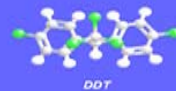




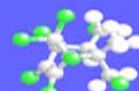
## THE KINGDOM OF THAILAND

# PLAN FOR THE IMPLEMENTATION OF ITS OBLIGATION UNDER THE STOCKHOLM CONVENTION ON THE PERSISTENT ORGANIC POLLUTANTS (POPs) IN THAILAND

May 2007



DDT



**GOVERNMENT OF THE KINGDOM OF THAILAND****CABINET DECISION**

Dated 15<sup>th</sup> May 2007

**NATIONAL ENVIRONMENT BOARD DECISION**

Dated 18<sup>th</sup> January 2007

**Approval of a Plan for the Implementation  
of its Obligation under the Stockholm Convention  
on Persistent Organic Pollutants**

Recognizing that persistent organic pollutants possess toxic properties, resist degradation, bioaccumulation and are transported, through air, water and migratory species and aware of the health concerns, resulting from local exposure to persistent organic pollutants the Government DECIDES:

1. To approve: a National Plan for Implementation of the Stockholm Convention on the Persistent Organic Pollutants (POPs) in Thailand.
2. The Ministry of Natural Resources and Environment (MNRE) has been assigned coordinating and control functions for carrying out the plan and for annual submission of the synthesized report to the Government.
3. The responsible Ministries, Departments and all involved Institutions will undertake the necessary measures for the achievement of the plan and will present annually, all actions and activities to the Government regarding the results of implementation of the plan.

## Acknowledgement

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- Pesticide Inventory Working Group (Task Team)
- PCBs Inventory Working Group (Task Team)
- Unintentional POPs Inventory Working Group (Task Team)
- Socio-Economic Analysis Working Group (Task Team)

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(Mr. Kasem Snidvongs)

Minister of Natural Resources and Environment

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## Executive summary

Thailand has recognized and is aware of the problem of chemical hazards, and considers the health and environmental concerns that they pose as a high priority for action. This is particularly the case with regard to persistent organic pollutants, which possess toxic properties including persistence, bio-accumulation, and potential for long-range environmental transport.

Import, export, manufacture and possession of hazardous substances are controlled under the Hazardous Substances Act. Most of POPs pesticides under the Stockholm Convention have been banned for importation since 1980s: endrin in 1981, toxaphene in 1983, DDT for agricultural use in 1983 and for malaria control in 1994, aldrin, dieldrin, and heptachlor in 1988, chlordane for public health use in 1995 and for agricultural use in 2000, mirex and hexachlorobenzene have never been imported or used in Thailand. 220 kilograms of products comprising stockpiles of chlordane, DDT and heptachlor were reported in the inventory of POPs pesticides and obsolete stockpiles carried out in 2005. However, there is evidence that POPs pesticide obsolete stockpiles might be found at the old pesticide storage facilities of the local Agriculture Extension Units.

Polychlorinated Biphenyls (PCBs) has never been imported for industrial use in Thailand. However, PCBs oil containing capacitors and transformers have been imported till 1975. Some of used capacitors and transformers were sent to France, United Kingdom and Belgium for a final disposal. The preliminary PCBs inventory carried out in 2005 indicated that there were 973\* PCBs containing capacitors and transformers at a total weight of almost 1,912 tons being kept in safe storage.

There is no production, import, export or use of unintentional POPs in Thailand. However, the generation of polychlorinated dibenzo paradioxin (PCDDs) and polychlorinated dibenzo furans (PCDFs) from sources as listed in the Annex C, Part II of the Stockholm Convention on POPs has been investigated. Inventory data for PCDDs/PCDFs emissions into the environment including air, water, land, product, and residues have been conducted following the UNEP Standard Toolkit. Emissions to residues from production of chemicals and consumer goods at amount of 384.16 g I-TEQ/a is the highest (49.68%) followed by uncontrolled combustion process of 236.10 g I-TEQ/a (30.53%), ferrous and non-ferrous metal production of 99.66 g I-TEQ/a (12.89%), waste incineration of 32.45 g I-TEQ/a (4.20%) and power generation and heating of 14.28 g I-TEQ/a (1.85%)

With the objective of protecting human health and the environment, Thailand has signed and ratified the Stockholm Convention on Persistent Organic Pollutants (POPs) since 22 May 2002 and 31 January 2005 respectively.

As Party of the Stockholm Convention on POPs, Thailand has developed a National Implementation Plan (NIP) to demonstrate how the obligations contained in Article 7 of the Convention will be implemented. The NIP provides policy and strategy frameworks as well as action plans and activities to meet objectives specific to Thailand. Based on the current situation and preliminary priority assessment on POPs in Thailand, the national objectives for the NIP are indicated as follows:

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\*

This number includes PCBs-transformers (60 units), PCBs-Capacitors (379 units), Transformers over 25 years old (382 units), and unidentified ages transformers (152 units) as illustrated in table 7 in this document.

- To establish a formalized approach to the protection of human health and the environment from the harmful impacts of persistent organic pollutants.
- To comply with the implementation of Thailand's obligations under the Stockholm Convention on POPs.
- To develop strategies and action plans to reduce or eliminate releases from production and stockpiles of POPs.
- To prioritize and identify possible options for the management of POPs to meet country priorities, and international obligations under the Convention.
- To identify needs for capacity-building assistance to meet obligations under the Convention.
- To identify data gaps and deficiencies that prevent the full assessment of inventory data.
- To develop and implement a Pollutant Release and Transfer Register (PRTR) to assist with public right-to-know, data collection and monitoring.
- To develop a regional laboratory for POPs analysis.
- To update and complete inventory data for PCDDs/PCDFs emissions from all source categories.
- To determine which technical and financial support from Thai government and international funding is necessary for implementation of the Convention in Thailand to the fullest extent possible.
- To develop a plan for improving the information base, and therefore improving the quality of POPs inventories.
- To develop a national plan for information exchange, public awareness, and education in the field of POPs management.
- To develop and implement a central database containing data and information on costs and benefits of POPs management options.

The government of Thailand has committed to address POPs issues by adopting and endorsing the NIP, as well as by taking steps to integrate it with relevant national environmental policies and strategies. The policy is to ensure that the NIPs be carried out within an efficient management framework, resulting in the safeguarding of human health and the environment. This POPs-specific policy framework will be integrated into the overall national environmental policy and management system, resulting in a consolidated strategy to meet both national and international obligation and priorities. In order to ensure that stockpiles consisting of or containing chemicals in Annex A or B and wastes as referred to the Article 6 of the Convention, Thailand has developed strategies to identify such stockpiles and wastes through the establishment of POPs inventories and undertaking POPs wastes management in an environmentally sound manner.

For the action plan: measures to reduce releases from unintentional production as referred to in Article 5 of the Convention, Thailand has determined the following activities:

- Update inventory data and projected releases for PCDDs/PCDFs emissions from all source categories.
- Update and revise existing legislation as well as establishing new legislation to include all potential source categories for PCDDs/PCDFs.
- Review this strategy in accordance with national policy every 5 years.
- Promote BAT for new sources as identified in Part II, Annex C after the 4-year period of entry into force, as determined in the Convention.
- Promote BEP for new and existing sources as identified in Part II and III of the Convention.

Considering Thailand-specific priorities and to facilitate the achievement of realistic and meaningful levels of release reductions of PCDDs/PCDFs through, in part, source elimination, prioritized activities are proposed as follows:

- Control open burning of household and agricultural residues.
- Install on all waste incinerators air pollution control systems such as bag house filters, fabric filters, cyclones, wet scrubbers, and NOx treatment.
- Promote the use of natural gas or liquefied petroleum gas as a fuel in households, for street vendors, hotels, restaurants, etc.
- Establish the-state-of-the-art crematoria centers.

Pursuant to requirements related to measures to reduce or eliminate releases from intentional production and use, as referred to Article 3 of the Stockholm Convention, Thailand has taken measures only related to stockpiles and wastes (Article 6). This is due to the fact that all POPs chemicals listed in Annexes A and B were banned during the years 1975-1995. Thailand, therefore, does not plan to transmit any requests to the Convention Secretariat related to the register of specific exemptions (Article 4).

