for the whole construction work was Rs. 2,804,709.00.

In December 2015, Office of the Registrar of Pesticides purchased two plastic waste crusher machines- one stationary machine and another mobile- to facilitate plastic waste recycling program under the premise of "public-private partnership" program (**Plate 1**). The stationary machine will be handed over to a promising entrepreneur while the mobile machine will be handed over to the pesticide industry association of Sri Lanka (i.e. Crop Life, Sri Lanka) through Central Environmental Authority (which is the legal authority in the implementation of hazardous waste regulations and management in Sri Lanka).

In October, 2015, *Polykar PVC Industries*, Hatton was selected as a successful entrepreneur for plastic waste recycling by open invitations through public newspapers. During initial field waste collection attempts by pesticide industries (i.e. Crop Life, Sri Lanka) in several districts, the Office of the Registrar of Pesticides have found that one of the main barriers to sustainable collection of pesticide containers was lack of acceptance for field-collected plastics; some of the problems encountered were: (1) collection of mixed-type containers; (2) collection of polluted wastes; and, (3) improper collection leading to dismay by health authorities.

The agricultural extension staffs in all 3 provinces were trained on key implementation aspects including the concept of container cleaning by "triple-rinsing". It is hoped that while accentuating the top level implementation, successful field collection plans could be achieved after installation of field level "drop-off" facilities during the first quarter of the year 2016. At provincial level, several grass root level awareness campaigns are

underway in order to educate farmers to keep hazardous empty pesticides containers out of the field.

Both industrialists selected to recycle plastic and the Piramal Glass Company can collect respective types of the containers more effectively than the existing system. Meanwhile the Ministry of Mahaweli Development and Environment is being explored to establish the DRS system for most of the common plastic and glass containers including all types of agrochemical containers which will further enhance the pesticide collection system in the country.

a.3) Waste disposal

Due to recent advent of chemical waste disposal at Holcim Geocycle, Sri Lanka, the DOA has been inclined to explore opportunities of disposal by co-processing of obsolete pesticides accumulated over the time. M/s Holcim Sri Lanka is the only production plant that produces cement clinker. This has been validated to perform PCB destruction by co–processing with an overall efficiency (Destruction and Removal Efficiency, DRE) of >99.9999% and the overall environmental performance as high as international regulations in relation to emission standards of PCDD/PCDFs or HCB (Karstensen et al., 2010). From 2009 through 2014, M/s Holcim Geocycle has undertaken destruction (by co–processing) of 273.68 tonnes of obsolete pesticides, pesticide contaminated packaging wastes and plant washings possessed by the pesticide industry.

Table 26 -Recent stocks of pesticide wastes incinerated by co–processing at M/s Holcim Cement Plant, Puttlam, Sri Lanka during 2009–2014 (Values are in tonnes).

No.	Customer	Waste Type	2009	2010	2011	2012	2013	2014	Total
01	M/s Harcros	Mixed solid/packaging/ expired pesticides	23.57	7.49	–	16.10	5.71	6.83	59.70
02	M/s Baurs	Expired pesticides/solid	–	8.04	–	2.73	6.54	2.80	20.11
03	M/s Opex	Mixed solid/packaging	–	3.60	–	–	0.96	–	4.56
04	M/s Hayleys	Expired pesticides/solid & liquids	6.21	26.27	2.13	17.13	27.39	11.83	90.96
05	M/s CIC	Expired pesticides/solid & liquids/packaging/ washings	13.91	24.04	4.65	0.91	12.46	6.22	62.19
06	M/s Ceypetco	Expired pesticides/solid & liquids	–	–	1.50	–	–	12.73	14.23
07	M/s BASF	Expired pesticides/solid & liquids	–	1.41	–	1.77	3.28	–	6.46
08	M/s Lankem	Expired pesticides/solid & liquids	–	–	–	4.51	2.57	2.22	9.30
09	M/s Mackwoods	Expired pesticides/solid & liquids	3.30	2.87	–	–	–	–	6.17
Total			46.99	73.72	8.28	43.15	58.91	42.63	273.68

The segregation of compounds according to hazard characteristics such as acute toxicity, environmental persistence etc. has always been the primary management operation in dealing with obsolete pesticides in the DOA. As a result, pesticides/pesticide formulations identified to be highly toxic (e.g. WHO Hazard Class Ia/Ib) and/or radioactive and/or inorganic (including heavy metals) and/or POPs pesticides were recorded separately.

In preparation for destruction by co–processing at M/s Holcim, Puttlam, the DOA has identified a regional stock of pesticides from several research stations in the north–western province (Makandura, Tabbowa and Kalpitiya). The trial stock of obsolete pesticides was represented by 13 litres of liquid pesticides and 104 kg of solid pesticides. A part of the stock was heavily deteriorated thus preventing true identity of pesticides remains an issue for further processing at M/s Holcim Goecycle, Puttlam.

The total tonnage of obsolete pesticides accumulated in government farms and research institutions represent 2,037.47 litres of liquids and 24,347.89 kg of solids for almost last 2–3 decades. Meanwhile, a stock of laboratory chemicals has also been accumulated over the past, which account for 303.55 litres of liquids and 1,291 kg of solids.

Alternatively, a multi–stakeholder project sponsored by M/s Bayer Crop Science has undertaken safe destruction of a total of 7.2 tonnes of pesticide wastes in a special waste incinerator at Bürrig, Germany in April, 2011. The entire waste tonnage consisted of 241 drums which had been accumulated over a period of 30 years in a former premise of Bayer Crop Science, M/s Hayleys Agro, Colombo, Sri Lanka.

The waste consisted of very old product mixtures owned by M/s Bayer Crop Science (e.g. Tamaron® (methamidophos), Folidol® (ethyl–parathion), Metacide® (methyl–parathion), Endosan® (endosulfan), Judo® (chlorpyrifos), Bayrusil® (quinalphos) and market returns (e.g. Antracol® (propineb), Fruvit® (propineb+metalaxyl), Unden® Dust (propoxur), Bathion® Dust (phoxim), Morestan® (oxythioquinox), Lecspro® (fentrazamide+propanil), most of them were highly toxic. The project demonstrated M/s Bayer Crop Science's cradle–to–grave responsibility for the safe use and handling of their products.

a 4) POPs pesticide contaminated sites

In locations where pesticides have or are been stored the buildings and soils are contaminated. Furthermore in Sri Lanka, disposal of pesticides have been conducted by burial in pits filled with simple absorbent/adsorbent materials (e.g. saw dust, charcoal) and reactants (e.g. lime powder) in a composite manner. Therefore, stocks of obsolete pesticides in the agricultural stations in the North Western Province (Makandura, Tabbowa and Kalpitiya) and also previously disposal sites on land around the agricultural areas in particular could be considered as

contaminated areas. These areas are critically in need for further investigation on presence of POPs pesticides in soil, water and biota.

b) PCBs stockpiles and contaminated sites

The Gazette of the Democratic Socialist Republic of Sri Lanka extraordinary No. 1534/18 - Friday, February 01, 2008 give regulatory powers by issuing license under SCHEDULE IV, Form A(Registration 16(b) ,National Environmental Act, No. 47 of 1980 (Section 23A) FORM OF APPLICATION FOR A LICENCE FOR SCHEDULED WASTE MANAGEMENT to regulate PCB contaminated waste specified under SCHEDULE VIII, List of Scheduled Wastes Waste Scheduled Waste Code in PART I - SCHEDULED WASTES FROM NON-SPECIFIC SOURCES and PART II - SCHEDULED WASTES FROM SPECIFIC SOURCES.

b.1) PCBs waste management

The license for operating a facility for scheduled waste management has to be obtained from Central Environmental Authority to operate a facility for generation, collection, storage, recovery, recycle or disposal of the waste more fully described in the Schedule hereto, on the premises and/or to transport. Accordingly, to manage the PCB containing or contaminated soils containing equipment or transformer oil, the owners in other word generators should be aware of that they do have the prescribe category items or liquid with them. But all of them are not aware that they have PCB containing equipment or liquids. Therefore, controlling tool has to be introduced for proper implementation of the above regulation.

Waste substances and articles containing or contaminated with PCB and/or PCTs and/or PBB are included as a waste stream (Waste Stream 23), in Schedule I of the regulation No. 1 of 1990, of the National Environmental Act, as amended by Gazette Extraordinary No. 595/16 of 1990. Under this regulation, no person shall collect, transport, store, recover, recycle or dispose waste containing or contaminated with PCBs or establish any site or facility for their disposal, except under the authority of a license issued by the CEA.

b.2) PCB Waste

Most of the obsolete and out of services transformers belongs to CEB stored at Kahapola Transformer Yard ,Moragaha Wattha, 191/1; Galpotha Junction, Polhena, Madapatha, Sri Lanka managed by LTL Transformers (Pvt) Ltd. Rest of the obsolete and out of services transformers belongs to CEB stored at respective branches of the CEB network. In addition to the above, obsolete and out of services transformers belonging to LECO are stored at Waskaduwa. LECO Littletonwatte, Samagipura Road, Off Bandaragama Road, Kudawaskadiwa, Waskaduwa.

Transformers obsolete in past belonging to CEB or private owners were sold to highest bidder. In past there were no mechanism to control PCB contain transformers. This means any transformers containing PCB oil sold in past may be end up in environment and/or in locally manufactured welding transformers. Table 27 gives a summary of the out of use transformers including custodian, location and total number of units etc.

Table 27 - Summary of the information on out of use transformers

Custodian	Location	Total Number of units	Manufactured on or before 1986 (including transformers those manufacturing dates were not recognizable) Units
Ceylon Electrcity Board	Branches in CEB net work	762	288
Ceylon Electrcity Board (managed by LTL)	Kahapola Yard	3029	1007
Lanka Electricity Company (Private) Limited	Waskaduwa,	> 89 (PCB suspected transformers. estimated Oil quantity 26736 Kg)	Further verifation required
Welding Transformers owners	Throughout the country	Detail survey required. Contaminated or PCB containing welding transformers identified.	Not applicable.

b.3) Disposal

Based on the findings of the inventory report on PCBs for the National implementation plan and the assessment report on PCB (Prepared by Prof. Ravindra Fernando) and taking into the fact that the every party for the Stockholm Convention has to stop the use of PCB by 2025 and dispose the PCBs in their own countries, Sri Lanka started to formulate a project on environmentally sound management of PCB containing and contained equipment in Sri Lanka in the latter part of 2012 with the technical assistance of UNIDO. The funding for the project was requested from the GEF.

The project on environmentally sound management of PCB containing and contained equipment in Sri Lanka was approved by the GEF on –with a total allocation of USD 4.725 million from GEF and co-financing from main stakeholders such as CEB, LECO, Ministry of Power and Energy and the Central Environmental Authority. At present some activities such as awareness creation among main stakeholders and building the inventory of the equipment (Power generation distribution and transmission transformers, and welding transformers) related to the project is already started with the help of financial allocation made for the project in its PPG phase. In addition, arrangements have being made through the project to test transformers for the presence of for PCBs before they are released to informal recyclers through IDB. These project activities are going hand in hand with the activities of the NIP update.

b 4) PCB contaminated sites

Current data indicates that the CEB, LECO and IPP owned transformers in service as at December 2015 is approximately 24,018 transformers. Presently decommissioned transformers owned by CEB are sold at the LTL yard in Piliyandala area and LECO does it at their Waskaduwa yard. If the contamination is as acute, the storage yards of decommissioned transformers as well as those sold to informal recyclers could have contaminated other sites.

Hence the PCB contamination to soil through leaks and spillage from illegal siphoning of oil makes all the historical storage yards of the CEB, LECO and LTL as potential PCB (and possibly PCDF) hot spots, covering all storage site throughout the country. During the 30 year war period it was the practice of the terrorists to destroy transformers supplying power. Such locations also could be considered as major contaminated sites of soil and possibly water.

On the other hand, the island wide survey conducted during the NIP update in 2015 has found that 6 welding transformers from" A, B, and C districts are contaminated with PCB indicating possibilities of contamination at welding shop sites island wide. Further, the questionnaire survey of the tea sector for PCB contain instruments has shown some indication of using welding plants in tea factories that also increase the possibilities for island wide contamination. Meanwhile, the possibility of using PCB containing oil at the service stations are also explored during the NIP update in 2015 and it was found that none of the samples collected and tested is negative for PCB. However, some sectors that are considered to have a high PCB contamination potential such as grease manufacturing from transformer oil could not be addressed during the NIP update.

c) PBDEs Stocks and contaminated sites

EEE and WEEE is a major stockpile of POP-PBDEs. The volume of c-OctaBDE in CRT casings in Sri Lanka is estimated to 4.4 tonnes containing 2.1 tonnes of POP-PBDE. This POPs content is mainly contained in approximately 1750 tonnes of CRT plastic casings. In addition a much larger volume of WEEE plastic is contaminated with DecaBDE which is suggested for listing to the convention in 2017.

Another relevant stock of POP-PBDE are vehicles. In total 5.4 tonnes of POP-PBDEs are contained in vehicles in use. In addition HBCD listed in 2013 and decaBDE suggested for listing are also contained in vehicles probably in a considerably higher concentration according to screening results in Japan. This has not yet been considered in the current inventory.

C 1) Potentially POP-PBDE contaminated sites

POP-PBDEs are in particular released in open burning of WEEE plastic in non-BAT recycling or other open burning scenarios such as burning of household waste with WEEE. Furthermore landfills are the ultimate destination of many PBDE-containing materials due to their widespread application in a multitude of consumer and industrial goods. POP-PBDEs can partly be leached from these materials in landfill leachate or released via landfill fires. Currently, Sri Lanka does not have any secured landfill to dispose scheduled waste.

Landfills and historical waste disposal sites in and around major cities such as Colombo (example Bloemendhal Land Fill) and Kandy in particular could be considered as major hotspots for release of PBDEs through leachate especially to rivers and ground water and to air and soils. Discarded materials containing these chemicals are also routed through domestic waste disposal pathways ending in landfills around Sri Lanka or burnt.

d) PFOS stocks and contaminated sites

PFOS contamination from fire-fighting foams use is estimated to be high. M/s Apogee Holdings (Pvt) Ltd is one of the major importers of fire-fighting equipment and materials in Sri Lanka. According to their information from the last 30 years, they had imported fire-fighting foams only from Europe (UL certified foams). Usually, they do not maintain any stock in the company but they only arrange to, deliver directly from the manufacturer to the site of customer subsequent to receipt of orders.

However, there are other fire-fighting foam suppliers to the Sri Lankan market from India, China and from other countries. Life time of the chemicals (foams) is 10 years and after that the chemical shall be tested and replaced at the cost of customer. Before applying the foam it will be mixed with water in the ratio of 1:30 at the site and pumped as needed when fire occurs at sites which can also lead to contamination of soil and groundwater.

According to the interviews conducted at M/s Apogee Holdings (Pvt) Ltd, all foams supplied by the company are UL registered and meanwhile non-PFOS containing eco-friendly brands. The main buyers from the company are; Airport & Aviation Services (Sri Lanka) Ltd, Ceylon Petroleum Corporation, Sri Lankan Air force, Sri Lanka Port Authority, Sri Lankan Navy and Customs fire brigade and Colombo Municipal Council(For Fire Brigade). These stations maintain their own stocks of fire-fighting foam.

Since Sri Lanka has faced many terrorist attacks for three decades, Colombo city, and its suburb areas and some other large cities had experienced major fires. According to the Sri Lankan fire brigade head office sources, they have ordered a larger quantity of fire-fighting foams in late 1980s and still a balance of 50,000L is in stock. Fire brigade maintains their foam stocks at Hettiyawatte, Grandpass, Madiwela, Fort, and, Colombo 10, Head Office. All these sites are around Colombo city area.

However, the chemical has already expired long ago and since that they usually use more than three times of the chemicals to control any fire. All of the firefighting foams were imported before year 2000 and no significance was attributed to the presence of on PFOS as it was before identification of PFOS as a hazardous material by Stockholm Convention. Therefore, there is little doubt that the foam contains PFOS. This statement was cleared by the Colombo Municipal Council Fire Brigade (they are using Flouro protein (Mixed) and Flouro chemical type foams).

Out of the major fires, the fire blown up at the bomb blast at Central Bank was crucial. In addition to the chemical used by the CMC Fire brigade, additional fire foams were directly taken from India by the Sri Lanka Air force as enough chemicals were not in the stores. Because of lack of experience in controlling a devastating fire in that capacity, no one has kept any record on the used amount of chemicals. Therefore, it is very difficult to analyse the chemical consumption and direct ingestion of PFOS amount almost after 30 years have passed. According the information by individual institutes, authorities and major fires possible contaminated sites and stocks of PFOS are included in table 28 below.