With respect to the measures related to stockpiles and wastes of POPs pesticides including DDT, Thailand has determined the following activities:

- Update inventory data for POPs pesticides including DDT.
- Prepare for disposal POPs pesticides wastes, including the development of a wastes management plan.
- Monitor POPs pesticides including DDT in agricultural products, the environment and in living organisms.

With regard to the elimination of the use of PCBs in equipment, the Stockholm Convention as outlined in Annex A, part II has determined the goal to eliminate PCBs from use in equipment by 2025, and achieve their environmentally sound management as wastes (including in equipment) by 2028. Thailand determines the objectives to institutional strengthening for PCB management; capacity building/training for PCB management; develop a monitoring system for PCBs, including strengthening of data collection/exchange and data management

Related to this, key activities that were identified include:

- Update the inventory for PCBs (including oil containing capacitors and transformers) in order to identify, label and remove these materials from use.
- Develop procedures for the maintenance, removal, and disposal of PCBs and PCBs contaminated equipment.
- Eliminate from use PCB-containing equipment by the year 2512.

To implement all measures to reduce or eliminate releases from POPs chemicals, institutional and regulatory strengthening measures are projected as follows:

- Assess responsibilities of the concerned institutions and preparation of institutional and technical set up for assigned responsibilities.
- Establish of the office for Stockholm Convention on POPs at national or sub-regional or regional level.
- Establish a center for laboratory analysis of PCDDs/PCDFs at the national, sub-regional or regional level.

- Amend and update the existing legislation frameworks as well as establishing a new legislation for POPs chemicals management.
- Issue notifications to facilitate the temporary, secure storage of PCB-containing until their removal for final disposal.

To facilitate or undertake the exchange of information as referred in the Article 9 of the Convention, Government of Thailand has appointed the Pollution Control Department (PCD), The Ministry of Natural Resources and Environment (MNRE) as a National Focal Point for the Management of information exchange. For actions on awareness raising, training and education (as outlined in Article 10), Thailand has the determined the following activities:

- Provide adequate information dissemination related to registration, regulations, standards and procedures on POPs chemical management.
- Improve public awareness and education at all levels.
- Provide training courses on POPs management for all stakeholders.

With respect to the development of a strategy for research, development and monitoring as referred to in Article 11, Thailand has the determined the goal to strengthening national scientific and technical research capabilities and promote access, exchange and data analysis. Related to this, the following activities are proposed:

- Evaluate adverse effects on human health.
- Conduct research on health and develop an environmental impact monitoring program.
- Promote the use of best available technique and best environmental practices (BAT/BEP) for minimization or elimination of POPs chemical releases.
- Establish research programs in the area of socio-economic analysis related POPs issues.
- Provide routine monitoring of POPs contamination in products, foods, drinks, the environment, and living organisms.

To implement all mentioned action plans efficiently, all related stakeholders (government and non-government) have had responsibilities and functions assigned to them. Time frames and budget have also been estimated, although some challenges were faced when undertaking this work. Efforts to address POPs pesticides can occur over a relatively short time frame since all of them have already been banned. These efforts will mainly to address obsolete POPs pesticides and stockpiles. Implementation of the Convention in the area of PCBs elimination is very similar to efforts to address POPs pesticides. Most activities could be finalized. PCB oil and PCB-containing equipment could be eliminated in Thailand in advance of the deadline of the Convention (Year 2025) depending upon the availability of the necessary financial and technical assistance.

On the other hand, it is extremely difficult to anticipate the success of implementation of activities related to the unintentional POPs. Due to this uncertainty, estimates regarding time frames and costs are less precise than for the other action plans. Without strong technical and financial supports, it is very challenging, if not impossible, to implement most measures to reduce, at a minimum, the total releases derived from anthropogenic sources of each of chemicals listed in the Annex C of the Stockholm Convention. Therefore, the need to procure the necessary technical and financial supports is a top priority in order to implement the NIP and its action plans, and therefore meet Thailand's obligations as a Party to the Stockholm Convention on Persistent Organic Pollutants.

## Foreword

Most problems elaborated in relation to production, generation, import, export and use of POPs chemicals in Thailand are summarized mainly on health effects and impacts on non-target organisms, as well as problems of residues in food and environment. Although most of intentional POPs had already been prohibited from use in a country, all of the adverse effects have not yet faded away, especially the stockpile and waste management have to be carefully taken into consideration. The unintentional POPs like PCDD/PCDF have been reviewed and emphasized on their emissions to air and residue in all source categories.

Thailand has now become a party of the POPs treaty after the ratification has been made on January 31, 2005. As party, Thailand is intended to create sustainable capacity to fulfill its obligations under the Stockholm Convention, particularly the preparation of a National Implementation Plan (NIP) for POPs. This will enable the Government of Thailand to prepare the ground for implementation of the Convention and to strengthen its national capacity to manage POPs and chemicals in general.

Thailand NIP has been developed and endeavour to implement a plan as required under Article 7 of the Convention and specific action plans and strategies required under Article 3 (e.g., measures to reduce or eliminate releases from intentional production and use), Articles 5 and 6 (e.g., identification of possibilities to implement best available techniques (BAT) and best environmental practices (BEP) to reduce or eliminate releases of PCDD/PCDF, establish a timetable for the phasing out the use of PCB containing equipment and for the environmentally sound disposal of PCBs).

Thailand NIP developed with the aims of sustainable development the sense of socially, economically and environmentally appropriate policies and actions to maximize the overall benefits. It linked to related initiatives where possible to ensure maximum efficiency and the national objectives.



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## 1. Introduction

The demand for agricultural productivity and the expansion of industry caused a rapid increase in the use of chemicals. Most chemicals, organic and inorganic, are imported from industrialized countries. The importation has increased from 600,000 metric tones in 1978 to 3,220,000 metric tones in 1996 and to 4,600,000 metric tones in 2003. In 2003, pesticides were the chemicals imported and have increased from 5,000 metric tones of active ingredient in 1971 to 10,000, 15,000, 25,000, 30,651, and 50,586 metric tones in 1981, 1991, 1995, 2000, and 2003 respectively. In particular, during 1950-1970, most of the pesticides imported were organochlorines which included such POPs as DDT, toxaphene, endrin, heptachlor and so on. However, importation of almost all specified POPs chemicals have now been prohibited for all uses by final governmental regulatory action for human health and environmental reasons.

Polychlorinated biphenyls (PCBs) had been widely used as additives to oil in electrical equipment, hydraulic machinery inert and other applications where chemicals stability has been required for safety, operation, or durability. In 1970, it was found that PCBs not only pose adverse effects and highly persist in the environment but also result in a formation of cancer in both animals and humans as well as a precursor of a formation of most toxic dioxin congener (2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD)). As a result, measures to control its uses and releases were taken into account in many countries. The use of PCBs was then completely prohibited in the past few decades. However, due to its persistence, PCBs contaminant has been being found in the environment affecting ecosystem. Under the Hazardous Substance Act, PCBs has been legally controlled since 1975. Statistically, there has been no record of imported in or exported out of PCBs in Thailand. PCBs-containing equipment existing in Thailand has been imported by electrical generators and distributors. These are such as Electrical Generating Authority of Thailand (EGAT), Metropolitan Electrical Authority (MEA) and Provincial Electrical Authority (PEA). According to the survey, there are certain amounts of PCBs-containing equipment. Some are still in services while some are not and stored for final disposal.

There is no production, import, export or use of unintentionally generated POPs (UPOPs). However, polychlorinated dibenzo *p*-dioxins (PCDDs) and polychlorinated dibenzo furans (PCDFs) can be generated unintentionally from sources as listed in the Annex C, Part II of the Stockholm Convention such as waste incinerators, crematoria and thermal process in the metallurgical industry.

PCDDs/PCDFs, known as dioxins/furans, are UPOPs under the Stockholm Convention on Persistent Organic Pollutants. They have received widespread attention and attracted a great deal of research due to their lipophilicity, persistent in environment and bioaccumulation in living organisms and subsequently induce harmful health effect. The awareness of dangers from PCDDs/PCDFs contamination was addressed when the use of Agent Orange to clear forests was occurred resulting in contaminations of the most toxic dioxins, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD).