Table 28 - Possible contaminations sites from PFOS bearing firefighting foams

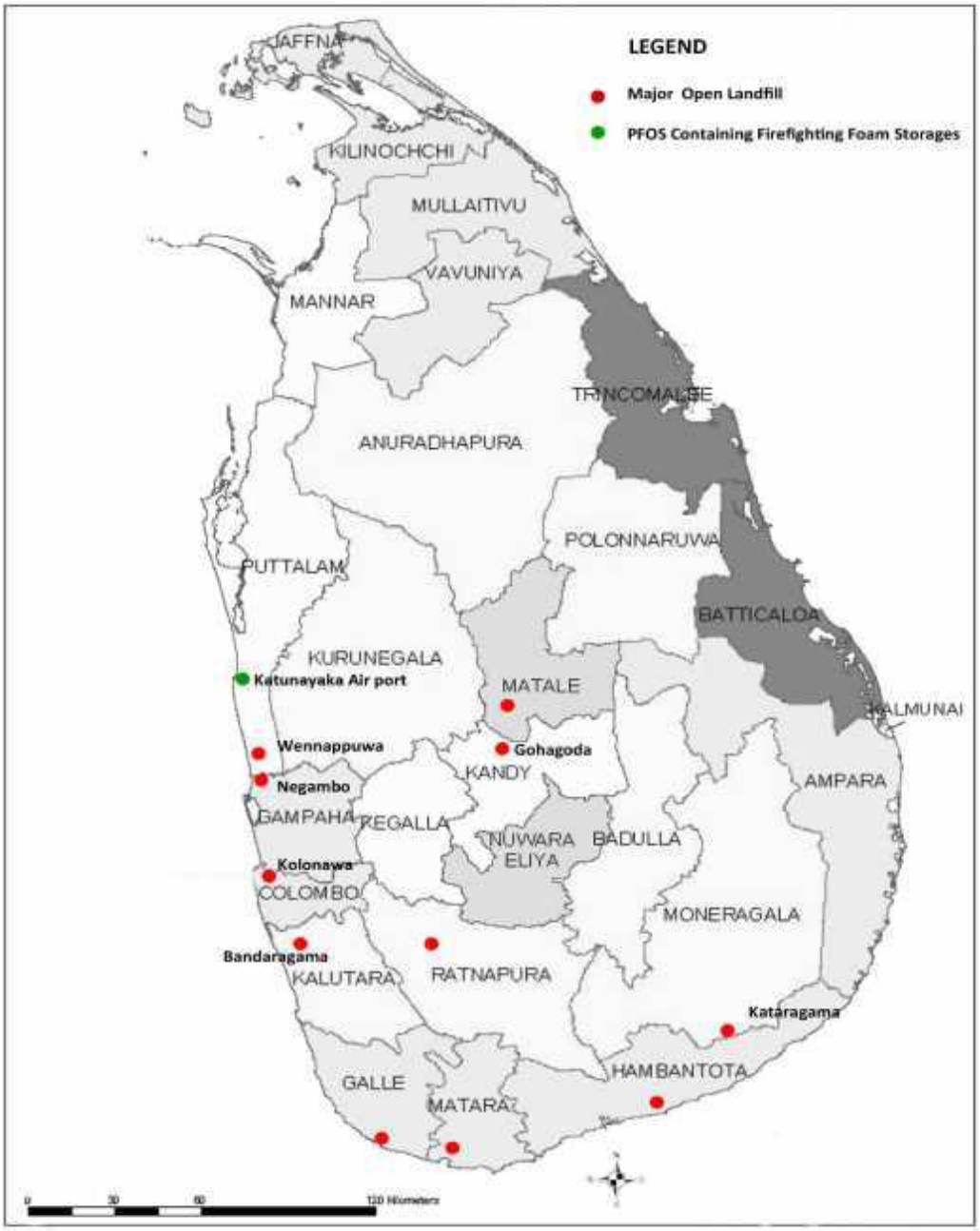
Location	Storage	Major Fire Attended	Total Capacity(l)	Current stock (litres)
Hettiyawatta (Colombo Fire Brigade)	Yes	Attended	Unknown	51595
Wellawatta (Colombo FireBrigade)	Yes	Attended		
Grandpass (Colombo FireBrigade)	Yes	Attended		
Ceylon Petroleum Corporation, Colombo	Yes	Yes(1990 bombblast/ Fire drills)	100000	100000
Sri Lankan Airport, Katunayake,	Yes	Yes-90's Terrorist attack/ Fire drills	Not Available	Not Available
Sri Lanka Air force	Yes	Not Available	Not Available	Not Available
Sri Lanka Ports Authority	Yes	Not Available	Not Available	Not Available
Sri Lanka Navy	Yes	Not Available	Not Available	Not Available
Sri Lanka Customs fire brigade	Yes	Not Available	Not Available	Not Available

Ceylon Petroleum Corporation and Sri Lankan Navy. Colombo Fire Brigade, Ceylon Petroleum Corporation, Customs fire brigade do their training in Hettiyawaththa. Sri Lankan airport do have their own training location in premises of the airport. Sri Lankan air force and navy do their practices on both Airport & Aviation Services (Sri Lanka) Ltd, and army training places which is highly secured.

Surveys of samples from water bodies along the western coastline in and around Colombo such as Negombo lagoon, Hamilton Canal, Kelani River, Beira Lake, Kirillapone canal and fresh water sample from the Kandy Lake had been studied previously to determine the presence of PFOS by Guruge in 2007. All water samples had contained detectable concentrations of PFOS (0.65-44 ng/L) and other fluorinated compounds were analysed in a Japanese laboratory. Greatest PFOS concentration was detected in Beira Lake. In addition, fires in and around the cities and in the war torn areas of Sri Lanka are potential hotspots as the firefighting foams used most probably contained PFOS and contaminated soil and water in those areas.

Large stocks of firefighting foam in institutions such as the Fire Brigade, Sri Lankan Ports Authority, Ceylon Petroleum Corporation and Sri Lankan Navy. Colombo fire brigade, Ceylon Petroleum Corporation. The foam is used in fire drills apart from real fires and such training sites also could be contaminated, Map: 4 Indicates the possible contaminated and storage sites around Colombo and Map: 5 indicates possible sites in the important districts.

Map 4: Possible PFOS contaminated and storage sites around Colombo



Map 5: Major Hotspots for PFOS and likely other POPs contamination

e) Potential Dioxin/UPOPs contaminated sites

During the inventory development the presence of Dioxin/UPOPs contaminated sites have not been assessed. However since the largest amount of Dioxin present today are from historic releases and have accumulated due to their persistence in soils and sediments, the assessment of Dioxin/UPOPs contaminated sites is suggested as a task in the action plan.

Preliminary considerations on Dioxin/UPOPs contaminated sites based on experiences from other countries suggest that following areas could be potentially contaminated in Sri Lanka:

- Areas with impact from long term industrial releases from metal industries or incinerators or from disposal of solid residues such as fly ashes or other residues from flue gas cleaning.
- Potentially PCB contaminated sites can also be considered PCDD/F contaminated as PCDF are present in PCB and can be formed from PCBs.
- (Historic) application sites of PCDD/F and other UPOPs containing pesticides and chemicals: This includes chlorinated phenol derived pesticides such as 2,4-Dichlorophenoxy acetic acid (2,4-D), 2,4,5-T, Pentachlorophenol (PCP). Also pesticides containing HCB or PeCBz such as PCNB/quintocene and other.
- Timber manufacture and treatment sites where PCP has been used.
- Textile factories where chloranil, PCP or other (production site, sediment of waste water release and sites of waste disposal)
- Leather factories where PCP have been used (production site, sediment of waste water release and sites of waste disposal).
- Sites where waste is and have been burned in the open for extended time.
- Sites of major fire accidents.
- Sites where copper cables and other electronic waste are or have been burned in the open.
- Dredging of sediments; contaminated flood plain.
- Dumps of wastes/residues from Source Groups 1-9 (e.g. sites where ashes from incinerators are disposed;; Sites where ashes from metal industry were/are disposed).

2.5.8 Summary on future production, use, and releases of POPs – requirements for exemptions

All POPs pesticides have already been banned for all uses and no exemption is needed for any of the pesticides. For PFOS a wide range of specific exemptions and alternative purposes have been listed. Within the NIP update the need for exemptions have been assessed. Currently only the metal plating industry is considered to need exemptions for PFOS use.

For POP-PBDEs the convention has an exemption for recycling of POP-PBDEs containing articles. Within the NIP update the assessment of the need for exemptions for recycling of POP-PBDEs containing articles have not been finalized. Further assessment is needed in particular when considering that decaBDE is suggested for listing in 2017 which is present at far higher amounts in WEEE plastic and other flame retarded product categories compared to the current listed POP-PBDEs.

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

There are no specific regular programs on monitoring of POPs in the environment and POPs in humans and related health impacts. However, several monitoring studies investigated the contamination of POPs in the environment and in humans. Some major findings are summarized below.

2.5.9.1 POPs pesticides – monitoring of environment and humans

Although some data are available concerning the concentration of limited number of pesticides in surface waters, river waters, etc. in Sri Lanka little or no information is available concerning the biological significance. Isolated incidences of pesticide related deaths of fish populations, snakes, etc. have been reported in surface waters following heavy application of mostly organophosphate and carbamate type of pesticides in agricultural fields without possible long-term environmental damages. Also, scattered incidences are reported to the Office of the Registrar of Pesticides on deaths of peacocks and other birds due to the consumption of rice grains treated with insecticides.

As required under the Stockholm Convention, the national scenario of the status of POP pesticides in the environment and the biota would be highly warranted. However, some of the POP pesticides have not been used over a decade (at least), and most of the candidates were discontinued from use over several decades, their persistent properties, semi-volatility, multimedia mobility and ability to bio-concentrate in the food chain, necessitated a closer look at contamination levels in the regional perspective, which would reveal a measure of the threat of damage to Sri Lankan nations' health and the ecosystem.

Data for the Indian Ocean Region (UNEP Region VI) is comparatively sparse. Available information mainly comprise data on Aldrin, DDT and HCB, Chlordane, Dieldrin, Endrin, Toxaphene and Endosulfan. In general, much of the pollution data are cases of spills or due to adoption of inappropriate disposal procedures.

2.5.9.2 PBDE– monitoring of PBDE in articles and products

A regional project with the Basel Convention Centre for Asia and the Pacific on PBDE management and phase out has started in 2015 with regional workshops in Lao PDR, Pakistan and Sri Lanka. The workshop in Sri Lanka was held in 27th November 2015. Within the project a monitoring studying is included for measuring PBDEs in WEEE plastic or other articles and products.

2.5.9.3 PFOS – monitoring of environmental and health impacts

Some monitoring of PFOS and other per- and polyfluorinated substances (PFAS) have been conducted in Sri Lanka revealing that these compound could be detected in monitored sites (Guruge, et al., 2007). The study done on human sera showed that the intake of these compounds via drinking water and dietary fish is significant enough to be a concern in Sri Lanka (Guruge, et al., 2007).

A study has also been conducted in the PFOS intake via fish, shellfish and water. PFAS were analyzed in fish, shellfish and water samples collected in Sri Lanka. The concentration of PFOS in fish muscle had ranged from 0.021 to 12.4 ng/g wet weight. In surface water the range of PFOS was from 0.66-47 ng/L. The upper limit of the dietary intake of PFOS in Sri Lanka was estimated to be 7.5 ng/ kg body weight/day (Guruge, et al., 2007).

In another study PFOS and twenty other PFAS were measured in coastal and inland waters in Sri Lanka. The compounds that were measured included six perfluoroalkyl sulfonates, ten perfluoroalkyl carboxylic acids, three flurooctane acetates, one fluorooctane sulfonamides and oneFluorinated telomere carboxylic acid. Water samples were collected from a depth of 0.5m to clean polypropylene sampling bottles from water bodies along the western coastline in and around Colombo such as Negambo lagoon, Hamilton Canal, Kelani River, Bera Lake, Kirillapone canal and fresh water sample from the Kandy Lake. The samples collected were refrigerated and sent to Japan for analysis.

All water samples had contained detectable concentrations of PFOS (0.65-44 ng/L) and other PFAS. Greatest PFOS concentration was detected in Beira Lake. It was even greater than the PFOS concentrations detected in areas such as Tokyo bay, Lake Erie and number of water bodies in New York. Negombo lagoon had the lowest reported concentration. This may be due to the fact that it has a higher water exchange with the sea.

The PFOS concentrations found in Sri Lanka fall within concentration ranges reported in most developed nations such as the US. and Japan. Another study in Sri Lanka was conducted on pipe borne water and river water contamination from PFAS. Water samples collected along Mahawali River from Peradeniya University to Victoria reservoir were analyzed for twelve PFCs at Kyoto University, Japan. Treated water samples collected from five water treatment plants along the same river segment were also examined. Then the PFCs levels obtained were compared with other country values. PFOS was found in most of river samples. PFOS concentration was found to be in average 1.5 ng/L. This was similar range as ChaoPhraya River, Bangkok, Thailand (Seneviratne, et al., 2009).

2.5.10 Socio-economic study and current level of information and awareness

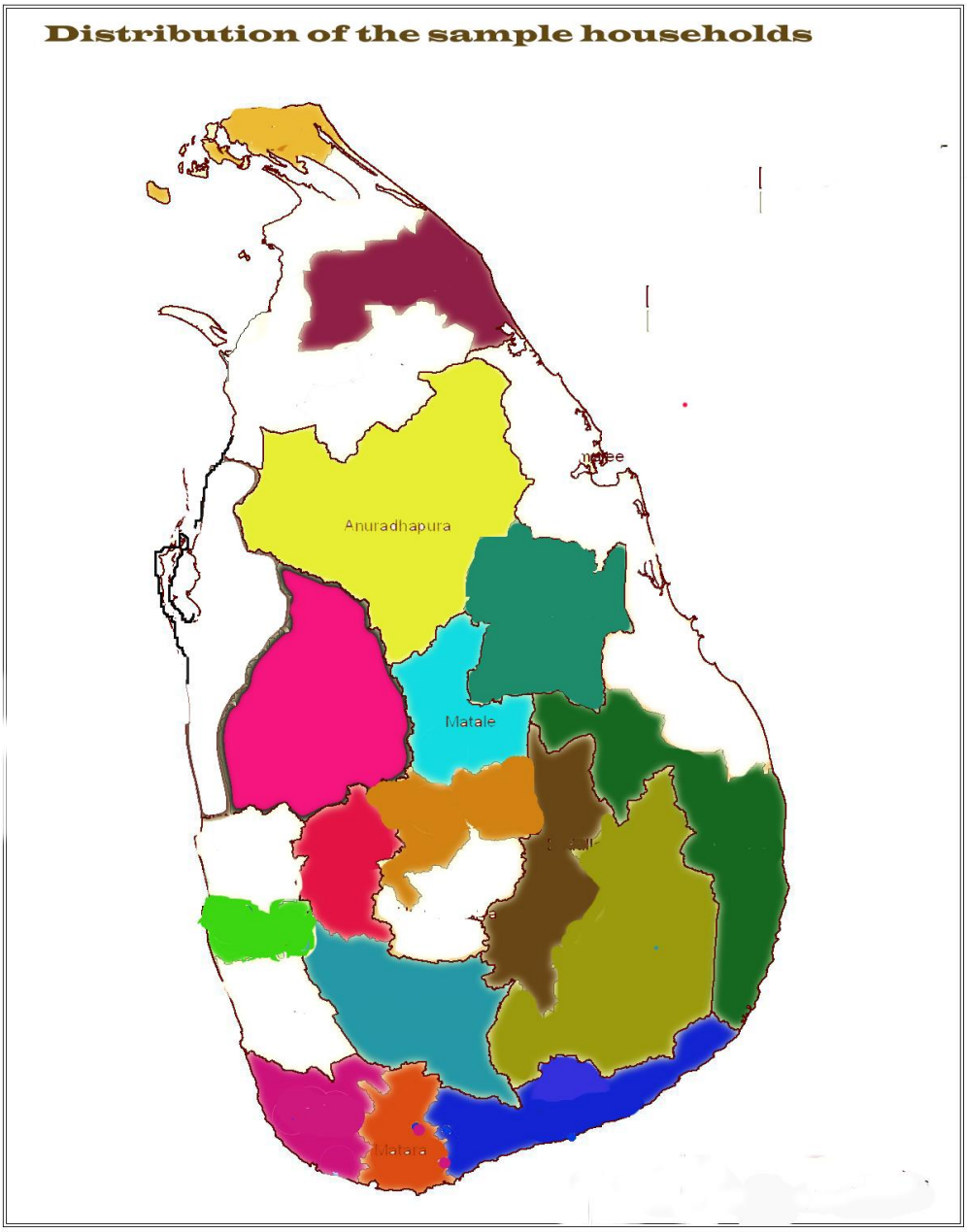
A survey was initiated by the expert on the subject to ascertain the degree of public awareness of the Stockholm Convention in general and the specific list of POPs chemicals in particular. As it is informative, Island wide household and industrial survey was carried out with the intention of updating National Implementation Plan (NIP) for the Stockholm Convention on Persistent Organic Pollutants (POPs).

It completed 744 household questionnaires and 103 industrial questionnaires as required and covered in 16 districts namely Kandy, Badulla, Ampara, Monaragala, Hambanthota, Matara, Kegalle, Gampaha, Colombo, Galle, Rathnapura, Jaffna, Mulativu, Kurunegala, Anuradhapura, and Polonnaruwa. This report describes the current knowledge and awareness on POP chemicals among general public in Sri Lanka based on the findings of the survey.

a) Methodology of the survey

The Multi Stage Stratified Random Sampling Method was used as an appropriate sampling technique for the survey. Differences could be expected between districts and thus districts were considered as the first stratification criterion. The next administrative level is

Divisional Secretariat Divisions and thus DSDs were considered as second stratification criterion. The primary sampling unit was a Grama Niladari Division (GND) and they were selected probability proportionate to the size. The secondary sampling unit was the household and the simple random sampling technique was applied to select these units. The districts involved in the survey are displayed with colours in the Map 6.



Map 6: Distribution of the sample households

Two questionnaires were prepared for the households and industries. This was a comprehensive schedule with many modules and questions to capture data on socio economic conditions, existing knowledge and awareness on POPs. Special attention was given to capture household level data on sub headings of demographic information including gender (male and female), livelihood and income generation details, housing details and existing level of knowledge & awareness on POPs, waste management practices and institutions providing services to the households for waste management. In those cases separate modules were included to capture necessary details.

The main questionnaires were finalized after the final discussion with and the confirmation from the CEA. Pilot surveys were also undertaken in areas close to Peradeniya specifically Pilimathalawa, Kadugannawa, Gannoruwa and Panideniya areas for the testing of the questionnaire and the questionnaire was modified by using the results of the pilot survey. Before getting into the survey there was a two day training session organized for all the enumerators to clarify their problems regarding the survey and also to be familiar with the questionnaires. And it was helpful for them to understand the purposes of the survey and they were able to share the knowledge with the people interviewed. Thus, a 4 months period from January 2015 to May 2015 was taken for the data collection.

The listing operation was undertaken before selecting sample households for data collection. This was applied for all the GNDs which were selected through sampling method. The quantitative and qualitative data collection was undertaken through face to face interview system. The data collection of the 16 districts was undertaken by 10 agriculture graduates. They were trained using the instruction manuals and questionnaires before they commenced the data collection activity at the field level. Data collection process in all the districts was also monitored and supervised by the core research team. The error correction and editing of the questionnaires were undertaken at the field level and completed schedules were transferred from the centres of data collection to the data entry team for the data entry operation to be in line with the agreed time schedule.

b) Socio- Economic Profile of Sample Households

In the sample, majority of the HHs belonged to the urban sector (48.79%). Semi urban and rural sectors represent 21.51and 28.63 percents respectively. 1.08 percent of households belong to the estate sector. As the HH heads' characteristics, gender distinction, age distribution of the HH heads, their educational level, occupations, level of income and their time allocation for paid work were studied. There was a total of 744 HHs in the sample and it comprised of 3192 individuals. The average HH size is 4.29 members while the male to female ratio is 49.48% to 50.51% in the respondents' families participating in this study. Figure 5 displays the distribution of HH size among the survey areas. These statistics well reflect the country statistics. 73.45 percent houses of the respondents have been established after 1986, which indicate the generation that the majority of the respondents belong to middle age.

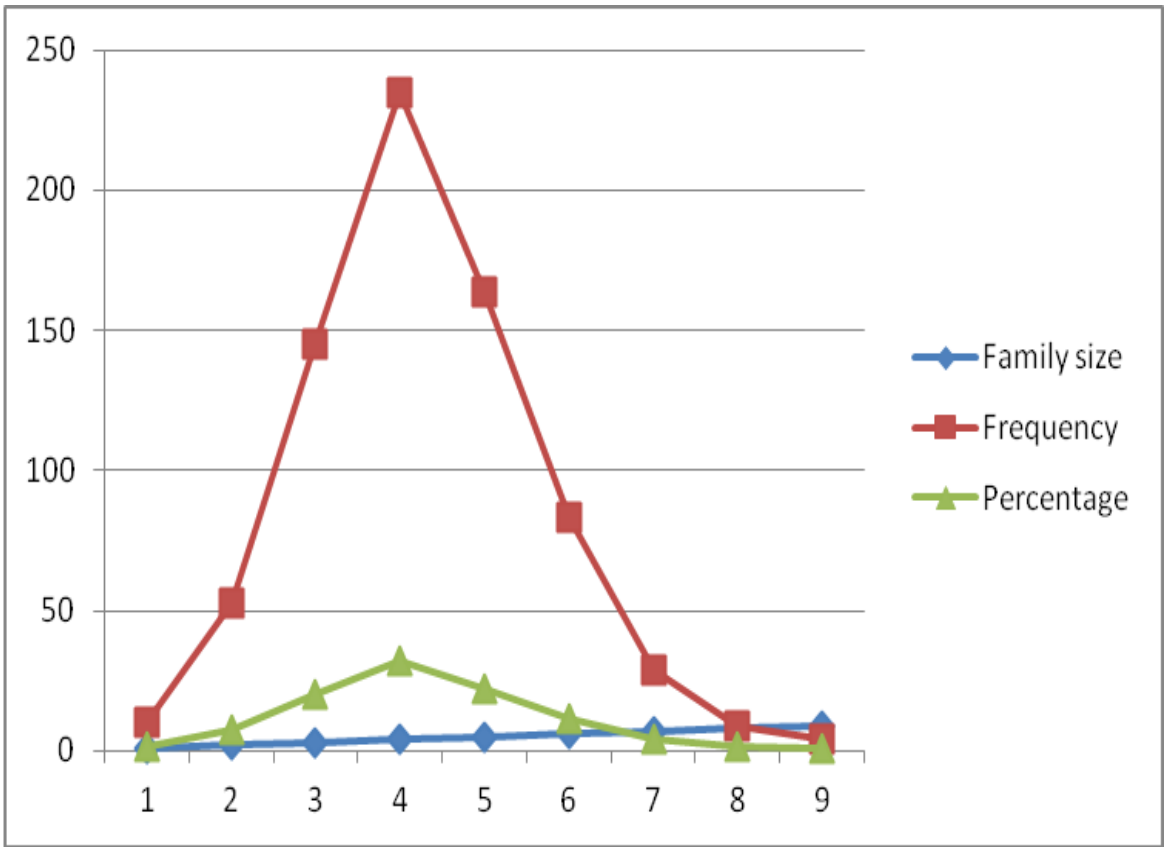


Figure 5 - Family size of the households

Of the respondents, nearly 60% of families had only one person to work. Mean of the working members in a family is 1.47. The monthly income distribution was classified into several

groups as shown in the Figure 6. Among the respondents, most of them (38.72%) had monthly income less than Rs.30000 while 11.41 percent households earn more than Rs. 60000 per month. Within the sample there were 56 entrepreneurs representing 7.53 percent. Majority of (352) households, represent mainly agriculture sector as one of their income sources.

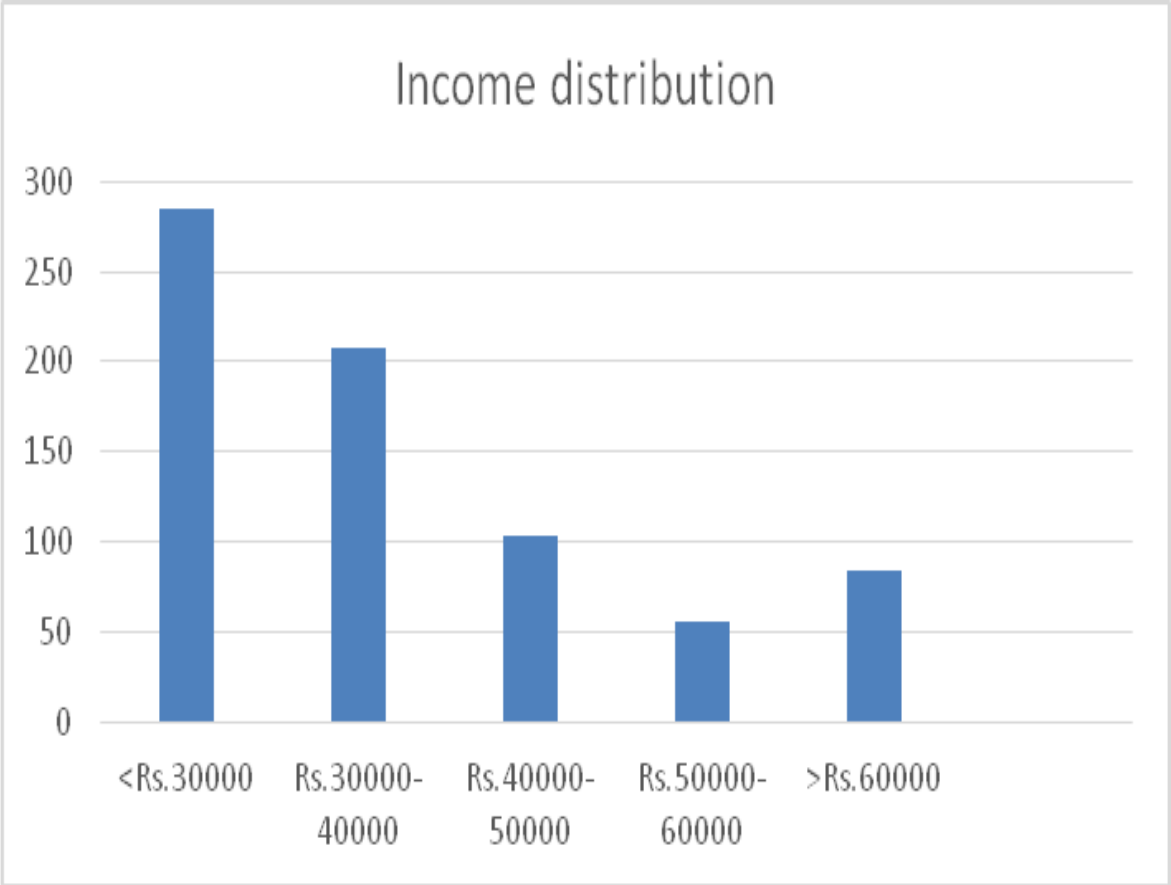


Figure 6 - Monthly income distribution of the family of respondents

When it comes to the category of nature of their farming approach, 135 households do not apply chemicals and mainly rely on organic fertilizers and substances. They have predominantly the home gardens. Another 101 households are commercial farmers and use agrochemicals. The others use both non organic and organic methods in their farming. Accordingly, more than 70 percent of households are reported to use agrochemicals for the farming activities. These households apply one or more chemicals like insecticides, herbicides and fungicides etc. It was reported that 175 households apply compost fertilizers for the farming, which is 24 percent. The study examined the agro chemicals that they use for their farming with the aim of finding whether POP chemicals were existent among those. No such pesticides were detected in the study.

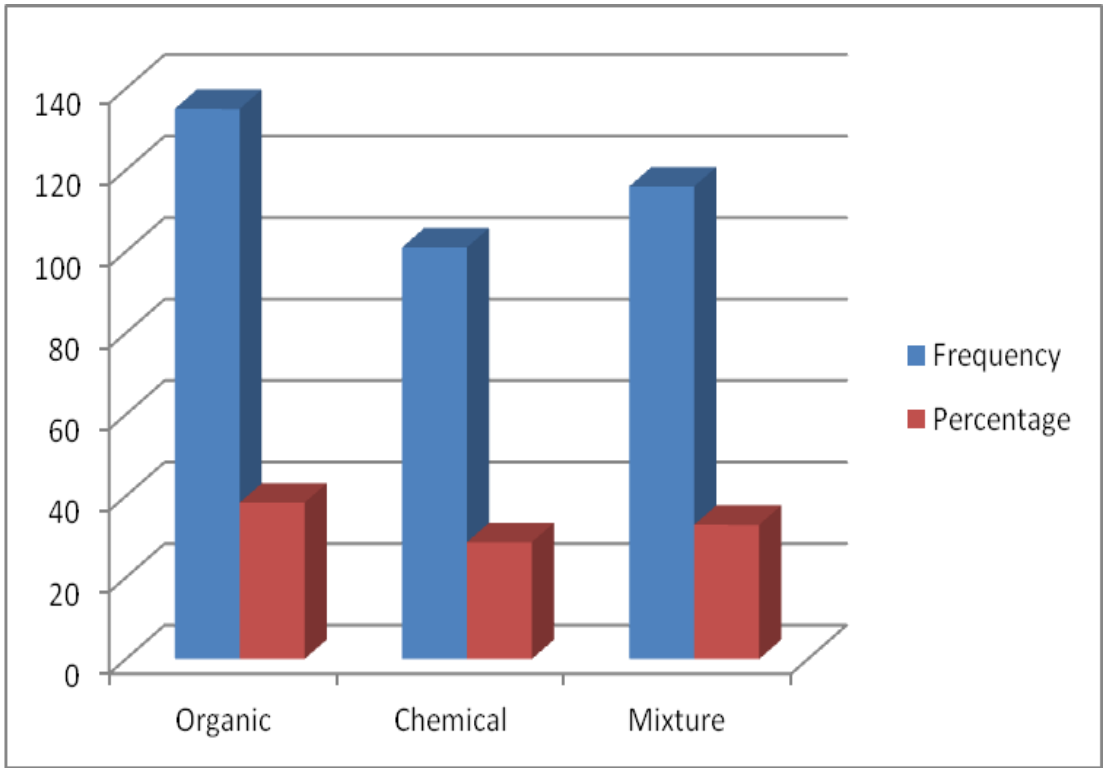


Figure 7 - Nature of Farming Approach of households

Among the sample 98.39 percent has electricity facilities. 59.54 percent use LP gas for cooking. 86.15 percent use fire woods. 58.16 percent of households use coconut shells. 27.96 percent of households burn Kerosene. Saw dust and dried leaves are used by 1.75 and 4.7 persent.

Table 29 - Uses of fuels

Electricity	732	98.39
LP gas	443	59.54
Kerosene	208	27.96
Firewood	641	86.15
Saw dust	13	1.75
Dried leaves	35	4.70
Coconut shells	418	56.18

2.5.11 Mechanism to report under Article 15 on measures taken to implement the provisions of the Convention and for information exchange with other Parties to the Convention

Sri Lanka has a mechanism in place to report under Article 15 on measures taken to implement the provisions of the Convention. Therefore, Sri Lanka sent all the three reports since its ratification, namely first report on 31.12.2007, second report on 27.09.2010 and third report on 04.11.2015.

2.5.12 Relevant activities of non-governmental stakeholders

The NGO , Centre for Environmental Justice (Sri Lanka) which a member of the International POPs elimination Network (IPEN) is a member of the National Steering Committee (NSC) of the NIP update project. In addition to awareness raising on POPs the Centre for Environmental Justice has conducted a range of studies on lead in paints in Sri Lanka which contributed to the EU project on Sustainable Consumption and Production in Asia (SWITCH-Asia).

Another NGO member of the NSC is the "People to People Volunteers". They have performed several studies on POPs including the assessment of PCB contamination in recycled transformer oil and related exposure to welders.

Industrial Development Board of Sri Lanka (IDB), National Cleaner Production Centre (NCPC), Lanka Electricity Company (Pvt) Ltd (LECO), LTL Transformers (Pvt) Ltd and Holcim Cement Co. (Pvt) Ltd are also the members of the NSC. In addition, Universities and Research institutes were involved in the inventory and NIP update process.

2.5.13 Overview of technical infrastructure for POPs assessment, analysis, alternatives and prevention measures, management, research and development – linkage to international programmes and projects

In order to address the monitoring capacity of POPs it is necessary to address both technical and administrative aspects. Through the two aspects are inter-related it is important that they are taken individually so that the strengths and weaknesses in the regional and local levels could be easily understood. These two aspects should further be considered in qualitative and

quantitative terms in respect of monitoring capacity. Some information on POPs monitoring in humans is described below in the section of POPs impacted population.

While there are a large number of laboratories (ITI, Registrar of Pesticides, SGS , TRI, University of Ruhunu, University of Colombo, NARA, City Analyst Lab, University of Moratuwa, Govt. Analyst Dept., IFS, CRI and NWSDB.) in Sri Lanka with chromatographic facilities, only ITI, Registrar of Pesticides, SGS (private laboratory) and TRI regularly carry out analysis of pesticides, and only ITI carries out analysis of PCB and industrial chemicals.