Dioxins contamination also occurred from an accidental release of TCDD from chemical plant explosion in 1976

PCDDs/PCDFs are an unwanted by-product of thermal or chemical process. They are formed during an incomplete combustion of organic carbon and chlorine containing products at

temperature above 200°C. Any chemical process that uses chlorine during the process is also contributed to the unintentional formation of PCDDs/PCDFs.

The United Nations Environment Programme (UNEP) has summarized the potential source categories of PCDDs/PCDF as follows:

- Source Category 1 : Waste Incineration
- Source Category 2 : Ferrous and Non-Ferrous Metal Production
- Source Category 3 : Power Generation and Heating
- Source Category 4 : Mineral Product
- Source Category 5 : Transportation
- Source Category 6 : Uncontrolled Combustion processes
- Source Category 7 : Production and Use of Chemicals and Consumer Goods
- Source Category 8 : Miscellaneous
- Source Category 9 : Disposal / Landfill

Therefore, the emphasis on PCDDs/PCDFs emission released to the environment including air, water, land, residue and products would be of much interest. The understanding of their life cycles from source, disposal, environmental fate and health monitoring from PCDDs/PCDFs exposure would be essential for the management of sources of PCDDs/PCDFs emission to reduce environmental contamination and alleviate harmful health effect from PCDDs/PCDFs.

## 2. Country baseline

### 2.1 Country profile

#### 2.1.1 Geography and population

Situated in the heart of the Southeast Asian mainland, Thailand covers an area of 514,000 square kilometers. It is bordered by Laos to the Northeast, Myanmar to the North and West, Cambodia to the East, and Malaysia to the South. Though the great majority of Thailand's 64 million people are ethnically Thai and Buddhist, the country has a substantial number of minority groups who have historically lived together in harmony. Of these, the Chinese are perhaps the most numerous (particularly in urban areas), though they have become so thoroughly assimilated it would be difficult to isolate them as a distinct group. Similarly, while there are Lao and Khmer groups in the Northeast and East, nearly all regard themselves as Thai, culturally as well as by nationality. More clearly defined as an ethnic group is the Muslims, who are mainly concentrated in the southern provinces, and assorted hill tribes who live in the far North; there are also sizeable communities of Hindus and Sikhs in large cities like Bangkok. Some 80 percent of all Thais are connected in some way with agriculture which, in varying degrees, influences and is influenced by the religious ceremonies and festivals that make Thailand such a distinctive country. (Figure 1)



**Figure 1 Map of Thailand**

Source: <http://phukhao.com/download/maps/Thailand-map.gif>

#### 2.1.2 Political and economic profile

Thailand is governed by a constitutional monarchy with His Majesty King Bhumibol Adulyadej as Head of State. Official power rests with the government, personified by the Prime Minister, the Parliament, and a bureaucratic system that reaches down to the village level. Over past decades the Prime Minister's personal power has steadily increased, largely because of the Thai tendency to express their concerns to the highest-ranking authority, in nation as well as family. This frequently results in provincial delegations appearing at the Government House requesting decisions on local problems. The Constitution is the highest law of the land, and provides for governing through a system of centralization. Legislative power is vested in the Parliament, and exercised through a bicameral National Assembly consisting of the publicly elected House of Representatives and the Senate. Executive power is exercised through a Cabinet headed by a Prime Minister. Essentially, the Royal Thai Government is composed of a Prime Minister and the Council of Ministers.

Thai economy has recovered from the Asian financial crisis in 1997. By 2002, the standard of living had returned to the level prevailing before the financial crisis. During 2001-2004 the economy grew at a moderate rate, but the rate of growth was slower than in the booming 1980s and the first half of the 1990s.

**Table 1: The 2004 Economic Indicators**

|                                     | Share %      | Growth Rate    |
|-------------------------------------|--------------|----------------|
| <b>Private Consumption</b>          | <b>54.5</b>  | <b>5.7</b>     |
| <b>Investment</b>                   | <b>22.5</b>  | <b>14.4</b>    |
| Private Investment                  | 16.5         | 15.3           |
| Public Investment                   | 6.0          | 11.7           |
| <b>Government Consumption</b>       | <b>8.4</b>   | <b>4.1</b>     |
| Export                              | 65.6         | 23.0           |
| Import                              | 52.9         | 27.0           |
| <b>Trade Balance</b>                | <b>14.6</b>  | <b>1.7</b>     |
| Consumer Price Inflation            | -            | 2.7            |
| <b>Gross Domestic Product (GDP)</b> | <b>100.0</b> | <b>6.1</b>     |
| GDP at Current Price (billion Baht) |              | 6,576.8        |
| Population (million)                |              | 64.86          |
| <b>GDP per Capita (Baht)</b>        |              | <b>101,400</b> |

**Source:** Bank of Thailand and National Economic and Social Development Board

Table 1 shows the economic indicators for 2004. The size of Thai economy measured in terms of Gross Domestic Product (GDP) reached 6,576.8 billion Baht in 2004 with the GDP per person of 101,400 Baht. In 2004 Thai economy expanded 6.1 percent. The largest component of GDP is private consumption accounting for 54.5 percent of GDP, registered a 5.7 percent growth. Consumer prices increased in 2004 by 2.7 percent, up from 1.8 percent the previous year, partly as a result of global demand for crude oil.

Trade is the lifeblood of the Thai economy, with exports and imports accounting for more than 65 percent and 52 percent of GDP respectively. The leading exports are high-technology products, especially integrated circuits, agricultural products, and tourism. The leading imports are crude oil, electrical and non-electrical machinery and parts, chemicals, iron and steel.

The population of Thailand approached 64.86 million in 2004, of which approximately 25 percent are under the age of 15. With a growth rate of 1.2 to 1.4 percent per year the population is projected to exceed 70 million by 2010. Between 2002 and 2004, the number of poor declined by about 2 million. In percentage terms, the poverty rate declined from 15.6 percent to 12 percent during this period, according to the World Bank Report.

### 2.1.3 Profiles of economic sectors

A long-term shift from agriculture to manufacturing and services continues, but about 49 percent of the workforce is still employed in agricultural sector, although this sector is responsible for less than 10 percent of GDP.

**Agricultural Sector:** In 2004 agricultural sector contributed 9.2 percent of GDP but employed 49 percent of the workforce. Thailand is the world's leading exporter of rice and a major exporter of shrimp. Other agricultural products include corn, rubber, soybeans, and sugar. Between 1992 and 2001, exports of logs and sawn timber increased from 50,000 cubic meters to 2 million cubic meters per year. The regional avian flu outbreak, which still had not been contained as of mid-2005, led to a contraction of Thailand's agricultural sector during 2004, and the tsunami disaster of December 26, 2004, devastated the west coast fishery industry.

**Manufacturing:** In 2004 manufacturing contributed to 38.7 percent of GDP but employed only 14 percent of the workforce. This relationship is the opposite of the one applying to agriculture. This sector expanded 8.4 percent in 2004.

Thailand is becoming a center of automobile manufacturing for the Association of Southeast Asian Nations (ASEAN) market. In 2004 automobile production reached 930,000 units, more than twice as much as in 2001. Two automakers active in Thailand are Toyota and Ford. The expansion of automotive industry has been a boon for domestic steel production. The local electronic and textile industries face competition from neighboring countries.

**Table 2: Thai Economic Growth Rate of GDP by Sectors**

| Sector                                  | Share %      | 2004        |
|-----------------------------------------|--------------|-------------|
| <b>Agriculture</b>                      | <b>9.2</b>   | <b>-3.9</b> |
| <b>Non-agricultural Sector:</b>         | <b>90.8</b>  | <b>7.2</b>  |
| Manufacturing                           | 38.7         | 8.4         |
| Electricity, Gas, and Water Supply      | 3.3          | 5.5         |
| Construction                            | 2.6          | 12.7        |
| Wholesale and Retail Trade              | 13.9         | 3.0         |
| Transportation, Storage, Communications | 10.1         | 7.7         |
| Hotels and Restaurants                  | 3.6          | 12.2        |
| Financial Intermediation                | 3.5          | 14.2        |
| Others                                  | 15.1         | 5.0         |
| <b>Gross Domestic Product (GDP)</b>     | <b>100.0</b> | <b>6.1</b>  |

Source: Bank of Thailand, Office of the National Economic and Social Development Board

**Energy:** In 2002, Thailand generated 118.9 billion kilowatt-hours of electricity. The total energy consumption in Thailand represented 0.7 percent of total world energy consumption. Thailand is a net importer of oil and natural gas, but government promoting the use of ethanol (gasohol) to reduce imports of petroleum. In 2003, daily oil consumption of 851,000 barrels per day exceeded domestic production of 259,000 barrels per day. Four oil refineries in Thailand have a combined capacity of 703,100 barrels per day.

**Construction and Real Estate:** Construction and real estate sector has recovered from a burst of housing market bubbles prickled by the Asian financial crisis in 1997. Since then, a lot of government incentive measures have been placed on the sector in order to absorb the housing gluts and resolve nonperforming loans from both home buyers and developers. In 2004, the construction and real estate sector contributed to 2.6 percent of GDP. The real estate market in 2004 continued to grow satisfactorily, albeit at a slower pace than in 2003, when housing and land transaction was recorded as accelerating, mainly due to the advantage taken before the termination of the property tax reduction measure at end-2003.

**Wholesale and Retail Trade:** Modern trading has been playing a significant role in Thai economy recently. It is clearly seen that the number of branches of big players has been significantly increasing throughout the country. It is also believed that modern trading is slowly replacing the traditional trading. Wholesale and retail trade accounted for 13.9 percent of GDP in 2004. Growth in the trading sector registered at 3.0 percent owing to the introduction of energy measures on the opening hours of department stores, slowdown of the economy as well as increase in goods prices.

**Telecommunication Sector:** With varieties of new supplementary services made possible by recent advancements in telecommunication technologies, telecommunication sector has been expanding currently, owing to the increase in demand from both business and household sectors.

**Financial Intermediation:** Dangerous levels of nonperforming loans at Thai banks helped trigger the attack on the Thai baht by currency speculators that led to the Asian financial crisis in 1997. By 2003 nonperforming loans had been cut in half to about 30 percent.

**Tourism and Hotel Industry:** Tourism and hotel industry is one of the backbone sectors of Thai Economy. In 2004, despite the spread of avian flu and the unrest in the three southernmost provinces, the tourism industry still expanded favorably. Tourism generated income in 2004 about 386.1 billion Baht, up by 18.9 percent from the previous year. The contributing factors included various promotion measures initiated by the government and the opening and addition of routes by low-cost airlines. The number of tourists from all countries grew significantly after the decline in 2003 as a result of the SARS outbreak. The number of foreign tourists in 2004 registered 11.7 millions, growing by 16 percent from the previous year. Hotel occupancy rate averaged at 64.0 percent in 2004. The country-of-origin pattern of foreign tourists in 2004 did not change significantly. At 56.5 percent, tourists from East Asia continues to account for the largest share of all foreign tourists to Thailand, followed by those from Europe and the US, which accounted for 24.3 and 7.0 percent, respectively.

## 2.1.4 Environmental overview

### 2.1.4.1 Water quality

The water quality in 48 main rivers and 4 standing surface water resources (Kwan Payao Lake, Bung Boraped Lake, Nonghan Lake, and Songkhla Lake<sup>\*</sup>), measured by mean of Water Quality Index (WQI), has been monitored and the following 8 water quality parameters were examined : Dissolved Oxygen (DO), Fecal Coliform Bacteria (FCB), pH, Biochemical Oxygen Demand (BOD), Nitrate (NO<sub>3</sub>), Total Phosphorus (TP), Total Solids (TS), and Suspended Solids (SS) to obtain water quality criteria as classified into good, fair, deteriorated, and highly deteriorated levels.

Overall quality of surface water resources throughout the country during 2004 were in the levels of good, fair, deteriorated, and highly deteriorated conditions at 23%, 51%, 21%, and 5% respectively. The comparison of water quality for the last 3 years revealed that the water quality in the fair level was likely to be increasing while deteriorated water quality was likely to be decreasing. Moreover, the highly deteriorated condition was slightly changing and still remained the same. Changing water quality in each year was up to many factors such as water quantity and municipal wastewater, etc. It should be noticeable that highly deteriorated water resources were

\*

Both Thale Noi and Thale Luang were included since their areas were contiguous.

the same as water resources found in previous years, e.g. the lower Thachin River from Muang District of Samut Prakarn Province to Nakhon Chaisri District of Nakhon Pathom Province, the lower Lamtakong River at Muang District of Nakhon Ratchasima Province, and the Songkhla Lake at Somrong Canal Estuary, Muang District of Songkhla Province.

Deteriorated water quality is a consequence of wastewater discharge from various sources such as communities, agricultural and industrial areas, discharged to natural water resources without any appropriate and standardized wastewater treatment. Deterioration of most water resources came from Fecal Coliform Bacteria contamination, and high Biochemical Oxygen Demand levels (BOD) causing low dissolved oxygen (DO) and high ammonia levels.

#### **2.1.4.2 Air quality**

Thailand state of air quality in 2004 still hung on the problem of particulate matter less than 10 micron (PM<sub>10</sub>), which was surplus to the standard condition, in several areas like the situation in the previous year. This problem was likely to be evidently increasing and found in existing areas such as Samut Prakarn Province, Bangkok (at roadsides), and Tambon Na Phra Lan, Chaloe Phra Kiat District, and Saraburi Province, etc. Also, more other areas were facing the particulate matter that was over the standard during the winter such as Chiang Mai Province, Lampang Province, Phra Nakhon Si Ayutthaya Province, Chonburi Province (Si Racha District), and Rayong Province (Pluak Daeng District).

Ozone gas situation was not different from last year; this problem occurred in some areas such as Bangkok, vicinity, and the Eastern region of Thailand. Concerning carbon monoxide, the amount exceeded the standard criteria in some periods of time at some roadsides of Bangkok. In part of other air pollutants such as sulphur dioxide, nitrogen dioxide, and lead, their concentration stayed in the standard criteria.

#### **2.1.4.3 Open Burning Control in Thailand**

On 10 June 2002, Thailand and other 9 ASEAN country members together signed, at Kuala Lumpur, Malaysia, the Agreement of Transboundary Haze Pollution, and six member countries ratified this Agreement at the end of 2003, which made this ASEAN Agreement come into force on 25 November 2003. The member countries ratifying this Agreement were Brunei, Malaysia, Myanmar, Singapore, Vietnam, and Thailand while the other 4 member countries (Indonesia, the Philippines, Laos, and Cambodia) were under the ratification process. Consequently, Thailand has prepared to control and handle open burning in the country along with setting up policies to resolve transboundary haze pollution pursuant to duties of country member, ratifying to the aforesaid Agreement. The Pollution Control Department as Thailand central coordinator pursuant to the ASEAN Agreement has cooperated with relevant authorities for the draft of National Master Plan on Open Burning Control in order to achieve a guideline to control open burning in Thailand, and the draft of an action plan in accordance with the National Master Plan on Open Burning Control (B.E. 2547 - 2551). Therefore, relevant authorities took policies on open burning control together with such National Master Plan to actual practice. The action plan comprised of 30 projects/activities with budgets amounting to 4,928.42 million Baht.

Year 2004 was the first year of operation according to such action plan; government agencies allocated some budgets have taken actions in open burning control arising from forestfire, burning in agricultural areas, and community solid waste management.

#### **2.1.4.4 Noise Pollution**

The Pollution Control Department has regularly monitored the noise level in the environment through air and noise quality-monitoring stations and temporary checkpoints established in Bangkok, vicinity, and other provinces. The monitoring results indicated that Thailand noise pollution between 1999 - 2004 in the areas of Bangkok and vicinity has not been changing in a great deal. As a result, the level of noise measured at roadsides has remained higher than standard noise limits. The 24-hour noise level average (Leq), measured in each year, ranged from 72 - 73 decibel (dBA) while the noise level in other general areas was still in the standard limit at 60 - 62 dBA.

For other provinces, the level of noise has not been changed as well; noise at both roadsides and general areas was still under the standard level with the 24-hour noise level averages (Leq), measured in each year were in the range of 63 - 65 dBA and 57 - 61 dBA respectively.