Further ITI is the only laboratory that has international accreditation against ISO 17025 for any of the POPs. (accreditation has been obtained for pesticides in water) There is no lab with facilities to measure Dioxin & Furan in Sri Lanka (HRGC/HRMS or other equipment capable such as MS/MS).

In order to address the monitoring capacity of POPs it is necessary to address both technical and administrative aspects. Out of the two aspects the most important with respect to monitoring of unintentional by-products is the technical aspect, as there are no facilities in the region to monitor unintentional by-products. Facilities to monitor other POPs are available but there are technical and administrative problems prevailing in the country that retard the development and maintenance of the laboratory monitoring capabilities.

Currently there is no dedicated system to assess alternative chemicals. Such a system has to be developed in the frame of improving sustainable production and consumption in Sri Lanka.

2.5.14 Identification of impacted populations or environments, estimated scale and magnitude of threats to public health and environmental quality, and social implications for workers and local communities

a) POP Pesticides

The acute pesticide poisoning effects often resulted in mortality are easily noticeable from sub-lethal effects which require exposure to pesticides for a longer period of time. Though it is likely to be prevalent, long-term effects are either not diagnosed properly in some cases or difficult to establish the actual causative agent under the conditions prevailing in Sri Lanka. Since all POP pesticides are banned for more than a decade, any observable effects due to POP pesticides should have been associated with long-term sub lethal exposure from contaminated environmental compartments and food chains.

Such effects are most often not studied to identify or associate with the cause though it is widely believed that cases of chronic health problems such as carcinogenicity and reproductive effects are rapidly increasing. Thus the real effects of POP pesticides are often underestimated and needed to be studied.

Poisonings in occupationally exposed persons are usually associated with contract spray operator groups or farmers carrying out prolonged spray operations under hot humid conditions without adequate personal protection. Recent poisoning data reveal >80% of poisonings caused by pesticides to be due to wilful ingestion of pesticides for self-harm.

The use of pesticides for suicide has already been described in chapter 2.4.1. These incidents are monitored and included in the statistic. In the past POPs pesticides (in particular endosulfan) were used in a high share of suicides. Since today no POP pesticides are imported other highly hazardous pesticides are used for this purpose.

b) Secondary use of transformer oil for welding transformer fabrication

Transformer oil is being used as a coolant in welding transforms. Therefore, 68 samples were collected during the survey conducted during the study. Those samples were tested against PCB 1260, PCB 1242 and PCB 1254. Five 5 samples out of 68 was confirmed for PCB contamination by GC- ECD analysis.

The following table 30 summarise the results of the analysis. This reflects that 7% of the tested sample size is contaminated with PCBs at a level below 50 ppm. Thus, attention for welding transformers is needed for possible human exposure to PCBs in particular if in some occasions highly contaminated PCB oils might be recycled. .

Table 30: PCBs positive samples in secondary use of transformer oil

ITI Identification Number	PCB 1260 standards, ppm	PCB 1242 standards, ppm	PCB 1254 standard Ppm
17	1.21	None	None
19	1.16	None	None
54	11.50	12.71	10.25
61	1.83	None	None
90	1.08	None	None

c) POP-PBDEs and HBB

In recent years, concern has been raised regarding the possible environmental and human impact of PBDEs. PBDEs are recognized as global contaminants and are associated with adverse health effects in animals and humans, including endocrine and thyroid disruption, immunotoxicity, reproductive toxicity, adverse effects on child development and neurological function and cancer. High human exposure can result from non-BAT recycling operations in particular involving open burning of e-waste or cables as it is practiced by some informal sectors in Sri Lanka.

d) PFOS

In Sri Lanka concentrations and accumulations of 13 PFCs in human sera and seminal plasma was measured. Measurable quantity of PFOS and Perfluorohexasulfonate (PFHS) were found in all seminal plasma samples. The PFOS accumulated in sera was pointedly positively linked with PFOA, PFHS and Perfluorononanoic acid (PFNA). This suggested that these compounds may have a similar origin of exposure and accumulation. Partitioning of both PFOS and PFNA between sera and seminal plasma gave positive associations.

This study showed that PFOS and other PFAS levels detected in Sri Lanka was similar to those reported from industrialized countries. This can point out to the fact that PFOS and other PFAS are widespread also in Sri Lanka with associated human exposure. The finding of PFAS in seminal plasma imply that further studies need to be done in order to observe the long-term exposure in humans may result in reproductive impairments (Guruge, et al., 2005).

The study done on human sera showed that the intake of these compounds via drinking water and dietary fish is significant enough to be a concern in Sri Lanka (Guruge, et al., 2007). The upper limit of the dietary intake of PFOS via wish in Sri Lanka was estimated to be 7.5ng/ kg body weight/day (Guruge, et al., 2007)

.

2.5.15 Details of any relevant system for assessment and listing of new chemicals

Beside the several attempts made by Sri Lanka recently, still there is no system for a systematic assessment of industrial chemicals in Sri Lanka. For pesticides there are efforts to assess new pesticides by ROP.

2.5.16 Details of any relevant system for the assessment and regulation of chemicals already in the market

a) Pesticides

The Registrar of Pesticides is the Authority vested with the responsibility of controlling the importation, use and disposal of pesticides. The Registrar functions under the provisions contained in the Control of Pesticides Act No 30 of 1980, Control of Pesticides (Amendment) Act No. 6 of 1994. Under this Act, all pesticides are required to be registered with the Registrar of Pesticides prior to being sold in the market. Prior to the registration of a pesticide a statement of the claim is made by the manufacturer or producer of such pesticides as to its use, potency, stability in storage and the period of usage.

The Registrar of Pesticides as the licensing authority is entrusted with the responsibility of assuring the safety to the environment. The Registrar is advised on all matters relating to technical and policy aspects of the enforcement of the Act by a Technical Advisory Committee (PeTAC) appointed by the Minister of Agriculture under the provisions of the Act.

b) Industrial and other chemicals

Despite the several attempts made by Sri Lanka recently, there is still no system for a systematic assessment of industrial chemicals in Sri Lanka

2.5.17 NIP implementation status

The level of compliance with the Stockholm Convention requirements is compiled in Table 31 below with emphasis to the "initial POPs" and the new listed pesticides in the Convention. As the measures for reduction with the aim of final elimination of the new listed POPs have started currently, the compliance with the SC provision in respect to new listed industrial POPs will be carried out and presented in the future NIP updates. The action plans for the new listed POPs and initial POPs are in Chapter 3.

Table 31 - Stockholm Convention requirements and level of compliance of Sri Lanka

Convention Article	Level of compliance	Comments
ARTICLE 3 Measures to reduce or eliminate releases from intentional production and use	For POPs pesticides see section 2.5.1	Inventory and assessment has been done. For initial POPs no production and use except PCBs contain/contaminated transformers. Still some possible illegal traffic and counter fight of POPs pesticides.
	For PCBs see section 2.5.2.	Ministry of Mahaweli Development and Environment has formulated the project on environmentally sound management of PCB and PCB contaminated oil in Sri Lanka with the technical assistance of UNIDO and GEF financing. The project was approved by the relevant authorities in Sri Lanka and also the GEF. The amount provided by GEF for the project is USD 4,725,000 which add the USD 18,989,752 as co-financing and it is to be implemented during the period of 2016-2020.
	For DDT see section 2.5.5.	No use since 1992
ARTICLE 4 Register of exemptions	Sri Lanka is not registered for any specific exemptions and/or acceptable purposes, as listed in SC Annexes	Exemptions will be registered.
ARTICLE 5 Measures to reduce or eliminate releases from unintentional production	See section 2.5.3	Sri Lanka has developed UPOPs inventories. However no project, funding or implementation of BAT/BEP measures in Sri Lanka.
ARTICLE 6 Measures to reduce or eliminate releases from stockpiles and wastes	For POPs pesticides, PCBs, uPOPs, PBDEs, PFOS see section 2.5.7.	Inventory of stockpiles and wastes have been compiled. 1000 tons of PCB stocks and wastes will be managed within a GEF/UNIDO project. For other stocks no project and funding for stockpile management and disposal yet.

Convention Article	Level of compliance	Comments
ARTICLE 7 Implementation plans	Sri Lanka submitted its first NIP on 28 of September 2007.	
ARTICLE 8 Listing of chemicals in Annexes A, B and C	Up to now Sri Lanka has not submitted a proposal on the listing of new chemicals in Annexes A, B and C to the COP.	
ARTICLE 9 Information exchange	See section 2.5.10 Current level of information, awareness, and education among target groups; existing systems to communicate such information to the various groups	There is no national inter sectorial exchange of information system or policies within the country and no effort is taken towards legalizing the exchange of information.
ARTICLE 10 Public information, awareness and education	See section 2.5.10 Current level of information, awareness, and education among target groups; existing systems to communicate such information to the various groups	Sri Lanka aims to continue and increase information and awareness on POPs in the country.
ARTICLE 11 Research, development and monitoring	See section 2.5.9 Existing programmes for monitoring releases and environmental and human health impacts, including findings	There is no monitoring program focused specifically on POPs in Sri Lanka. Despite this, several POPs have been monitored in main matrices of the environment and living organisms including humans, as well as in foodstuff, but in a non-continuous and sustained manner.

Convention Article	Level of compliance	Comments
ARTICLE 12 Technical assistance	Sri Lanka is a recipient developing country Party. Since the first NIP, Sri Lanka has received technical assistance from the following developed countries/internati onal organizations: Please list what projects with technical assistance Sri Lanka has received	Considerable more technical assistance is needed for appropriate implementation.
ARTICLE 13 Financial resources and mechanisms	As of 30 November 2015, according to the Status of Contribution compiled by the SC Secretariat, Sri Lanka has no unpaid pledges for 2015 and prior years	
ARTICLE 15 Reporting	Sri Lanka has submitted its first report on measures taken to implement the provisions of the Convention on 31/12/2007, its second report on 27/09/2010 and its third report on 04/11/2015.	

Convention Article	Level of compliance	Comments
ARTICLE 17 Non-compliance	As the procedures and institutional mechanisms for determining non-compliance are not yet approved and developed, the countries compliance cannot yet be verified by the Conference of Parties/Compliance Committee	
ARTICLE 19 Conference of the Parties	Sri Lanka is a party to the Stockholm Convention and participating in COPs	
ARTICLE 21 Amendments to the Convention	Sri Lanka has accepted all the Stockholm Convention amendments	
ARTICLE 24 Signature	Sri Lanka signed the Stockholm Convention on 05/09/2001.	
ARTICLE 25 Ratification, acceptance, approval or accession	Sri Lanka ratified the Convention on 22/12/2005.	
ARTICLE 26 Entry into force	The Stockholm Convention entered into force for Sri Lanka on 22/03/2006.	

CHAPTER 3

3. Introduction

Chapter 3 has the two following main contents: the formal policy statement and the implementation strategy for the NIP. The implementation strategy sets out specific action plans and strategies to achieve Convention obligations and any additional objectives set by the Sri Lankan government.

3.1 Policy statement

Since its ratification of the Stockholm Convention, Sri Lanka was focused in addressing the POPs issues by integrating it to the general context of chemical and waste management aiming for a more sustainable development. Its achievements on this matter, which are reflected in several places during this NIP update, highlights Sri Lanka's commitment towards POPs reduction and elimination motivating to continue on this path. Government of Sri Lanka is committed to streamline and update its national legislative and regulatory framework in addressing POPs, as well as to strengthen the implementation measures in order to reduce the negative impacts of POPs on human health and environment.

The "integrated chemical and waste management" is the ruling principle that can ensure the transition to a more circular and green economy in the context of sustainable development of Sri Lanka. Efforts are made to create, maintain, strengthen and streamline the coordination mechanisms designated to lead the implementation of chemicals and wastes requirements, including those on POPs. All these actions are also seen as prerequisites for attracting more technical assistance and international funding in order to deal with the outstanding issues related to chemicals and wastes management.

As the Global Environment Facility is one of the main financial mechanisms in dealing with POPs, in the current NIP, Sri Lanka has correlated its vision in managing POPs substance also taking into account GEF 2020 Strategy, as well as the GEF-6 Strategy. Sri Lanka aims to take a more integrated and systemic approach based on the causal chain of environmental change, and identifying the key underlying drivers to tackle. Where useful, the current NIP in the action plan strives to address hazardous chemicals (POPs, ODS, mercury

and others) together in inventory development, information databases, BAT/BEP implementation and waste management and contaminated site assessment.

In the case of POPs considerations are made from end of pipe solutions to advancing green and sustainable chemistry more precise to substitution of POPs chemicals including non-chemical alternatives.

Focusing on the direct drivers by reducing the use of POPs in production and supply chains through, for example, the assessment and use of alternatives to harmful chemicals. This is part of the approach to move to more sustainable consumption and production patterns included as goal 12 in the Sustainable Development Goals and "by 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment".

Enhancing the monitoring and research activities on chemicals, including POPs, at national level represents a Government's priority. The outcomes of such monitoring and research activities will be used as basis for informed decision-making actions, as well as for raising awareness among relevant stakeholders. Building-up and streamlining the multi-purpose information databases on chemicals/wastes/contaminated sites is of crucial importance from the information management and implementation status perspective in Sri Lanka.

3.2 Principles and strategies involved in preparing and implementing the action Plan

In deciding the action plan on the management of Persistent Organic Pollutants, following principles have been followed. Chemical Management Secretariat of the Ministry of Mahaweli Development and Environment will engage with relevant parties and coordinate all the activities with the relevant stakeholders in implementing the activities.

3.2.1 Efficiency

Finding of the POPs inventories prepared under the study along with the social survey results will be used in deciding the action plan within the framework identified in the Final

Report of Capacity Building for Promoting Synergistic Implementation of Basel, Rotterdam and Stockholm Conventions in Sri Lanka on chemical management jointly conducted by CSIR-National Environmental Engineering Research Institute (CSIR-NEERI), Stockholm Convention Regional Centre on POPs for Asia, Nagpur, India and Ministry of Environment and Renewable Energy (MoERE), Sri Lanka in 2014.

Implementation of the action plan will be coordinated by the Chemical Management Secretariat of the Ministry of Mahaweli Development and Environment. The relationship between the Stockholm Convention with other sister conventions namely Basel Convention and Rotterdam Convention is always highlighted.

Actions will be prioritised according to the national requirement of the country while taking into account the international consequences that can effect on the practical implementation of such actions. Simultaneous implementation and synergies of the actions will be encouraged wherever possible for the efficient management of resources involved including human resources.

3.2.2 Feasibility and Sustainability

Economic acceptability and environmental sustainability of the proposed action is always analysed when deciding them. Recognizing the fact that introducing new procedures is time consuming, the proposed action will use the existing regulatory mechanism and guidelines and laws to the extent possible. However, if there is a necessity for such laws, new procedure, action will be taken to formulate them.

It has been frequently identified by many stakeholders that although Sri Lanka has enough legislative tools to regulate the chemicals, problem is lack of proper coordination among relevant organizations. Therefore, it should be focused on establishing a proper mechanism to regulate the procedure as proposed in this document (Please refer Figure 1). These activities can be coordinated by the Chemical Management Secretariat of the Ministry of Mahaweli Development and Environment.

The action plan will propose limited number of programmes rather than making many separate actions as it is being accepted by the treasury. But arrangements will be made to implement each and every action proposed by relevant experts. Actions will be built in such a

way where all stakeholders can participate in implementation of them through their budgetary allocations. The identified activities will be informed before the allocations are made in every year according to economic efficiency, environmental sustainability and social justice.

In costing each related activities the estimates will be made using the experiences on practical circumstances and also the cost associated with the risk factors such as changes in economy and technical aspects. The proposed actions will be implemented in such a way to capture the international as well as national changes in the area of management of chemicals.

3.2.3 Mainstreaming POPs into general chemical management and general waste and resource management

POPs are only a part of the thousands of hazardous chemicals in current use. Sri Lanka's strategy is to address POPs within the larger frame of hazardous chemicals management. For example an overall assessment of POPs-like properties for chlorinated, brominated, fluorinated and mixed halogenated chemicals is needed considering that Sri Lanka does not have destruction capacity and all chemicals imported/used in the country eventually are released to dumpsites and the environment. SAICM has established per- and polyfluorinated substances (PFAS) as a focal area which can be addressed together with PFÓS and related substances in a synergistic implementation approach.

The attempt to inventorize and manage PCBs stockpiles the last 10 years have revealed the challenges Sri Lanka faces to manage and dispose POPs. A similar challenge exists for all persistent toxic chemicals. Furthermore the recycling of PCB waste oils have revealed that POPs can negatively impact several recycling flows and can lead to contamination in different applications.

With the listing of POP-PBDEs the threat of contamination of other material and recycling flows were revealed (plastic from EEE and polyurethane foam) which resulted in the requirement of exemption for recycling by some parties. Also PFOS is impacting recycling flows of carpets and possibly textiles. These examples demonstrated how POPs/hazardous chemicals are negatively impacting reuse and recycling. This is a large threat when moving to a more circular economy needed for more sustainable production.