#### **2.1.4.5 Municipal Solid Waste**

In 2004, Thailand municipal solid waste has increased. The total amount of solid waste around the country was approximately 14.6 million tons or 39,956 tons a day (excluding the amount of solid waste not being dropped into the bins), increasing about 0.2 million tons from the previous year. Only in the Bangkok Metropolitan area, the amount of collected solid waste was 9,356 tons while the amount of solid waste generated in the municipal area and Muang Pattaya was 12,500 tons a day. The amount of waste generated in other non-municipal areas, covering all Tambon Administration Organization areas, was 18,100 tons a day. The rising amount of solid waste might come from the population growth, expansion of communities, economic stimulus by the governmental sector, tourism promotion and development.

#### **2.1.4.6 Hazardous Waste**

The Pollution Control Department had a projection that the total amount of hazardous waste generated in 2004 would like to 1,808 million tons, about 8,000 tons higher than year 2003. From this amount of hazardous waste, it could be classified into the industrial hazardous waste about 1,405 million tons or 5,000 tons higher, and municipal hazardous waste about 0.403 million tons or 3,000 tons higher, and this total amount included 0.02 millions tons of infectious waste. Most hazardous waste or 59% of all hazardous waste or approximately 1.06 million tons was generated in the Bangkok Metropolitan area and vicinity.

#### **2.1.4.7 Hazardous Chemicals**

The statistic data recorded by the Customs Department regarding the import of organic and inorganic hazardous chemicals in 2004 and the total production amount registered with the Department of Industrial Works and the Industrial Estate Authority of Thailand in Number 42 (1) (2) categorized by industries operating chemical products, chemical substances, or hazardous materials) revealed that about 4.81 million tons of hazardous chemicals have been imported while 24.68 million tons have been produced locally. The total amount of imported and locally produced hazardous chemicals was 29.49 million tons, increase of 9.63% if compared to the year 2003.

Hazardous chemicals affected to human health proportionally, 131 patients from petroleum 118 patients from toxic gases and vapors, 556 patients from heavy metals (in groups of manganese, mercury, arsenic, and cadmium), and 48 patients from lead. One dead person was caused by the

toxicity of petroleum. The North region had the highest number of patients; the second highest number of patients were Northeastern, Southern, Eastern, and Central regions respectively.

#### **2.1.4.8 Hazardous Chemical Accidents**

Hazardous chemical accidents are severe and have the huge impact to people lives and properties, including the environment. Although both government and private sectors have issued preventive measures and the preparation to tackle accidents, caused by hazardous chemicals, the statistic data, collected by the Pollution Control Department pursuant to the general people complaints to the Department and other governmental agencies, revealed that, in 2004, 24 hazardous chemical accidents occurred (excluding 4 cases of illegal waste or hazardous chemical dumping and 1 case of naturally rising gas), which could be categorized as 5 accidents from the transportation of hazardous chemicals, 13 accidents from industrial factories, and 6 accidents from hazardous chemical storage. Those accidents resulted to 140 injured persons and 27 dead persons with the damage costs at 200 million Baht (the overall amount, in some cases, the damage costs were not assessed).

### **2.2 Institutional, policy and regulatory framework**

#### **2.2.1 Environmental policy**

1. Encourage rural and urban communities to seek a better quality of life by coordinating efforts to formulate city plans and communities rules that suit the potential of concerned areas.
2. Protect, maintain and rehabilitate environmental quality to keep it at a standard suitable for human health and to apply appropriate technology for managing environmental quality.
3. Prevent and control risks to human health that affect the livelihood of the people and improve environmental quality and the quality of life.
4. Enhance the learning process to increase that community's capability to protect, maintain and rehabilitate the environment, community, ancient arts, natural beauty, archaeological significance, historical monuments, ancient national treasures, traditional beliefs, lifestyles and local knowledge as national heritage, for the benefit

#### **2.2.2 Roles and responsibilities of ministries, agencies and other governmental institutions involved in POPs life cycles (from source to disposal, environmental fate and health monitoring).**

Thailand has recognized the problem of chemical hazards as a high priority, particularly the importance of the chemical management under the Chapter 19, Agenda 21. Since the 1960s it has been tackling health and environmental problems systematically and enacted legislation at the national level. At present, there are many governmental agencies responsible for the field of chemical control and management.

Chemicals classified as initial Persistent Organic Pollutants comprise 9 pesticides, 1 industrial chemical and 2 unintentional production chemicals. POPs are generated from various sources including industries and related activities. In particular, sources of PCDDs/PCDFs are divided into 9 source categories including 1) waste incineration, 2) ferrous and non-ferrous metal production, 3) power generation and heating, 4) mineral product, 5) transportation, 6) uncontrolled combustion processes, 7) production and use of chemicals and consumer goods,

8) miscellaneous and 9) disposal/landfill. Therefore, there are many ministries that have roles and responsibilities in controlling sources of PCDDs/PCDFs emission as follows:

The **Ministry of Natural Resources and Environment (MNRE)** has developed policies, strategies and action plans in protecting the environment and other living systems. Recommendations have been made concerning environmental quality standards with regards to the control of pollution and also hazardous chemicals as protective measures under the Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992). The Pollution Control Department (PCD), part of MNRE is one of leading agencies responsible for chemicals management in general and POPs in particular. It hosts the Stockholm Convention Focal Point and also the Designated National Authority for the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Chemicals and Pesticides in Trade (PIC) as well as the focal point for the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Furthermore, MNRE also makes up of Department of Environmental Quality Promotion and Office of the Natural Resources and Environmental Policy and Planning.

**Ministry of Industry (M-IND)** is responsible for management and control of production, import, export and having in possession of chemicals in industries, particularly those generating hazard of toxic chemicals. M-IND is composed of Department of Industrial Works (DIW) and the Industrial Estate Authority of Thailand (IEAT) that are responsible for controlling hazardous waste management in industries. All industries are required to submit their waste manifestation and permission to transport waste from its generation to disposal facility such as wastewater treatment, sludge treatment, landfill and incineration.

The **Ministry of Agriculture and Cooperatives (MOA)** by the Department of Agriculture, Department of Fisheries, Department of Livestock Development, Department of Agriculture Extension, and Office of Agriculture Economics have managed and controlled production, import, export, and having in possession of chemicals in agriculture (pesticides) under the Hazardous Substance Act B.E. 2535 (1992). Since the major PCDDs/PCDFs emission to air is from agricultural residue burning; therefore, MOA has authority to enforce a reduction or prohibit on agricultural residue burning to reduce and/or eliminate the releases of PCDDs/PCDFs.

**Ministry of Public Health (MOPH)** has a role and responsibility to manage and control import, export, and having in possession of toxic substances used in consumer products or some other human health purposes. MOPH also has authority to control and manage medical waste incineration and assign on characteristic for infectious waste contained area. Moreover, under the Hazardous Substance Act B.E. 2535 (1992).

**Ministry of Finance (MOF)** has role and responsibility to control on customs duties and the collection of taxes on imported and exported goods on behalf of other government agencies, such as value added tax, excise tax and municipal tax. The Customs Department is responsible for prevention and control smuggling all goods and other illegal products including import, export and re-export of hazardous substances, chemical products and hazardous wastes. The Customs Department will also collaborate with other government agencies, i.e. MNRE, MOI, MOA, MOPH which are responsible for management and control of hazardous substances. In addition, MOF also works in collaboration with other government institutions including **Ministry of Commerce (MOC)** and **Ministry of Industry (M-IND)** for the imported chemicals or raw materials that have a potential PCDDs/PCDFs formation during the industrial process.

The Foreign Trade Department, **Ministry of Commerce**, is one of the national authorities who responsible for strictly control of goods containing POPs chemicals by using the Export and Import of Goods Act B.E.2522 (1979) such as metal scrap in ferrous and non-ferrous production, chlorine or chlorinated compounds used in industrial process and production of consumer goods, and catalyst of the industrial processes.