The need for a better resource management and higher recycling rates highlight the

need for a quick phase out of POPs and POPs-like chemicals from articles and products not only for the protection of human health but also for the protection of recycling flows. Clean recycling cycles are a basis for moving towards a more circular economy. At the same time this would reduce waste volumes.

The new listed industrial fluorinated POP (PFOS) and brominated POPs (POP-PBDEs, HBB, HBCD) and other industrial POPs currently in POPs Reviewing Committee (DecaBDE, PFOA and Short Chain Chlorinated Paraffins which had even larger production volumes) are contaminating large stockpiles of consumer goods. Sri Lanka has discovered the need of managing the affected stocks and wastes (e.g. electrical and electronic equipment, end of life vehicles, synthetic carpets, insulation foams) - containing further pollutants - in an integrated manner considering all pollutants and considering extended producer responsibility.

The policy and strategy of Sri Lanka is to substitute and phase out chemicals and materials which hinder or hamper the reuse, recycling or recovery (including energy recovery) of products and materials to improve material recycling and waste management.

3.2.4 Linking to sustainable consumption and production and SDG implementation

In accordance with the provisions of the Article 7(3) of the Stockholm Convention, "Parties shall endeavour to utilize and, where necessary, establish the means to integrate national implementation plans for persistent organic pollutants in their sustainable development strategies where appropriate" Sri Lanka is aiming to address POPs in connection to sustainable consumption and production efforts. A range of activities towards more sustainable consumption and production (SCP) have been initiated in Sri Lanka in the frame of SWITCH-Asia and other activities. An action plan for SCP has however not been developed yet but a policy component is currently developed. Here synergies between the chemical convention and SCP activities will be evaluated with the aim of common implementation where appropriate.

The contamination of several potential recycling flows by POPs revealed the unsustainable impact of POPs and the threat for a more circular economy and related resource conservation. Also the negative impact of halogens in high calorific fractions such as PBDEs/BFRs and PVC in WEEE plastic or polymer fraction of end of life vehicles are

hampering or restricting the thermal recovery of these high calorific fractions and lead to associated problems.

A key is the substitution of POPs and other hazardous chemicals by more benign substances. In this regard, Sri Lanka aims for an assessment of alternative chemicals considering green and sustainable chemistry principles for improving the recyclability and thereby supporting the waste hierarchy and SCP. Sri Lanka considers the alternatives to POPs and hazardous chemicals as a business opportunity.

Furthermore Sri Lanka aims to support several Sustainable Development Goals by the use of more green and sustainable chemicals including Goal 12 on Sustainable Consumption and Production, Goal 3 on Good Health and Well-Being and Goal 6 on Clean Water among others.

3.2.5 Multi Stakeholder Participation

It is expected the multiple stakeholder participation for the implementation in addition to relevant ministries and governmental institutions.

a) Encouraging the Private Sector Participation

Recognising the fact that the private sector plays a major role in economic development, the action plan will minimize economic injuries to the private sector while protecting the environment of the country.

Action plan will have maximum focus on application of economic instruments such as tax, subsidies, Deposit Refund Systems and Performance bond etc. to change the behaviour of the concerned party rather than focussing on costly and time consuming alternatives for behavioural change.

Private sector driven initiatives for sound management of chemicals will be promoted and encouraged with necessary inputs. Such initiatives currently driven by private sector are implementing Globally Harmonised System (GHS) for Classifying. Labelling of Chemicals, implementing novel business models such as Chemical Leasing, voluntary Certifications

which are related directly or indirectly with the chemicals management. (e.g.OHSAS 18001, ISO 14001 etc.)

The inputs, those are necessary to replicate and generate multiplier effect in the private sector are Capacity building, local adaptation of best practices guidelines, developing mechanisms for recognition and appreciation of best practices by the private sector organisations etc.

b) Universities and research institutions

Universities and research institutions such as Institute of Chemistry, Institute of Fundamental Studies have an important role in the implementation of the NIP. Science based information is key for the assessment of pollution of the environment and humans but also e.g. for the assessment of alternatives. Also the development of awareness raising strategies could benefit from a scientific assessment of communication tools and an assessment on the approaches to inform individual groups.

c) Civil Society Organisation

As highlighted above different NGOs are actively involved in chemical management sector and are functioning as members of the National Steering Committees in the sector. CSOs have better skills and placed close to the communities to play the community awareness role under this plan. In addition their participation which requested either by Ministry or by themselves is feasible depending on the issue. Therefore, they will continue to play an active and prominent role in the further implementation of the Convention.

d) Affected communities and general population

Affected communities will be closely involved in the implementation process. This includes affected workers, farmers and consumers affected by the POP in consumer products since a range of POPs are present in daily consumer goods. In this, the general population can play a key role in the implementation by avoiding products containing POPs and related chemicals. Involvement of affected communities would be a good platform for awareness raising to these stakeholders.

3.2.6 Equity, Participation and Social Justice

Members of NCC meetings of the BRS conventions will be requested to participate in the action plan activities after the formal meetings as a routine practice. Extending the time allocated for such meetings and grouping and diverting them for several activities simultaneously will also be used to get maximum input from the respective members.

The most affected parties such as who are not aware of the impacts of POPs and unable to avoid and overcome the impacts of POPs should be included in the implementation plan.

An annual symposium related to chemical management including POPs will be held to attract the attentions of high level policy makers. The topics of each year will be determined through discussion of the NCC members. Sharing information and experience from national, Regional and International level organizations is always welcome to enhance the efficiency of resources allocated for the POP chemical management.

3.2.7 Gender policy in NIP development and implementation

Efforts to ensure sound management of chemicals, including POPs have important gender dimensions, because in daily life, men, women, and children are exposed to different kinds of chemicals in varying concentrations. Biological factors, notably size and physiological differences between women and men and between adults and children, influence susceptibility to health damage from exposure to toxic chemicals. Also social factors, primarily gender-determined occupational roles, also have an impact on the level and frequency of exposure to toxic chemicals, the kinds of chemicals encountered, and the resulting impacts on human health.[6]

It is important that these gender dimensions to be reflected at both site and policy level interventions for sound chemical management. The gender analysis is used to identify, understand, and describe gender differences and the impact of gender inequalities on a sector or program at the country level. Gender analysis is a required element of strategic planning and is the basic foundation on which gender integration is built.

[6] United Nation Development Programme, Gender Mainstreaming. A Key Driver of Development in Environment and Energy, Energy and Environment Practice. Gender Mainstreaming Guidance Series;

Gender analysis examines the different but interdependent roles of men and women and the relations between the sexes. It also involves an examination of the rights and opportunities of men and women, power relations, and access to and control over resources. Gender analysis identifies disparities, investigates why such disparities exist, determines whether they are detrimental, and if so, looks at how they can be remedied.[7]

Consistent with the GEF Policy on Gender Mainstreaming and the GEF-6 approach on gender mainstreaming, GEF projects funded under this strategy will not only acknowledge gender differences within their design but determine what actions are required to promote both women and men's roles in chemical management, disproportionate chemical exposure and vulnerability, as well as sustainable alternatives.

3.2.8 Monitoring and Evaluation

Key performance indicators will be built to monitor the effectiveness of implementing each action proposed. Record keeping in the steps followed in implementing the activities will always be encouraged and followed to learn the lessons from them that will subsequently improve the effectiveness of future activities. Proposed actions on POPs will be linked with other existing environmental programmes to attract more funds for the sector and implement them effectively. The benefit of any funding source and training opportunities will be shared among the stakeholders depending on their role to enhance cooperation among them and also to motivate them

3.3 Overall Goal of the action plan

The overall goal of the action plan is to manage, reduce and eliminate where feasible the Persistent Organic Pollutants under the Stockholm Convention with the effective participation of all stakeholders including Government, private sector institutes, universities and research institutes and non-governmental organizations for both health and environmental benefits of the society while not harming the economic development of the country.

[7] United States Agency for International Development (2011), Tips for Conducting a Gender Analysis at the Activity and Project Level. Additional Help for ADS Chapter 2011;

3.4 Specific goals and activities

Irrespective of the type of POPs, sub sector specific goals have been formulated and proposed for the NIP by sector experts within the chemical management framework on the basis of the report on *Capacity Building for Promoting Synergistic Implementation of Basel, Rotterdam and Stockholm Convention in Sri Lanka,* are summarized as follows;

1. Enhance awareness of POPs on relevant sectors and segments of the society
2. Control and management of POPs at the point of entry
3. Reduction and possible stop of release of POPs to the environment by regulation and policy, and ensuring the life cycle management and substitution
4. Data collection and information dissemination related to management of POPs
5. Enhance coordination among stakeholders involved in management of POPs.
6. Strengthen analytical capacity, research and development and monitoring related to POPs management.

From the experience of the first NIP a better strategy is needed to implement the activities. Therefore it is suggested to earmark selected activities which need an immediate action for kick-starting the NIP implementation process. Such activities are for example a compilation of awareness raising tools including an assessment of different stakeholder groups and methodologies how to approach them. It is suggested to have a seed funding to immediately kick-start these processes. Such funding could include e.g. a funding package for Universities and research institution for initiating Master and PhD thesis to support individual implementation areas.

3.4.1 Programme on Enhancing awareness of POPs

This programme is scheduled to take a period of three years to raise the awareness of all relevant stakeholders of the society including school children, general public, political activists, high level decision makers and industries. An array of awareness tool will be compiled and developed tailor made for stakeholder groups and used to raise awareness. Topics and approaches for the individual POP group will be identified under each methodology proposed. Where it is

appropriate to make combined information and awareness for different or all POP groups the opportunity will be taken and used.

Furthermore, the awareness on POPs is considered as a part of general awareness raising on hazardous chemicals. Therefore, where appropriate POPs will be addressed within an awareness on chemical groups or general hazardous chemicals. Where possible links are made to other international or UN activities (e.g. awareness on POPs pesticides together with awareness on FAO/WHO highly hazardous pesticides; awareness on PFOS within the frame of awareness on PFAS being a SAICM topic).

Another larger international frame which will be considered are the link and relationships to the Sustainable Development Goals (SDGs) in particular to goal 12 on Sustainable Consumption and Production where chemicals and waste are highlighted. Also chemicals are closely linked to Sustainable Development Goals related to health (SDG 3) and water (SDG 6) and decent work for all (SDG 8).

As a strategy to minimize cost already existing and on-going programmes and also the infrastructure and institutional mechanisms under the stakeholders will be used. Under each component a leading institute has been selected and indicate in the first place among the stakeholder institutes and highlighted. The activity will be coordinated by the Chemical Management Secretariat of the Ministry of Mahaweli Development and environment. Key performance indicator is mentioned under each methodology.

Table 32 – Action plan on enhancing awareness of POPs

Main Activity	Sector	Sub Activities	Implementing Agencies	KPI	Time Frame	Budget
Awareness creation and information sharing	All POPs; Chemicals in Products (SAICM synergy)	Compilation of awareness raising information and tools for individual stakeholders on POPs chemicals.	**MoMDE** Universities.	Number of sectors/ programs covered	Within 2 years	Seed funding; Research University

	PBDEs; POP-BFRs, PFOS & PFAS; Chemicals in products (SAICM synergy)	Knowledge sharing among neighboring countries on POPs in products (e.g. (W)EEE, transport ELV management	**MoMDE** CEA DMT, Customs	Number of successful events	Within 2years	In-kind
	Pesticides, PFOS and PFAS (SAICM), PCBs, PBDEs/POP-BFRs, UPOPs Chemicals in products;	Awareness raising on POPs for policy makers, implementing agencies, custom authorities and public	**ROP-**For pesticides **CEA, Dep. of Imp/Exp, Customs**- For other industrial chemicals **MoMDE, Dep. of Imp/Exp,** CEA, Min. of Health, **,** CAA, NCPC -Policy makers	Number of programs	Within 3 years	US$10000
	PBDEs, POP-BFRs; PFOS and PFAS, UPOPs; SDG 12 & 8 (sustainable production)	Specific awareness programs for individual industries, manufacturers, retailers, importers, exporters on status, problems and alternatives and related assessments (EEE, Polyurethane, PVC, Rubber, Paint/ lacquer, Textile manufacturing) .	**Min. of Industries, NCPC, CEA,** MoMDE, Min. of Health	Number of programs/ Number of participants	Within 3 years	US$30000

	POPs Pesticides, Highly hazardous pesticides; SDGs 3, 8, 12 (sustainable production)	The awareness needs to be raised on pesticides currently produced/used and on available alternatives and IPM and organic farming. on national, regional and local levels for stakeholder groups (decision makers, farmers, public, NGOs, industry etc.)	**ROP/ Min. of Agriculture,** CEA, MoMDE, Min. of Health, Ministry of agriculture	Number of programs/ Number of participants	Within 3 years	US$50000
	Pesticides	Implement awareness and control mechanisms to encourage effective and efficient pesticide use practices in order to minimize waste and reduce accumulation of obsolete pesticides at the source.	**ROP**, MoMDE, Min. of Health, CEA	Number of the training programs/ participants	Within 5 years	US$50000
	UPOPs, PBDEs, PFOS, Chemical in products, SDG 12	Extensive awareness campaign on waste management, 3R, separation and open burning targeting local	**CEA, Min. of Local Govt. & PC, WPWMA,** MoMDE, Min. of Health, Min. of Education, Provincial	Number of programs	1 to 5 years	US$ 0.5 million

		authority, and general public including school children	Environmental Authorities, NWMSC			
	Pesticides, PCBs, PBDEs, PFOS/PFAS (SAICM synergy) UPOPs, SDGs 12 (Sustainable Consumption)	Providing the public with information on chemicals in products (POPs and related hazardous chemicals) within the frame of SCP/SDGs in order to make people aware on POPs and their effects on humans and biota (web pages, films, print, workshop, etc.)	**MoMDE, CEA,** Min. of Health, DMT	Number of paper articles/Number of web pages/ Number of programs	Within 5 years	US$70000
	UPOPs; Short lived climate change pollutants; carbon black (CCAC)	Inter-sectorial involvement in awareness should be done on open burning of waste.	**CEA, MoMDE**	Number of programs	Within 2years	US$5000
Training and inter-agency coordination	Pesticides, PFOS, PCBs, PBDEs, UPOPs	Encourage inter-agency coordination among relevant stakeholders.	**MoMDE,** Min. of Health, CEA, Dep. of Customs, ROP	Number of trainings	Within 2 years	US$2000
	Pesticides, PFOS, PCBs, PBDEs, UPOPs	The staff should be trained for appropriately handling of POPs based on best practice guidelines	**ROP-** For pesticides **CEA-** For other industrial chemical MoMDE, Min. of Health, Dep. of Customs	Number of participants	Within 3 years	US$20000

3.4.2 Programme on Management of POPs at the point of entry

Sri Lanka does not produce POPs chemicals, all POPs are imported and import control is therefore an option to stop POPs stockpile growing. Management of POPs at the point of entry can be further improved if the existing gaps identified in the NIP are correctly addressed. Basically, there is a gap in the HS code since they are not specific enough to control POPs and POPs-like chemicals and chemicals in products. The 8 digit system need to be upgraded to sufficient digits to e.g. include CAS numbers in the control. This might be implemented along with GHS implementation.

Stakeholders of BRS technical committee and BRS NCC namely Central Environmental Authority, BOI, ITI, Ministry of Health are also proposed to link with the on line system developed by the Customs. There may be a necessity of temporary solution for information exchange until the full capacity of the online system is developed. As it is being frequently observed by the BRS committee that some importers seek the permission of the committee after importing the products controlled under BRS conventions, there should be an awareness programme for the companies involved in importation of such products.

The necessity of guidelines and legal procedures to return the products back to the origin and penalty system for illegal importers of the POPs related materials is to be highlighted. International cooperation between government of Sri Lanka and institutes such as Regional Enforcement Network on the movement of hazardous materials are being identified. Most of them can be achieved by a cabinet paper developed through deep consultation of stakeholders and respective sector experts. As these processors involve a deep discussion the required documents will be made by detail discussions among the stakeholders through NCC meetings and workshops.

Table 33 - Action plan on management of POPs at the point of entry

Main Activity	Sector	Sub Activities	Implementing Agencies	KPI	Time Frame	Budget
Implement GHS; Revisit the HS codes system and develop a method to track chemicals and chemicals in products at custom level (CAS)	Pesticides, PCBs, POP-BFRs, PFOS & PFAS (SAICM synergy),	Globally harmonized system of classification and labeling of chemicals (GHS) should be enshrined in law and implemented	**MoMDE, CEA, Dep. of Customs, Dep. of Imp/Exp,** Min. of Industry and Commerce, Chemical importers	Cabinet paper is approved and System is in place	Within 2 year	US$10000
		Development of methods to control POPs and other hazardous chemicals at custom level (CAS numbers).		Method is on place	Within 2 year	US$10000
Ban/ Control of Importation	PBDEs/POP-BFRs, PFOS	Prohibition of the import of POPs (allowance only for exemptions)	**MoMDE, CEA, Dep. of Imp/Exp**, Min. of Industry and Commerce, Chemical importers, BOI Dep. of Customs	Update the related gazette	Within a year	In-kind
	PBDEs/POP-BFRs, PFOS; UPOPs in products	Restriction on import of POP contaminated consumer articles (in the form of finished, semi-finished products or scrap)		Number of such cases identified.	Within a year	In-kind
	PBDEs/POP-BFRs;	Ensure not to import plastic wastes entering into the country as factory rejects and apply the Basel Convention requirements		Guidelines are issued to importers through DI&EC	Within a year	In-kind

Strengthening the traceability of existing Custom approaches	PBDEs/POP-BFRs and PFOS and PFAS Chemicals in products (SAICM synergies);	Improvement of tracking (and thereby control) of chemicals and chemicals in products (including scrap for recycling; (bio-fertilizer). Database, screening/analysis (cooperation laboratory)	**MOMDE CEA, Dept. of Customs**	Number of agreement made with coordination bodies	Within 3 years	US$10000
	PBDEs/POP-BFRs, hazardous chemicals	Improvement of the traceability of WEEE exports through monitoring and for WEEE (for verification and monitoring of physical quantities by respective stakeholders; conclusive physical inventory)	**MoMDE, CEA**	Number of cases detected and amount of WEEE caught	Within 2 years	US$10000
Development of Online system to control the importation of POPs and related products contaminated with POPs	All POP sectors including Pesticides, PCBs, PBDEs/ POP-BFRs, PFOS & PFAS (SAICM synergy)	Linking the activities of Import and Export Control Department with the Technical committees and National coordination Committees that gives the concurrence (CEA, ROP) of importing the products that has a potential to contaminated with POPs and Department of Customs	**Dep. of Imp/Exp, Dep. of Customs,** MOMDE , CEA, ROP	Online system is in place	Within 2 years	US$20000

3.4.3 Policy, regulation and implementation for reduction of POPs use and release

Policy and the appropriate regulatory frame and implementation is needed to control the use and release of POPs. This programme will focus on the POPs already inside the country. POPs can be released to environment by intentional and unintentional release. Therefore, the activities/programme will cover both issues. On one hand, sustainable alternatives for the products that can release POPs will be promoted through economic tools. Alternatively, activities related to production of unintentional POPs releases will be discouraged. Further, steps will be taken to establish procedures, methods, guidelines and standards where appropriate to collect the waste that has a possibility to produce POPs.

Table 34a - Action plan on control the release of POPs by regulation and enforcement

Main Activity	Sector	Sub Activities	Implementing Agencies	KPI	Time Frame	Budget
Development and Enforcement of Legislation	PBDEs/POP-BFRs	Ban the import and use of POP-BFRs. Enforce the phase-out of use of POP-PBDEs; POP-BFRs and POP-PBDE contaminated consumer articles (in the form of finished or semi-finished products).	**MoMDE, CEA,** Dep. of Imp/Exp, Min. of Industry and Commerce, Chemical importers, BOI	Legislations are in place	Within 3 years	US$20000
	PBDEs; POP-BFRs; HFCs (GHG); CFCs (ODS), hazard. chemicals in EEE (SAICM synergy	Regulation for vehicle deregistration and End of Life Vehicles (ELV) management, prevention of illegal dumping and illegal use, as well as regulation for WEEE recycling activities	**DMT**, CEA MoMDE,	Related regulations are in place	Within 3 years	US$20000

	PFOS	Ban PFOS and restriction of import and export of PFOS and PFOS related products Prohibit the import of PFOS containing fire-fighting foam and control foams imported. Allowing only the exempted uses for which Sri Lanka notified to the Secretariat	**MoMDE, CEA**, Dep. of Customs, Dep. of Imp/Exp Min. of Industry and Commerce, Chemical importers, BOI, Civil Aviation Authority, Sri Lankan Airlines, Sri Lanka Air force	Related regulations are in place Information on exempted products are sent to relevant institutes	Within 3 years	US$20000
	PFOS	Further assessment of needed use of PFOS in metal plating industry and other allowed uses and potential listing of exemption(s)	**IDB, Min. of Industry and Commerce**, MoMDE, CEA	Related regulations are in place Information on exempted products are sent to relevant institutes	Within 3 years	US$5000
	PFOS	Stop recycling and reuse of PFOS containing articles.	**IDB, Min. of Industry and Commerce** MoMDE, CEA	Recycling and reuse of PFOS containing articles are stopped.	Within 3 years	US$ 5000
	POPs Pesticides, highly hazardous pesticides	Implement effective regulatory mechanism and control programs to assess current used (highly) hazardous pesticides and substitution by less hazardous pesticides and integrated vector control.	**ROP**, Min. of Health, MoMDE	Number of highly hazardous pesticides replaced with less hazardous pesticides	Within 3 years	US$ 3000
Guidelines for POPs management	Pesticides, PFOS, PCBs, PBDEs, UPOPs	Assessment of usefulness of the Development of a “Generic Legal	CEA, MoMDE	Guideline is in place	Within 3 years	US$ 3000

		Guideline" document based on the currently available booklet for Montreal Protocol				
	PFOS	Develop a guidance for collection and treatment of PFOS containing waste: run-off water from fire incidents where PFOS containing foams, use. Establish a frame for environmentally sound disposal and management diverting PFOS waste from landfill sites	**CEA, MoMDE, BOI, Civil Aviation Authority, Sri Lankan Airlines, Sri Lanka Air force**	Related guidelines are institutionalized	Within 2 years	US$1000
	PCBs	Translate Technical Guidelines/ Manuals to Handle PCBs containing/contaminated equipment in an environmental sound manner(developed by UNEP) into the national languages	CEA, MoMDE, CEB, LECO, LTL	Translations are ready and distributed among the related stakeholders CEB, Welders and welding plant manufacturers	Within a year	US$2000
	Pesticides, PFOS, PCBs, PBDEs, UPOPs	Development/improvement of a waste catalogue (e.g. assess EU waste catalogue) to categorize the waste categories present in Sri Lanka.	**MoMDE, CEA, ROP, WPWMA,** Ministry of Health, BOI IDB	Waste catalogue is in place	0 to 3 years	USD 10000
Develop & apply EPR for POPs and hazard. chemical	Pesticides, PBDEs, PFOS, HFCs (GHG), CFCs (ODS);	Apply Extended Producer Responsibility (EPR) concept to reliable	MoMDE, CEA DMT, ROP, Consumer Affairs Authority, Ministry of	Cabinet Paper on EPR is approved. Number of	Within 2 years	US$5000

management	Chemicals in products (SAICM synergy)	collection of scrap cars, WEEE, empty containers	Finance, Ministry of Industry and Commerce, Telecommunication Review Commission	products that apply EPR.		
Development of Sri Lanka Standards (SLS)	PBDEs/POP-BFRs	Assessment and possible modification of flammability standards developed by Sri Lanka Standards Institution (SLSI)	**MoMDE, CEA, SLSI**	SLSI standard on flammability is in place and Number of institutes that apply the standard.	Within 1 year	US$2000
	UPOPs	Develop limit values for UPOPs in chemicals and products	MoMDE, CEA, SLSI Ministry of Health	Maximum permissible limits are decided and applied in the related guidelines	Within 2 years	US$2000
	PFOS, PFOA other PFAS (SAICM synergy)	Introduce PFOS guidelines for drinking water and for daily intake of humans.	SLSI, Water Board and Ministry of Health	Maximum allowable daily intakes and guideline for drinking water are developed	Within 2 years	US$2000
Implement the existing laws and policies	Pesticides, PFOS, PCBs, PBDEs, UPOPs	Strengthening the scheduled waste and contaminated sites management practice in the country	**CEA**	Number of issues brought into place	Within 2 years	US$
	PFOS and PFAS (SAICM); PBDEs/POP-BFRs	Undertaking law and policy assessment related to management of industrial POPs, amending existing laws or developing new laws where it is necessary related to industrial POPs	**CEA, MoMDE BOI, IDB, Ministry of Health, Consumer Affairs Authority, Ministry of Industry and commerce,** Department of Legal Draftsman	Number of laws and regulations amended and applied	Within 3 years	US$2000

	UPOPs	Assessment of options for UPOP standards emission standards in incinerators and industries.	CEA, MoMDE	Emission standard of incinerators and industrial emissions are amended	1 to 3 years	US$ 2000

Table 34b - Action plan on controlling the release of POPs by BAT/BEP

Main Activity	Sector	Sub Activities	Implementing Agencies	KPI	Time Frame	Budget
BAT/BEP for Reduction of Emissions from Industrial Processes	UPOPs, PBDEs, PFOS, PCBs, mercury, other pollutants control, Pesticides	Establishment of an information clearinghouse for transferring BAT for industries. This role can be assigned to the Central Environmental Authority (similar to USEPA or EU BAT Reference documents).	**CEA, Provincial Environmental Authorities**, ITI, MoMDE	Clearing house mechanism is in place	0 to 5 years	USD 2 M
	UPOPs, mercury, other pollutants control	Assess current technology level of major UPOP emitter and improve with BEP and where required, BAT measures. Apply BAT/BEP for new Annex II and III industries and introduce integrated pollution prevention and control approach	MoMDE, CEA	Number of industries under annex ii and iii that apply BAT/BEP	3 to 10 years	US$ 1 million
	UPOPs	Life cycle assessment and management of PVC in Sri Lanka	**University**, Related industries, MoMDE	Completed Life cycle assessment	Within 2 years	US$ 5000
	UPOP, PAH, PM	Assessment of impact from biomass indoor use and program of improved stoves, biogas stoves or solar cooker	**Universities, ITI, NERD** MoMDE, CEA,	Assessment of current status related to stove. Level of reduction of respective pollutants	Within 3 years	US$ 20000

	PBDE/POP-BFRs mercury, CFCs, HFCs; etc. (hazard. Chemicals in life cycle EEE SAICM synery)	Apply BAT/BEP for recycling of WEEE including WEEE plastic	**CEA, Ministry of Industry and commerce,** MoMDE, IDB	Number of industries with related BAT/BEP	Within 3 years	US$ 10000
	PBDE, POP-BFRs mercury, CFCs, HFCs; etc. (hazard. Chemicals in life cycle EEE SAICM synergy)	Apply BAT/BEP for end of life vehicles and related recycling and recovery	**CEA, DMT, Ministry of Industry and Commerce**	Number of ELV industries with BAT/BEP	Within 5 years	US$ 50000
	PFOS and PFAS (SAICM synergy)	Apply BAT/BEP for the use of PFOS and PFAS in industrial use and substitution	**MoMDE, Min. of Finance, CEA Ministry of Industry and Commerce**	Number of industries with BAT/BEP and number of substitutes introduced	Within 5 years	US$ 50000
	UPOPs, PBDEs, PFOS, PCBs, Pesticides	Apply BAT/BEP for waste disposal. Establishment of hazardous waste destruction facility. Establishing hazardous landfill.	MoMDE, CEA	Number of industries that apply BAT/BEP, Hazardous waste facility established . Land fill is established	Within 5 years	US$ 2 million

3.4.4 Programme on data collection, database development, improving inventories and information dissemination related to management of POPs and related management

Main objective of this programme is to develop database required for collection of data related to POPs and other hazardous chemicals and generate necessary information for decision making required for their sustainable management within the frame work of life cycle assessment and life cycle management. In addition, the programme is scheduled to collect the information that will be required time to time for the update processes of future NIPs. This might include a database for (hazardous) waste, stocks, emissions (integrating UPOPs, GHG, mercury etc.; PRTR), contaminated sites and possibly others.

In principle, it is not expected to introduce new mechanism of data collection but the existing formats used for information on products, manufacturing and practices will be amended to cover the collection of all the required information. The review of the existing formats to find out the required changes and additions to be made will be done with the help of respective experts. The draft will be discussed with relevant stakeholders at the BRS technical committee and BRS NCC to finalize them.

Finally the programme will be coupled with the GEF data management project. The data base already developed by ITI can be the starting point of the exercise and chemical management Secretariat of the Ministry of Mahaweli Development can maintain the data base with the help of other main stakeholders namely Department of Customs, Department of Import and Export control, BOI and Ministry of Industries etc allowing them a limited access for necessary activities including upgrading and accuracy checking.

Table 35a: Action Plan on data collection, inventory, database development, information dissemination and management of POPs

Main Activity	Sector	Sub Activities	Implementing Agencies	KPI	Time Frame	Budget
Update and maintenance of Data base/ Inventory related to POPs	PBDEs/POP-BFRs; hazardous chemicals in EEE/WEE (SAICM synergy)	Review and update the national inventory for Electrical and Electronic Waste management and transport sector in Sri Lanka	**CEA, MoMDE** Dep. of Customs, Imp/Exp, DMT	Data base structure is finalized. Formats for collection of data are ready	Within 3 years	US$ 5000
	PBDEs/POP-BFRs, PFOS	Stockpile management of firefighting foams, aviation fluids, synthetic carpets and possible other uses (furniture, textile, polish etc). Environmental safe storage of PFOS-containing materials, in order to manage, reduce and eliminate releases from stockpiles and wastes.	CEA, Min. of Industry and Commerce, Chemical importers, BOI, Civil Aviation Authority, Sri Lankan Airlines, Sri Lanka Air force	Amount of respective materials managed	1 year	US$ 1million
	Pesticides, PFOS, PCBs, PBDEs, UPOPs;	Streamlining of national data collection and management system	**MoMDE CEA, Dep. of Customs, DMT**	Presence of integrated database	Within 2 years	US$ 50000

	Hazardous waste	such as EPL, VET, NSWMSC and Schedule Waste Licensing Scheme (ex: integrated waste database management)				
	PFOS and PFAS (synergy SAICM)	Improving the PFOS inventory identifying different users, chemicals and details of stocks including fire fighting foams. Inventory improvement of historical use of fire-fighting foams in the last 40 years under practice areas, major used areas and other used places, as well as of other uses of PFOS in Sri Lanka e.g. metal plating, hydraulic oil etc.	**MoMDE, CEA, Civil Aviation Authority, Sri Lankan Airlines, Sri Lanka Air Force,** Dep. of Customs, Dep. of Imp/Exp, Min. of Industry and Commerce, Chemical importers, BOI	Formats are ready for data collection Data collection started	6 months	US$ 0.3 million
	PCBs	Establish a full inventory of PCBs containing/ contaminated equipment including transformers, capacitors and other electrical items with dielectric fluids. Initial assessment of PCBs in open applications	**MoMDE, CEA, CEB, LECO, LTL, Min. of Plantation, Informal PCBs oil users,** NGOs, Dep. of Customs, Dep. of Imp/Exp	Data collection formats are finalized. Data collection started	Within 2 years	US$ 5000
	PCBs	Develop a database to track chain of custody of the inventories items till the disposal completion.	**MoMDE, CEA, CEB, LECO, LTL, Min. of Plantation, Informal PCBs oil users,** Dep. of Customs	Presence of the database	Within 3 years	US$ 5000
	Pesticides, PFOS, PCBs, PBDEs, UPOPs	Include the data requirements for POPs in National Census	**MoMDE, Dep. of Census and Statistics**	Concept paper is prepared in agreement with National Census to collect data	2 to 3 years	US$ 2000
Develop a Pollutant	UPOPs, POPs, GHG, ODS,	Evaluate the option and challenges to	**CEA**, **Ministry of industry and**	Report on pros and cons	Within 3 years	US$ 10000

Release and Transfer Registers (PRTR)	mercury, other pollutants	develop a Pollutant Release and Transfer Registers (PRTR) as a frame of the overall emission inventory and related development.	**Commerce, BOI,** MoMDE,	of the method is prepared		
Management and destruction of POPs stockpiles	Pesticides	Establishment of a secured temporary storage facility for obsolete pesticides to avoid any misuse of such pesticides at field level and identify possible disposal options.	**ROP, Dept. of Agriculture**	Storage facility established. Disposal options are identified	Within 2 years	US$20000
	Pesticides	Destruction of pesticide stockpiles	**ROP**, ITI, CEA, Holcim, MoMDE	Amount of pesticides stockpiles destructed	Within 2 years	US$ 100000
	PCB	ESM on storage facilities and destruction of PCB stockpiles	**CEB**, ITI, Holcim, CEA, MoMDE	Amount of pesticides stockpiles destructed	Within 4 years	US$ 340000
	PFOS	ESM of storage facilities and treatment of contaminated sites	**Stakeholder industries,** ITI, MoMDE, CEA	Amount of PFOS treated/No of sites rehabilitated	Within 5 years	US$ 1M
	PBDE Note: PBDE stockpiles (WEE and ELV contaminated with PBDE) is comparatively small and widely distributed hence destruction of existing stockpiles not considered in this juncture	Introduction of occupational safety and health guidelines for recycling facilities	Min of industries, Min. of Health, Min of Labour	Finalized guidelines and the establishment of mandatory OSH practice guidelines	Within 2 years	Rs. 2 M
		Strengthen and formalize the WEE collection facilities (especially CRT monitors) and WEE export mechanism adhering to the requirements of the Basel Convention	MoMDE , CEA	No. of WEE collection facilities having EPL and scheduled waste license	Within 2 years	Rs. 2 M
		Establishment of WEE/ELV recycling facilities within the country	Government of SL to support PPP ventures	No. of WEE recycling facilities having EPL and scheduled waste license	Within 5 years	Rs. 50 M*

		Establishment of secure landfill facilities within the country	Government of SL to support a PPP venture	National level secure landfill for scheduled wastes	Within 5 years	Rs. 50 M*
*The expenditure should be part of the National Waste Management Infrastructure expenditure and may come from several action plans. Thus this is not needed as a single commitment.						