**Ministry of Energy (MOE)** has a role and responsibility to manage and control fuel used as energy in all sectors, i.e. unleaded gasoline with octane 91 and 95, gasohol, slow and fast diesel, heavy oil, liquefied petroleum gas (LPG) and natural gas. There are several departments under MOE such as Department of Energy Business (DOEB), Energy Policy and Planning Office (EPPO). EPPO also supports and promotes the conservation of energy and alteration of biomass fuel from agricultural products and residues. In addition, the Electricity Generating Authority of Thailand (EGAT) is the State Enterprises under MOE that is responsible for generating electricity supplied to governmental and non-governmental institute in the northern part of Thailand. However, there are Metropolitan Electricity Authority (MEA) and Provincial Electricity Authority (PEA) under **Office of Prime Minister** also responsible for generating electricity supplied to Bangkok Metropolitan and other provincial areas besides from EGAT.

**Ministry of Transportation (MOT)** has a role and responsibility to manage and control vehicles registration on the road, river, sea and ocean, mass transit and train. MOT is also responsible for license plate taxation. All license plates are required annually renewal to ascertain that all vehicles are in safe condition for transportation and the exhaust not exceed the emission standard.

**Ministry of Interior (MOI)** has a role and responsibility for management and control of local and provincial administration. Department of Local Administration (DLA) and Department of Provincial Administration (DPA) have authority for local and provincial administration with tidiness. The role and responsibility relevant to PCDDs/PCDDs emission is to manage and control municipal waste incineration and crematoria. In addition, Department of Disaster Prevention and Mitigation (DPM) under MOI is responsible for registration on forest fire and miscellaneous fire events on house, building, school, university, hotel, hospital, vehicle and factory to evaluate the lost or damage on properties.

**Local Administration (LA)** is an independent organization that has role and responsibility for local authority as assigned from government.

**Office of National Buddhism (ONAB)** is an independent organization that has a role and responsibility for management and control of all Buddhist temples in Thailand with regard to crematoria registration.

### 2.2.3 Relevant international agreements and their obligations.

Thailand has actively supported activities and international actions related to chemical management, including Basel Convention on the Control of transboundary Movements of Hazardous Wastes and their Disposal, Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, and Stockholm Convention on Persistent Organic Pollutants (POPs). Thus, the implementations of the Conventions in compliance with the obligations are of its concern.

Thailand has ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal on 22 November 1997. Basel Convention aims to minimize the generation of hazardous waste in terms of quantity and health hazard according to environmentally sound hazardous waste system, dispose of hazardous waste as close to the source of generation as possible and reduce the movement of hazardous waste to other countries.

The transboundary movements of designated hazardous wastes are controlled. Basel Convention previously determined 47 controlled wastes. The list was then reclassified as List A, which consisted of 59 and 61 types respectively as follows;

1. Metal and metal-bearing wastes e.g. arsenic, lead, mercury, asbestos, cadmium, lead-acid batteries, waste electrical and electronic assemblies (19 types of wastes)
2. Wastes containing inorganic constituents e.g. waste inorganic fluorine compounds (6 types of wastes)
3. Wastes containing organic constituents e.g. crude oil, bunker oil bitumas
4. Waste which may contain inorganic and/or organic e.g. wastes generated in hospitals wastes of an explosive nature (16 types of wastes)

In addition, wastes controlled under the Convention include other wastes subjected to hazardous characteristics in Annex III of the Convention and wastes that are banned by Parties. However, it is advisable to inform, through Secretariat, other Parties.

The Convention was later on amended to prohibit the transboundary movements of hazardous wastes in List A from OECD to Non-OECD. This amendment has entered into force since 1 January 1998.

Despite the above amendment, wastes under List B, non-hazardous wastes are exempt for recycle and reuse purposes such as iron and steel scrap, copper scrap, electrical and electronic assemblies, ceramic wastes, plastic wastes, paper and waste from textile industry.

Thailand has gone through the accession process to the Rotterdam Convention since 19 February 2002. The Convention entered into force on 24 February 2004. The objective of this Convention is to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm and to contribute to their environmentally sound use, by facilitating information exchange about their characteristics, by providing for a national decision-making process on their import and export and by disseminating these decisions to Parties. There are currently 39 chemicals subjected to the prior informed consent procedure, which can be divided into 3 groups. These are 24 pesticides, 4 pesticide formulations and 11 industrial chemicals.

With regard to the Stockholm Convention, Thailand has ratified the Convention since 31 January 2005. The Convention entered into force on 17 May 2005. The objective of this Convention is to protect human health and the environment from persistent organic pollutants. The 12 initial POPs are aldrin; chlordane; DDT; dieldrin; endrin; heptachlor; hexachlorobenzene; mirex; toxaphene; Polychlorinated Biphenyls: (PCBs); Polychlorinated dibenzo-p-dioxins: (PCDDs) and Polychlorinated dibenzofurans: (PCDFs). The main obligations are as follows;

1. Prohibit and/or take the legal administrative measures necessary to eliminate the production, use, import and export of the nine chemicals listed in Annex A.
2. The importation and exportation of POPs can be permitted only for a specific exemption.
3. Develop national implementation plan within 2 years of the date of entry into force of this Convention in its country

4. Promote the development and, where it deems appropriate, require the use of substitute and the use of best available techniques and best environmental practices (BAT/BEP).
5. Ensure that stockpiles consisting of or containing chemicals listed either in Annex A or B are managed in a manner protective of human health and the environment.
6. Raise awareness among its policy and decision makers with regard to POPs.
7. Provide information on POPs to public and facilitate the development and implementation especially for women, children and least educated of educational and public awareness programmes on POPs as well as on their health and environmental effects
8. Encourage and/or undertake appropriate research pertaining to POPs at national and international levels.
9. Designate national focal point for the exchange of information.

Thailand has also ratified the ASEAN Agreement on Transboundary Haze Pollution in 2002. In order to implement the agreement effectively, PCD, MNRE has established the National Master Plan of Open Burning Control in 2003 as strategic approach for relevant ministries and stakeholders to adopt the policy and control on open burning. The ASEAN Agreement on Transboundary Haze Pollution aims to 1) reduce forest fire and expects to reduce the affected area to less than 48,000 Hectare (300,000 Rai) per year, 2) reduce open burning on municipal waste, 3) make use of agricultural residue as biomass fuel for alternative fuel consumption at the contribution of 21% and 25% of total energy used in year 2006 and 2012, respectively as well as an available invention of commercial products.

According to Agenda 21, the emphasis on Citizens' Right-to-know, basis for public participation in integrated pollution prevention and control policy-making is raised to public awareness. Therefore, considerations for implementing an effective Pollution Release and Transfer Register (PRTR) should be initiated from data collection and management with basic design and implementation, data verification, and disseminate to the public.

In addition, Thailand is an active member of international organizations and has participated in various programs such as IFCS, IPCS, UNEP (IRPTC), WHO, FAO, UNIDO, and ILO as well as international agreements, such as Agenda 21, UNEP London Guidelines, FAO Code of Conduct, Montreal Protocol, Basel Convention, Rotterdam Convention, and GATT/WTO agreements.

#### **2.2.4 Description of existing legislation and regulations addressing POPs (manufactured chemicals and unintentionally produced POPs).**

Although there is presently no special legislation on POPs, Thailand has established a number of legal instruments and non-regulatory mechanisms to control the use of chemicals and reduce risks to human health and the environment originating from chemicals including POPs. Some of the most concerned laws are as follows:

##### **2.2.4.1 The Enhancement and Conservation of National Environment Quality Act B.E. 2535(1992):**

This Act provides a legal basis for the management and control of environmental quality and emission/effluent standards, monitoring, policy development and requirements for EIA as well as the pollution control.

With respect to the hazardous wastes and chemicals related to POPs and in case of no specific law thereto, the Minister shall, with the advice of the Pollution Control Committee, have the power to issue ministerial regulation specifying the types and categories of hazardous wastes generated from the production and usage of chemicals or hazardous substances in the production process of industry, agriculture, sanitation and other activities which shall be brought under control. For this purpose, rules, regulations, measures and methods must also be prescribed for the control of collection, storage, safety measures, transportation, import into the Kingdom, export out of the Kingdom, and for proper and technically sound management, treatment and disposal of such hazardous wastes.

Relevant legislations enacted to control the releases of PCDDs/PCDFs from source categories issued under the Enhancement and Conservation of National Environment Quality Act B.E. 2535(1992) are as follows;

- Notification of Ministry of Science, Technology and Environment : Emission Standard for Municipal Waste Incinerators, dated June 17 B.E. 2540 (1997) and published in the Royal Government Gazette, Vol.114, Part 63 D dated August 7, B.E.2540 (1997) prescribing PCDD/PCDFs not exceed 30 ng/m<sup>3</sup> total mass.