Table 35b: Identification, assessment and management of contaminated sites

Main Activity	Sector	Sub Activities	Implementing Agencies	KPI	Time Frame	Budget
Contaminated sites	Pesticides, PBDEs, PFOS, UPOPs, PCB	Identification, risk assessment, prioritization, securing and taking measures to remediate contaminated sites	**CEA, ROP,** Sri Lanka Aviation Authority, Sri Lanka Air force, Sri Lankan Airline, BOI	Number of sites identified and application of remedial actions for them	Within 3 years	US$ 1 million
	Pesticides, PBDEs, PFOS, UPOPs, PCB; Mercury, heavy metals	Database development (GIS) and inclusion of (potential) contaminated sites identified with all relevant information	**CEA, ITI,** Sri Lanka Aviation Authority, Air Force, Sri Lankan Air Line, BOI, Ministry of Industry and Commerce	GIS base information system on contaminate sites are ready	Within 2 years	US$ 10000

3.4.5 Programme on Enhancing coordination between existing mechanisms involved in management of POPs for present as well as future activities

Under this programme, it is proposed to strengthen and make changes in the present institutional structure of chemical management to meet the framework introduced by the report Capacity Building for Promoting Synergistic Implementation of Basel, Rotterdam and Stockholm Conventions in Sri Lanka. The gaps in the present system has already been identified in the report and issues were discussed in the training held during 28-30 October 2014 by Stockholm Convention Regional Centre on POPs for Asia and Ministry of Environment and Renewable Energy.

One of the main gap is that the present BRS related committees (both NCC and technical committee) are not legalized rather the earlier committees of the Basel convention are converted

into present structure. Further, stakeholder participation in the committees especially for BRS technical committees remains poor and continuous participation of one officer is rarely observed in many cases, which is one of the most important requirements of handling the technical aspects.

The effective coordination between the relevant institutions (eg. Import and Export Control Department, Sri Lanka customs, ITI, BRS technical committee and NCC etc.) are also not satisfactory. Furthermore it is proposed to strengthen the relationship between the activities of Technical Advisory Committee on management of Industrial Chemicals (TACMIC) and Pesticide Advisory Committee (PTAC) as they address the issues related to Rotterdam Convention. These drawbacks of the current system will be addressed through discussions based on the concept notes prepared by Sector experts.

Table 36 – Action plan on enhancing coordination between existing mechanisms involved in management of POPs and related waste management for present as well as future activities

Main Activity	Sector	Sub Activities	Implementing Agencies	KPI	Time Frame	Budget
Strengthen the National Chemical Management System	Pesticides, PFOS, PCBs, PBDEs, UPOPs, Mercury, ODS, etc	All chemicals related to the Multilateral Environmental Agreements (MEAs) to which Sri Lanka is a Party to be managed under single institutional mechanism	**MoMDE, CEA,** Dep. of Customs, Dep. of Imp/Exp, Min. of Industry and Commerce	Legally approved chemical management system is in place	1 year	US$ 3000
		Identify the synergies among the activities related to POP, CAPP, CWC, Basel etc	**MoMDE, CEA**	Report on synergies	Within 1 year	US$ 5000
Implementation of integrated waste management systems	UPOPs, mercury, heavy metals, GHG reduction	Implementation of integrated waste management systems based on Waste Management Hierarchy at national, regional and local authority level. Due attention to be paid for the residues, such as ash or sludge generated from industrial and waste management activities	**Ministry of Local Authorities, CEA, MoMDE** NWMSC, WPWMA, BOI **Ministry of Local Authorities, CEA, MoMDE** NWMSC, WPWMA,	Integrated waste management system is in place	2 to 5 years	US$ 5 million

	UPOPs, PBDEs, PFOS, PCBs, Pesticides	Avoid and reduce the amount of waste at generation points, waste segregation and recycling	BOI			
	UPOPs, PBDEs, PFOS, PCBs, Pesticides, GHG reduction	Promote clean composts and biogas (including sludge used then in agriculture), and recover and recycle as appropriate	**Ministry of Agriculture, Ministry of Industry and Commerce, CEA**	I ncreased volume of compost, Some sludge is used as compost, Different compost standards are introduced,		
	UPOPs, PBDEs, PFOS, PCBs, Pesticides	Minimization and possibly restriction of landfilling POPs containing materials and application of the waste management hierarchy or destruction in BAT/BEP cement kiln or incinerators.	**CEA, Ministry of Industries, MoMDE,** Ministry of Health	Annual decrease in the % amount of POP containing materials that go to landfill and increase the % amount destroyed by incinerators and BAT/BEP (The values are to be calculated considering total amount in a given year	2 to 5 years	
Strengthening the schedule waste management unit of the CEA	UPOPs, PBDEs, PFOS, PCBs,	Strengthening the capacity of inspecting the practice of hazardous waste generators and keep records of the amount of waste generated by the licensees of hazardous wastes generated in industries, including ashes or sludge from incinerators, boilers or metal industries	**CEA, Related industries, BOI**	Formats are introduced to respective industries	1 to 3 years	USD 0.5 M
Incorporate informal recycling sector into formal scheme	UPOPs, PBDEs, PFOS, PCBs,	In order to streamline the informal recycling sector into formal scheme, CEA officials and Public Health Inspectors need to identify the informal recyclers and malpractices in the industry and to take measures to bring it in legality or close them.	CEA, Min. of Health	Informal recyclers are registered by a paper notice and monitoring mechanism is in place	1 to 4 years	USD 0.5 M

3.4.6 Programme on Research, monitoring and evaluation activities related to management of POPs

A relative by small number of researches on chemicals (including POPs) are being conducted by individuals and institutes. Some of them are published while some remain unpublished and focused on fulfilling some objectives such as completion of higher degrees etc. Some facilities are available including accredited laboratories for the testing of (hazardous) chemicals including some POPs. An opportunity is already being opened to receive a GCMS under the PCB management project to be started in this year.

Further, a large laboratory is developed in Kandy with Chinese funding. Therefore, this programme will make recommendations of integrating POPs in a larger frame of pollutant monitoring. There is concern of the private sector that the cost of testing of chemicals including POP is high. One aim should be the reduction of the cost of testing which will ultimately be helpful for the management of POPs. The Ministry of Mahaweli Development has already purchased a portable XRF machine (within NIP update) that can test for elements such as heavy metals but also bromine indicating the possible presence of POPs-BFRs.

There is no regular mechanism in Sri Lanka to gather research findings and use of them for decision making. Therefore, a network of collecting research findings on POPs and other relevant chemical pollution will be developed under this programme. In addition, it is also proposed to liaise with international institutes that disseminate research findings related to POPs other relevant chemical pollution and regular contact necessary for continuous information flow will also be established under this programme. It is also further proposed to hold a symposium on POPs and other hazardous pollution research, policy and management every year to motivate the research to generate data for decision making.

Table 37: Action plan on research, monitoring and evaluation activities related to management of POPs

Main Activity	Sector	Sub Activities	Implementing Agencies	KPI	Time Frame	Budget
Strengthen the analytical capacity of laboratories	PBDE; POP-BFRs; chemicals in products	Monitoring of POP-BFR level in imported finished, semi-finished products (new/used) or scrap during its life cycle and certification of POP level	**ITI, CEA**, ROP, Min. of Health, Government Analyst's Dep., Dep. of Customs, Dep. of Imp/Exp, SLS	% number of cases sent for testing	Within 5 years	US$ 1 million
	POPs Pesticides, highly hazardous pesticides, PFOS/PFAS, PCBs, PBDEs	Establishment of facilities in Sri Lanka for sampling and analysis of PBDE/POP-BFRs, PFOS/PFAS and strengthening the facilities of analysis of PCBs and POPs and other hazardous pesticides	**ITI, CEA, Universities**	Number of accredited laboratories to test POPs is increased	Within 5 years	USD 10 M
	esticides, PFOS, PCBs, PBDEs, UPOPs	Improved manpower and expertise in laboratories for POPs management and enhance regulatory monitoring of illegal POPs accompanied with analytical confirmations in order to spot possible infiltration of banned POPs.	**ITI, ROP, Universities, CEA**	Number of officers trained for testing of POPs	Within 5 years	US$ 0.1 million
Monitoring of POPs chemicals	Pesticides, PFOS, PCBs, PBDEs, UPOPs; other environmental pollutants	Formulation of separate monitoring committee; introduce at one stop shop under Central Environmental Authority (CEA) and Consumer Affairs Authority (CAA). Development of overall monitoring concept for environment & humans	**CEA,** CAA, ROP, Min. of Health, MoMDE,	Monitoring Committee is in place Number of POPs chemicals monitored	Within 2 years	US$10000

	UPOPs	Evaluation of appropriateness of current general emission standards from UPOPs sources. Monitoring of major industrial emitter and option assessment of standard development	CEA, MoMDE	Change in present emission standard to include UPOPs	1 to 2 years	US$10000
Symposium for networking and information	Pesticides, PFOS, PCBs, PBDEs, UPOPs	Symposium on POPs, heavy metals and other environmental pollutants	**MoMDE, CEA,** Ministry of Industry and Commerce, Ministry of Health, BOI	Symposium is held	Within 1 year	US$ 20000
Monitoring of articles and recycling	Pesticides, PFOS, PCBs, PBDEs, UPOPs, mercury,	Assess the presence of POPs in articles and recycling and its risks.	**CEA, ITI**, ROP, Government Analyst's Dep., MoMDE	List of articles with POPs	Within 3 years	US$ 40000
	Pesticides, PFOS, PCBs, PBDEs, UPOPs, mercury, heavy metals, Chemicals in products	Material and substance flow analysis of POPs, heavy metals and other pollutants in Sri Lanka in order to find the means and ways to control and eliminate pollutants from the country	**CEA, ITI, ROP**, MoMDE, Government Analyst's Dep.	Report on POPs content in products with recommendations to reduce inflow. Report on POPs emission from various sources	Within 5 years	US$ 1 million
	Pesticides	Implement coordinated research network to encourage local analytical laboratories to effectively engage in environmental sampling for POPs pesticides in tandem with establishing possible correlations between their presence and biological effects.	**ROP, ITI, CEA, Universities, MoMDE**	Number of correlation established	Within 5 years	US$ 50000

3.5 Development and capacity-building proposals

This section details the priority areas where current capacity needs to be strengthened to achieve the objectives of the NIP. Priorities are determined based on the needs to meet Convention obligations and country priorities.

Capacity building priorities for the further implementation of the Stockholm Convention NIP in Sri Lanka are similar to the capacity building priorities which have been discovered in the GEF National Capacity Self-Assessment. Therefore, capacity building areas and the approaches for POPs can be linked to general action on improving the national capacity for environmental and sustainable development.

1) Awareness, information and environmental education

As highlighted in the action plan an overall awareness on POPs related issues should be linked or be integrated in awareness in sustainable development (the "big picture"). Awareness on POPs can also be used as a tool for awareness on more sustainable consumption and production. One particular approach is integrating green and more sustainable alternatives to POPs and POP-like chemicals and their phasing out. Historic lessons learned and impacts on global recycling flows integrated with the long term perspectives of the POPs challenges in Sri Lanka having no or very limited destruction capacity can be used to develop tool for SCP.

The information and awareness raising approaches in Sri Lanka needed to be tailored for all levels of stakeholders including policy makers, industry and the society at large. Material development and education approaches for the individual POPs groups (Pesticides, UPOPs, PCB and new POPs) should be coordinated as some of the new POPs are present in goods of daily life (electronics, car shredder residues, synthetic carpets, flame retarded or surface treated textiles, furniture, mattresses etc.) consumers. While for pesticides and for PCB occupational exposure has the highest priority.

2) Development of policy and regulatory frameworks and enforcement

The need of a more comprehensive regulatory framework has been highlighted and an action plan has been elaborated. The capacity building on policy and regulatory frameworks for

POPs should be addressed within the larger framework of hazardous chemicals and hazardous waste and should include capacity building for the related enforcement.

For the large material flows of consumer goods (EEE/WEEE and end of life vehicles) a policy and regulatory frame are needed to guide the entire life cycle of these products. For these resource containing material flows (EEE/WEEE, ELVs) the policy of waste hierarchy (reuse, recycling, and recovery) will be elaborated as a model for other waste streams in accordance with the Stockholm Convention BAT/BEP guidance and the PBDE BAT/BEP Guidance. For such articles/material flows industrial countries have included in the policy and in the regulatory frame the extended producer responsibility (EPR) where currently no policy and regulatory frame exists in Sri Lanka and capacity building is needed in this respect.

3) Capacity building on BAT/BEP

The capacity on BAT/BEP for emission reduction is relatively low. Sri Lanka has an experienced Cleaner Production Centre which has worked more than 20 years on emission reduction and resource (energy and water) savings. BAT/BEP are not described in detail for different industries and facilities in Sri Lanka as it has been done e.g. in the EU the last 20 years with the development of BAT Reference documents. Further capacity building for the BAT/BEP for Dioxin/UPOPs reduction and BAT/BEP for PBDE containing wastes can be an impulse for a more broad capacity building on integrated pollution prevention and control.

4) Capacity building on contaminated site assessment and management

Further, currently no policy and regulatory frame and database exist for contaminated sites. Management of POPs can be a start for such frame work that the pollution of the soil/environment in the country is broadly addressed while a better protection against chemical pollution is developed. The development of soil limits and assessment of sites as well as a frame for assessment and management of already contaminated sites is a policy and capacity building need.

3.6 Timetable for implementation strategy and measures of success

The implementation strategy has been outlined above. An estimated cost with suggested timelines for implementation strategy are included in the individual action plan tables above. The measures are categorized in short term, medium term and long term time frames.

For a considerable part of the implementation activities, Sri Lanka will need international funding. Therefore, the time table depends considerably on approval of the projects. The experience on Stockholm Convention implementation has revealed some challenges to establish projects within the Stockholm Convention frame and that the time required to obtain the final approval can be longer than anticipated. Therefore, the time suggested in particular for short term projects have related uncertainties.

3.7. Resource requirements

This subchapter compiles some considerations on resource requirements of measures included in the NIP. Estimated resource requirements of the respective activities are included in the individual action plan tables on chapter above. Incremental costs for measures would be identified and potential sources of funding for both incremental costs and baseline costs would be noted. In accordance with Article 13 of the Convention, alternate sources of funding would be considered, as appropriate, by countries that are seeking development assistance.

Sri Lanka is aware that the financial resources from GEF and other international funding organisations are not covering the full implementation without considerable co-financing. Funding has to be considered. Some considerations for co-financing for POPs projects (details on co-funding will be elaborated during the respective project developments) are presented below.

- Sri Lanka aims for an integrated approach in the implementation of the Stockholm Convention (coordinated implementation of different conventions and integrated in national programs where feasible). Therefore co-financing might come from other project budgets.

  E.g. national projects on waste management have allocated budgets. When projects for municipal waste or waste from industry or institutions with POPs relevance are

processed e.g. for WEEE or end of life vehicles then waste fees would cover a part of co-financing.

- Also, waste with some valuable materials (metals in WEEE or end of life vehicles) can be used as co-funding for the overall management.
- Owners of the PCBs (utility sector) have the major responsibility for a large share of the PCB containing transformers.
- Extended Producer Responsibility is not currently included in Sri Lankan regulations. e.g. WEEE or end of life vehicles. In the update of regulatory frame such regulations are planned which are aimed to get co-financing from the industries making business.
- For pesticide stockpiles some co-financing might come from Crop-Life or other stakeholders from pesticide industry (related to Extended Producer Responsibility).

Further, some activities might not necessarily need a particular large budget where only information dissemination or amendments or regulations like restrictions are needed. Also, the phase in of alternatives does not necessarily need a large budget if phase in alternatives are available for direct substitution.

REFERENCES

Anon (2014) Emerging Contaminants-Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic acid (PFOA).

Anon (2012) Ninth meeting of the competent authorities for the implementation of regulation (ec) nr 850/2004 of the European parliament and of the council on persistent organic pollutants. Brussels, s.n., pp. 30-31

Central Bank Annual Report (2014) Economic and Social Statistics of Sri Lanka, P. 135

Clarke et al., (19, J.L., P.R.J. Herath and M.B. Wickramasinghe, (1974) Studies on DDT resistance in Anopheles culicifacies in Sri Lanka. WHO/MAL/74.826 and WHO/VBC 74.478, pp. 1–11.-Control of Pesticides Act No 33 of 1980

Country profile of Environmental Burden of disease: Sri Lanka. 2009 [cited 2010 3rd, April]; available :http://www.who.int/quantifying_ehimpacts/nation al/countryprofile/ srilanka.pdf.

Cranham and Danthanarayana (1971) Tea tortrix (Homona coffearia Nietner). Advisory Phamplet–Tea Research Institute of Ceylon, No. 5–66, 8 p.

Danthanarayana, W. and A. Kadirawetpillai (1969) The bionomics of tea looper (Bistonsuppressaria Guen.) Tea Quarterly 40: Para. 1, Sinhala, p. 120.

Damstra et al (2004) - T., Barlow, S., Bergman, A., Kavlock, and Van Der Kraak, G. (eds.), 2004. Global Assessment of the State of the Science of Endocrine Disruptors. International Program on Chemical Safety. Geneva, Switzerland: World Health Organization. http://www.who.int/ipcs/publications/new_issues/endocrine_disruptors/en/

Dantanarayana and Fernando (1970) - Biology and control of the live–wood termites of tea. Tea Quarterly 41(1): 34–52.

Ecobichon,- Toxic effects of pesticides: organochlorine insecticides. In: Klaassen, C.D., Amdur, M.O. and Doull, J., editors. Casarett and Doull's Toxicology: the basic science of poisons. New York: McGraw–Hill; p. 649–655.

Guruge, et al., (2005) Perfluorinated organic compounds in human blood serum and seminal plasma: a study of urban and rural tea worker populations in Sri Lanka. J. Environ. Monit. 7: 371–377.

Guruge, K., Taniyasu, S., Yamashita, N. & Manage, P., (2007) Occurrence of perfluorinated acids and fluorotelomers in waters from Sri Lanka. Baseline/ Marine Pollution Bullertin, 54, 1663-1672.

Hagen and Ekanayake, (1977)- Handbook for cut flower growers. Published by the West German Agricultural Team in collaboration with the Royal Botanic Garden, Peradeniya, p. 99.

Herath and Joshi, (1986) - Factors affecting selection for multiple resistances in Anopheles nigerremus in Sri Lanka.Trans. Royal Soc.Trp. Med. Hygi. 80: 649–652

Jaga and Dharmani (2003) - Global Surveillance of DDT and DDE levels in human tissues. Int J Occup Environ Health, 16: 7–20.

Karstensen et al., (2010) - Test burn with PCB–oil in a local cement kiln in Sri Lanka. Chemosphere 78: 717–723.

Li et al. (2014) The release of persistent organic pollutants from a closed system dicofol production process. Chemosphere 94: 164–168.

Nandasena, A.R. Wickremasinghe , N. Sathiakuma (2010) Air pollution and public health in developing countries: Is Sri Lanka different? 123S. (4932-17525-1-PB.pdf from jccpsl.sljol.info)

Roberts et al (2013) D.M., A. Karunarathna, N.A. Buckley, G. Manuweera, M.H. Rezvi Sheriff, and M. Eddleston, 2003. Influence of pesticide regulation on acute poisoning deaths in Sri Lanka. Bulletin of the World Health Organization 81: 789–798.

Qiu et al. (2005) Contribution of dicofol to the current DDT pollution in China. Environ. Sci. Technol. 39: 4385–4390

Ramasundaram et al. (1978)- , N., S. Nagarajah, W.G. Handasiri, and H.R.J.T. Peiris, 1978. A survey of organochlorine insecticide residues in Sri Lanka. Tropical Agriculturist 134 (2).

Robinson et al. (1985) - A.K., Sirbasku, D.A. and Stancel, D.M., 1985. DDT supports the growth of an estrogen-responsive tumor. Toxicol. Lett. 27: 109–13.

Seneviratne, et al, D,(1995) Shot hole borere (Xyleborus formicatus) and tea...a 100 years. Journal of the National Institute of Plantation Management 11 (1–2): 34–48.

Sri Lanka National Water Development Report (2006), UNESCO and Ministry of Agriculture, Irrigation and Mahaweli Development

Secretariat of Stockholm Convention (2015), Stockholm Convention PBDE BAT/BEP guidance

The National Energy Balance (2013), Sustainable Energy Authority Sri Lanka-2014

The National Environmental Policy (NEP), (2003) Ministry of Mahaweli Development & Environment

United Nations Environmental Programme (UNEP), (2007) Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices -relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants

United Nations Environmental Programme (UNEP), 2013) Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs. January 2013.

Wickramasinghe, M.B., (1981). Malaria and its control in Sri Lanka. Ceylon Medical Journal 26: 107–115.

World Health Organization (WHO), Indoor Air Pollution: National Burden of Disease Estimates. 2007, World Health Organization: Geneva. p. 1. 15. WHO.

Annex 1-National Steering Committee (NSC)

No	Name	Designation	Institute	Telephone	Fax	E mail
1	**Mr. Udaya R. Seneviratne**	Secretary	Ministry of Mahaweli Development & Environment, 82, Sampathpaya, Battaramulla	011-2877290	011-2877292	secretary@environmentmin.gov.lk
2	**Mr. Gamini Gamage**	Addl. Secretary (E&P)				gaminigamage@yahoo.co.uk
3	**Mr. Anura Jayatilake**	Director, ARM & IR		011-2888248	0114410236	lasith@slt.lk
5	**Mr. Ajith Silva**	Director, Policy & Planning		011-2887068	011-2887061	koralage2001@yahoo.com
6	**Mr. S. M. Werahara**	Assistant Director/ ARM & IR		011 2888248	0114410236	smwerahera@yahoo.com
7	**Ms. Lumbini Kiriella**	Legal Officer		011-2877284	011-2877284	lumbiniki@yahoo.com
8	**Ms. Vindya Hewawasam**	Research Assistant/ ARM & IR		011 2888248	011 4410236	vindyawh@yahoo.com eeconga@yahoo.com
9	**Mr. Asitha Senavirathne**	Addl. Secretary	Ministry of Industrial Development, P O Box: 570, 73/1, Galle Road, Colombo 03	0112447224	0112333341	asithakumar@gmail.com
10	**Mrs. Anuradhi Perera**	Assistant Director/ Planning	Ministry of Power & Energy, 72, Ananda Coomaraswamy Mw, Colombo 07	011-2574749 071 3248333	011 2574915	anuradhiperera@yahoo.com
	Ms. Prasadi Wejesinghe (Alternate)	Assistant Director (Development)		011-3030078 0718153532	0112574915	prasadi.mope@gmail.com prasadi_wijesinghe@yahoo.com
11	**Mr. M C Gamage**	Director	Ministry of Technology & Research, No: 408,Galle Rd, Col 03	0714201695	011 2669273	mcgamage@gmail.com mstsasad@sltnet.lk
12	**Dr. J D H Wijewardena**	Director (Organic Fertilizer)	Ministry of Agriculture, 80/5¸Govijana Mandiraya, Rajamalwatta Raod, Battaramulla	011-2885409 0773884846	011-2885409	sec.agri@yahoo.com
	Mr. S A S K Senadheera (Alternate)	AD (Agriculture Technology)		0777032409	0112878674	senadheerasask@gmail.com

13	**Dr. Inoka Suraweera**	Consultant Community Physician/ Environment & Occupational Health	Ministry of Health, Baddegama Wimalawansa Thero Mw, Col 11	0714-809450	011-2686113	isuraweera@yahoo.com sujeewaf@gmail.com
	Ms. Sujeewa Fernando (Alternate)	EMO		0714-439218		sujeewaf@gmail.com
14	**Mr. D.S.P. Senarathna**	Controller	Import & Export Control Dept, 75,1st Floor, Hemas Building, Colombo 1	011-2324386 011-2327113	011-2328486	
	Ms. Pathmini Kumarihami (Alternate)	Assistant Controller		011-2324386 011-2327113	011-2328486	pathmini@iuj.ac.jp
15	**Mr. R. D. A. M. G. Niyarepola**	Deputy Director	Sri Lanka Customs, Department of Customs, 5th Floor, Customs House, No: 40, Main Street, Colombo 11	071-4487479	011-2472179	randiwa@live.com
16	**Mr. Ranjith Meegaswatte**	Chairman	Marine Environmental Protection Authority, 758, 2nd floor, Baseline Rd, Colombo 09	011-2687520	0114615960	
	Ms. T.S.Ranasinhage (Alternate)	Assistant Manager		011-2687520 071- 8188866	0114615960	thalatha15@yahoo.com
17	**Mr. Ajith Weerasundara**	Director- WM Unit	Central Environment Authority, 104, Parisara Piyasa, Robert Gunawardena Mw, Battaramulla	0718175005	0112872605	weerasundara@cea.lk gaweera@hotmail.com
18	**Mr. T D A Gamage**	Assistant Director- WM Unit		0714395393		tissa@cea.lk
19	**Ms. Shanthini Thiruneelakandan**	Director- Competition Promotion	Consumer Affairs Authority, 1st& 2nd Floor, CWE Secretariat Building, 27, Vauxhall St. Co 02	0717555784	0112399148	caapromotion@sltnet.lk
20	**Dr. Lakdas Panagoda**	Chairman	Sri Lanka Ports Authority, 19, Chaithya Road, Colombo 01	011 2325559		chairman@slpa.lk
	Mr. M A U S Athukorala(Alternate)	Marine Pilot		0776078921		udeni125@slt.lk

21	**Mr. P.L.U. Rathnamalala (Act)**	Director General	Industrial Development Board of Ceylon, PO Box 09, 615 Galle Road, Katubedda, Moratuwa	011-2605368	011-2607002	
	Mr. Mohan Gunasinha	TSD		011- 2605278 071- 8053302	011-2607002 011-2623846	mohan@idb.gov.lk
	Mr. T. M. Kumara (Alternate)	Director/Technical Services Division		011-2605278	011-2605278	tmahindakumara@yahoo.com
22	**Mr. S H Midigaspe**	Chief Engineer (Business & Operational Strategy)	Ceylon Electricity Board, 6th floor, No. 50, Chittampalam A Gardiner Mawatha, Colombo 02	0112 333068 0714240483	011 2333067	ce2bos@ceb.lk
23	**Mr. Rohitha Gunawardena**	Head-Environment		0714150635	0112320012	rohitha.gun@gmail.com
24	**Mrs. Sherine Perera**	Director/ Environment Management	BOI, P.O. Box:1768, West Tower, WTC, Echelon Esquire, Col 01	011-2451273	011-2452089	sherinep@boi.lk
	Ms. A S Beling (Alternate)	Senior Deputy Director/ Environment		011-2320080	011-2452089	amarab@boi.lk
25	**Mr. W R K Fonseka**	Principle Research Engineer, Environment Technology	Industrial Technology Institute, Head Office, 363, Baudhaloka Mw, Colombo 07	0112379800 0714434763	0112379850	keerthi@iti.lk
	Dr. Irosh Fernando (Alternate)	Research Scientist		0112379800 076-8356210	0723677177	eustace619@yahoo.co.uk eustace@iti.lk
26	**Mr. Sena Peiris**	Consultant	No:1206, Zone 05, Millennium City, Athurugiriya	0773281903 011-2822272	0112-822274	sena.vijerupa@gmail.com
27	**Mr. Udayantha Wijesinghe**	Test Engineer/ Meter Lab	Lanka Electricity Company (Pvt) Ltd, 10, St. Anthony's Mawatha, 4th Lane, Kanuwana, Ja-Ela (E H Cooray Building, 411, Galle Road, Colombo 03)	071 5337640 011 2234846	011 2234846	general@leco.lk udayantha.wijesinghe@leco.lk
	Mr. H. A. C. H. Jayawardhana (Alternate)	Electrical Erg.		071-0167891	011-2371622	chatura.jayawardhana@leco.lk

28	**Mr. K M Parakrama B Kothwala**	Manager/ Quality Assurance	LTL Transformers Pvt Ltd, No. 67, Park Street,Colombo 02 (154/11, Railway Station Rd, Agulana , Moratuwa)	0117513195 0777558351	011 2607312	parakrama@ltl.lk pbkothwala@gmail.com
	Mrs. Isuri Apeksha Dickson (Alternate)	Quality Assurance Executive		0117513195	011 2607312	isuri@ltl.lk transformer@ltl.lk
29	**Mr. Chalaka Fernando**	Envt. & System Compliance Manager	Holcim Cement Co. (Pvt) Ltd, 413, R A De Mel Mawatha Colombo (Geocycle), Col 03	077-3541047		chalaka.fernando@holcim.com
	Mr. H D Sahan Chamruk	Technical Support Engineer		0774815986 011 2030200	011 7389240	sahan.chamruk@lafargeholcim.com
30	**Mr. Hemantha Withanage**	Executive Director	Center for Environmental Justice, 20A, Kuruppu Road, Colombo 8	011 2683282 0777600503		info@ejustice.lk
31	**Mr. K.A. Anuradha Prabhath Kumara**	Vice President	People to People Volunteers, No:9, Thalahena, Negombo	0717007771 0332291160		peoplepeopleto@yahoo.com
32	**Mr. Priyantha Ratnayake**	Director General	External Resources Department, 3rd Floor, Treasury, Secretariat Building, Colombo 01	011-2484693 0112434876	011-2447633 011-2387153	priyantha@erd.gov.lk dg@erd.gov.lk
	Ms. P D H Dabare (Alternate)	Assistant Director		011-2484703	011-2447633	dharshani@erd.gov.lk
33		Director General	National Planning Department, The Secretariat,1st Floor, Colombo 01	011-2484500 011-2484600	011-2445065	dgnp@npd.treasury.gov.lk
	Mr. M F A Mubarak	Director		011-2484875	011-2448063	
	Mr. K. B. S. S. Fernando(Alternate)	Assistant Director		076-6815790 011-2484968	011-2431620	sachiths@npd.treasury.gov.lk suradewa@gmail.com
34	**Dr. Anura Wijesekara**	Register of Pesticide	Department of Agriculture Office of Registrar of Pesticides P O Box: 49,Gattambe, Peradeniya	081-2388076 081-2388135 0714484143	081-2388135	awijesekara@yahoo.com

35	**Mr. S. A. M. Azmy**	Research Directorate/ National Project Coordinator ofNIP	National Aquatic Resources Research & Development Agency, Crow Island, Col 15	0777 368638		azmyahamed@yahoo.com
36	**Ms. Niroshi Peiris**	Programme Secretary	UNIDO Country Programme for Sri Lanka,UNIDO Focal Point Office C/O Ministry of Industrial Devpt, 73/1, Galle Road, Col 03	0777948979		n.pieris@unido.org
37		Director General	National Institute of Education, P.O. Box 21, High Level Road, Maharagama,	011-7601601	011-7601800	info@nie.lk

Experts

35	**Dr. J A Sumith**	Research Officer/ Pesticide Expert	Office of Registrar of Pesticides P O Box: 49,Gattambe, Peradeniya	081-2388076 081-2388135 077 2363824	081-2388135	sumith.ja@unb.ca mail2me.sumith@yahoo.com
36	**Mr. J K A B Wijegunasekera**	Senior Deputy Director, Chemical & Microbiological Laboratory/ PCBs expert	Industrial Technology Institute, Head Office, 363, Baudhaloka Mw, Colombo 07	0112379901, 0777-925325	0112379911	bandula@iti.lk
37	**Dr. Parakrama Karunarathne**	Senior Lecturer/ UPOPs Expert	Faculty of Engineering, University of Peradeniya	0776-126110		parakrama.karunaratne@gmail.com
38	**Prof. Piyasena Abeygunawardena**	Professor /Socio Economic Expert	Post Graduate Institute of Agriculture, University of Peradeniya	077 2502721		sgcpabey@gmail.com
39	**Dr. Shameen Jinadasa**	Senior Lecturer / PFOS Expert	Faculty of Engineering, University of Peradeniya	071-8003139		shamj@pdn.ac.lk shamnj@hotmail.com
40	**Prof. Ajith De Alwis PBDE Expert**	Head-Faculty of Chemical & Process Engineering	University of Moratuwa, Katubedda, Moratuwa	0777342476		ajith@uom.lk
41	**Dr. S.K. Weragoda**	Chief Engineer	National Water Supply and Drainage Board, Dambulla	0770-102852	0662285600	skwera7@gmail.com