- Notification of Ministry of Science, Technology and Environment: Municipal Waste Incinerators is designated as Pollution Point Source which its emission must be controlled, dated June 17 B.E. 2540 (1997), and published in the Royal Government Gazette, Vol.114, Part 63 D, dated August 7, B.E.2540 (1997), and applicable to the incinerators with capacity of 1-50 ton/day and greater than 50 ton/day

- Notification of Ministry of Natural Resources and Environment: Emission Standard for Infectious Waste Incinerators, dated December 15, B.E. 2546 (2003) and published in the Royal Government Gazette, Vol.120, Special Part 147 D, dated December 25, B.E.2546 (2003) prescribing PCDD/PCDFs not exceed 0.5 ng I-TEQ/Nm<sup>3</sup>

- Notification of Ministry of Natural Resources and Environment : Crematory is designated as Pollution Point Source which its emission must be controlled dated October 16, B.E. 2546 (2003), published in the Royal Government Gazette, Vol. 120 Special Part 130 D, dated November 10, B.E. 2546 (2003).

- Notification of Ministry of Natural Resources and Environment: :infectious Waste Incinerator is designated as Pollution Point Source which its emission must be controlled, dated December 15 B.E.2546 (2003) published in the Royal Government Gazette, Vol. 114 Special Part 147 D, dated December 25, B.E. 2546 (2003), effective by December 25, B.E. 2552 (2009) for the existing facilities and by December 25, B.E. 2547 (2004) for the new facilities.

#### **2.2.4.2 The Factory Act B.E. 2535 (1992):**

This Act is to control factory operations regarding waste disposal, pollution emission and contamination with the main objective of minimizing the impacts on the environment. The Minister shall have the power to prescribe the ministerial rules fixing the factory of any type, kind or size to be the group 1 factory, group 2 factory or group 3 factory as the case may be by taking into consideration the necessity for the control, prevention of nuisance, prevention of damage and prevention of danger in accordance with the gravity of impacts on the public or environment by classifying as follows:

1. Group 1 factory are such factory of the type, kind and size as capable of engaging in a factory business immediately upon desire of a person engaging in a factory business.

2. Group 2 factory are such factory of the type, kind and size as, when engaging in a factory business, must be notified in advance to the Grantor.

3. Group 3 factory are such factory of the type, kind and size as to be granted a permit prior to the engagement.

Relevant legislations enacted to manage hazardous substances and hazardous wastes are as follows;

- Notification of the Ministry of Industry No.24 issued under the Factory Act B.E. 2512 (1969) entitled functions of person eligible for receiving a permission to operate a factory. This Notification determines guidelines with regard to collection, transport, and use of hazardous substances and preventive measures as well as personal protective equipment for workers.

- Notification of the Ministry of Industry B.E. 2548 (2005), entitled Disposal of Wastes or Unusable Materials. The notification prescribes codes and types of wastes or unusable materials, and functions of waste generator, disposer, collector and transporter

- Notification of the Ministry of Industry B.E. 2548 (2005), entitled Prescription of the Content Values of Contaminants in Air Emitted from the Factory in case of Use of Processed Used-oil and Synthetic Fuel as Fuel in Industrial Furnaces, dated May 20, B.E.2548 (2005). (Dioxins/Furans 0.5 ng I-TEQ/Nm<sup>3</sup>)

#### **2.2.4.3 The Customs Act B.E. 2469 (1926) and amendments B.E. 2534 (1991)**

It is the primary law governing the control of customs duties and the collection of taxes on imported and exported goods on behalf of other government agencies, such as value added tax, excise tax and municipal tax as well as the prevention and control smuggling of goods and other illegal products included the imported and exported chemical products and hazardous wastes.

#### **2.2.4.4 The Public Health Act B.E. 2535 (1992):**

This Act covers the prevention and management of all aspects of danger and nuisance caused by pollutants. The Act is characterized as most decentralization for the local administration. Minister of the Ministry of Public Health is in charge and control of execution of the Act and have power to appoint public health officials and local governmental authorities all over the country. The Minister also has power to issue the Ministerial Regulations as follows;

1. Prescribing rules, procedures and measures for controlling or overseeing activities or operations on matters under this Act.

2. Prescribing living standards suitable to the livelihood of the population and procedures for controlling or overseeing or remedying things affecting the living standard suitable to the livelihood of the population.

A legislation controlling releases of PCDDs/PCDFs issued under the Public Health Act 1992 is the Notification of the Ministry of Public Health determining the characteristic of storage areas of infectious waste containers

#### **2.2.4.5 Hazardous Substance Act B.E. 2535 (1992)**

This Act has come into force in 1992 and replaces the previous acts of 1967 and 1973. The reason for the proclamation of this Act is that at present a great number of hazardous substances have been used in various businesses and some of them have caused serious injury to the

persons, animals, plants, property and environments. Although, at present, some laws are applicable to control hazardous substances, many of them are under the umbrellas of several ministries, bureaus, departments as a result of different proclamations made in different periods of time entailing discrepancies and incomprehensiveness of their provisions. It is therefore expedient to revise the law on toxic substance by expanding the scope of application to cover all kinds of hazardous substance as well as to adopt the criteria and procedures for an even more suitable control of the hazardous substances and to establish the administrative system to promote coordination among various agencies involved in the supervision of the said hazardous substances. The hazardous substance is classified according to the needs for control as follows:

1. **Type 1** hazardous substance is that of which the production, import, export, or having in possession must comply with the specified criteria and procedures.
2. **Type 2** hazardous substance is that of which the production, import, export, or having in possession must first be notified to the authority and must also comply with specified criteria and procedures.
3. **Type 3** hazardous substance is that of which the production, import, export, or having in possession must obtain a permit.
4. **Type 4** hazardous substance is that of which the production, import, export or having in possession is prohibited.

The definitions of the terms managed in this Act are as follows:

- **“Produce”** means to make, culture, blend, mix, alter, modify, contain separately or contain collectively.
- **“Import”** means to bring or order into the Kingdom or to transit.
- **“Export”** means to send or undertake to send out of the Kingdom.
- **“Having in possession”** means having in possession whether for oneself or for others and regardless of whether having in possession for sale, for transport or for use or for other purposes and also includes leaving or existing in the area under possession.

Under this Act, certain related notifications have been enacted as follows;

- Regulation of Ministry of Industry B.E. 2538 (1995), prescribing permit procedure for production, import, export and having in possession of hazardous substances.
- Notification of Ministry of Industry entitled List of Hazardous Substance B.E. 2538 (1995) which classified more than 1,000 chemicals.

There are numerous chemicals considered as severely restricted or banned for agricultural and public health use, as well as in foods, cosmetics and household products. A summary for the POPs giving the date of the ban and some of its reasons is shown in Table 3.

**Table 3: Banned POPs chemicals in Thailand**

| Chemicals | Date of Ban            | Reasons                                                                               |
|-----------|------------------------|---------------------------------------------------------------------------------------|
| Aldrin    | 1988                   | Persistent, accumulate in living organisms                                            |
| Chlordane | 1995 (PH)<br>2000 (AG) | Possible carcinogen, persistent, high impact to environment, many alternatives        |
| DDT       | 1983 (AG)<br>1994 (PH) | Persistent and accumulation in food chains, possible carcinogen in tested animals     |
| Dieldrin  | 1988                   | Persistent, accumulate in living organisms, high acute poisoning, high risk for users |

| Chemicals         | Date of Ban | Reasons                                                                             |
|-------------------|-------------|-------------------------------------------------------------------------------------|
| Endrin            | 1981        | Persistent in agricultural products and in food chain, harm to non-target organisms |
| Heptachlor        | 1988        | Persistent, accumulate in living organisms                                          |
| Hexachlorobenzene | -           | Never imported                                                                      |
| Mirex             | 1995        | Never imported                                                                      |
| PCBs              | 2004        | Risk to human health and the environment                                            |
| Toxaphene         | 1983        | Possible carcinogen in tested animals, persistent                                   |

Source: Department of Agriculture

Remark: AG = agricultural use, PH = public health use

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

### 2.2.5.1 Existing policy and implementation guidelines

1. Establish an effective system for managing hazardous substances covering import, export, production, transport, trade, use, storage and waste destruction.
2. Establish system for prevention and mitigation of emergency and serious accident resulting from hazardous substances
3. Promote reduced utilization of pesticides
4. Improving and strengthening of environmental education on PCDDs/PCDFs' source, their formation and harmful health effect, and measures to reduce PCDDs/PCDFs emission
5. Promoting measures to reduce PCDDs/PCDFs emission and waste,
6. Promoting measures in compliance with the legislation
7. Promoting measures in compliance with the waste management law to minimize PCDDs/PCDFs emission and wastes as well as formulate the national policy concerning PCDDs/PCDFs emission and waste reduction, proper treatment and disposal,
8. Providing financial and technological support for the necessary financial investments to reduce PCDDs/PCDFs emission and waste

### 2.2.5.2 Law Enforcement Guidelines

1. Strict and efficient control of hazardous substances according to the law by assigning units other than government agencies and the private sector to monitor these substances
2. Accelerate the improvement and amend concerned laws and regulations for effective management of hazardous substances in all stages: import, export, production, trade, transport, utilization, storage and the destruction of wastes.
3. Formulate standards for hazardous substances contaminating the environment, agricultural products and consumable items, to cover a greater number of types of substances.
4. Instruct all industries that use and produce large quantities of extremely hazardous substances to prepare an environmental impact assessment report and risk assessment.
5. Control the storage of hazardous substances by designating areas for establishing warehouses for hazardous products. Stipulate standards for warehousing of hazardous products, along with systems and insurance system to prevent and mitigate emergencies when an accident occurs.

6. Consider strictly prohibiting imports and production or restricted uses of hazardous substances in agriculture, industry and public health that substantially affect health and the environment.

7. Control the transport of hazardous substances by stipulating standards for vehicles, methods of transport, suitable routes for channeling transportation, driving speed, qualifications and duties of drivers of transport vehicles and labels giving details of the hazardous substances.

8. The legislation should be updated to include emission standards for all source categories of PCDDs/PCDFs emission. All source categories are required by the legislation to meet the compliance of emission standards for PCDDs/PCDFs.

### 2.2.5.3 Monitoring Requirements

The use of POPs pesticides has been banned in Thailand for a long period of time. However, there are some stockpiles of obsolete and POPs pesticides scattered around the country. There are no specific measures for eliminating these stockpiles. Also, there is no active monitoring program for measuring POPs pesticide stockpiles.

There are several companies, institutions and government agencies, obtaining PCBs containing equipment while there is no clear approach for their management. However, some PCBs wastes in electrical equipment owned by the Electricity Generating Authority of Thailand, the Metropolitan Electricity Authority, and the Provincial Electricity Authority are currently being considered and prepared to eliminate by disposing to the industrial countries.

Inventory and assessment of releases of dioxins and furans has been carried out. There is no specific current measure for reducing a formation of dioxins and furans formed during the burning of agricultural residues, household trash or other wastes. Crematoria, in addition, are among the main emission sources of dioxins and furans that are highly unintentionally polluted. Thus, it is needed to educate people by publishing awareness raising campaigns via available media to raise public awareness of hazards and risks from unintentional production chemicals.

Monitoring of PCDDs/PCDFs in the environment and food products should be set up as routine monitoring schedule for potential sources of PCDDs/PCDFs emission. The state of pollution caused by PCDDs/PCDFs should be investigated so that prevention and mitigation of PCDDs/PCDFs formation can be achieved. In case of accidents, it is necessary to take emergency measures immediately when a large amount of PCDDs/PCDFs is released into the environment and food products. The data should then be evaluated for health risk assessment from PCDDs/PCDFs exposure.

In the perspective of socio-economic analysis, all possible measures for reducing and eliminating POPs need to be investigated and compared their effectiveness. The most cost-effective measure with routine monitoring program for POPs reduction and elimination is likely to be selected for consideration. Importantly, the analysis of enforcement costs of all relevant laws and legislations should not be ignored.

## 2.3 Assessment of the POPs issue in the country

### 2.3.1 POPs Pesticides

#### 2.3.1.1 Production, Import and Export of 9 POPs-pesticides

Information on the importation of the 9 POPs-pesticides was not systematically collected from the beginning. The term “toxic chemicals” was not recognized at that time. The only term known to people at that time was “poison” from plants, snakes, mushrooms and other living things. Thailand, by that time, was very conservative in this field and had never introduced any toxic chemicals into the country in those days. The first report on the application of chemicals was issued after the Second World War. That was in 1949 when [1,1 – (2,2,2-trichloroethylidene) – bis (4-chlorobenzene)] or DDT was first introduced for a malaria control trial in Chiangmai Province. The Malaria epidemic in 1951 was very serious and killed over 40,000 Thai people at a mortality rate of 200/100,000. DDT has been widely applied at rate of 2 gm-a.i./m<sup>2</sup> ever since. It proved capable of decreasing the mortality rate each year until it reached 1/100,000 in 1993. During those days, this toxic angel has not only been used for malaria control but also in agricultural for pest control. It was first applied to control the epidemic of corn grasshopper (Patanga) in 1953 and became widely known after 1955 when it was applied to control the cotton ball worm and tobacco insect pest.

Following DDT, the “drin family” was introduced in 1955 by a local company in Thailand importing dieldrin aldrin and endrin. Another local company, in turn, imported lindane (or BHC) and Toxaphene. Since 1959 all of these organochlorine pesticides have been widely applied for the pest control of almost all crops including cassava, fruit and vegetable crops. During 1960-1965, farmers applied a mixture of DDT + Endrin, DDT + dieldrin and DDT + Toxaphene and even DDT + Toxaphene + methyl parathion instead of DDT only for the control of cotton pests and other plant pests.

In 1971 when Toxaphene, DDT and BHC formed the largest volume of 62, 1, 968 and 17 metric tons respectively, the volume of dieldrin, aldrin, endrin, chlordane and heptachlor were less, as 8, 6, 0.8, 3 and 1 metric ton(s) respectively. The mixtures of DDT + Toxaphene and DDT + Toxaphene + methyl parathion were also reported. The importation of such POPs had increased years by years. There were fluctuations in volumes annually but in general the trend had been increased until they were banned in specified years due to impacts posed on human health and the environment. Only chlordane remained in use until the year 2000.

Thailand, a major food producing country, has earned the main income from exporting agricultural commodities. In 1998 agricultural products were exported with value of 14,642 million USD, accounted for 38.4% of the total exportation. When compared with the previous statistics of 1987, the value of exported agricultural products was 6,086 million USD, being 51% of the total export (Agricultural Statistics of Thailand Crop Year 1986/87, 1997/98). Thailand has been a major rice producing country from the history until now, but the country's agricultural sector has become more diversified during the last decade.

Horticultural crops such as vegetables, fruits and flowers gain a growing importance due to the increase of demands, especially from foreign markets, where favor of appearance and quality of products. For this purpose, significant amounts of pesticides and fertilizers have been applied for vegetables and fruits farming. Pesticides are needed in agricultural because roughly one-third of

the production of food and fiber was lost due to weed, insect pests and diseases. The reason for extensive use of pesticides in Thailand is due to the wide variation in climate and crops and also the great multitude of pests and diseases, etc. Use of POPs Pesticides in the past was illustrated below;

**Aldrin** was an insecticide applied to soil for termite control and other soil pests such as corn rootworm. Aldrin was used to control insects in grain storage and ectoparasites on cattle.

**Chlordane** was used extensively for termite and ant control in buildings, nurseries and forest plantations. Chlordane was a broad-spectrum insecticide used to control pests on a wide range of crops.

**Dieldrin** was a very effective pesticide applied against termite in buildings, crops, nurseries and forest plantations. The main used in the past also focused on locust control as well as grain storage and ectoparasites on cattle.

**DDT**, the most important POPs chemical, was used widely on control of malaria, typhus and other diseases spread by insects. It was also applied widely on crops and soil to protect insect pests, e.g. Lepidoptera. The assessment of DDT regarding its history, production, import and impact had been described earlier, with other organochlorines in the POPs list. The reports of DDT on environmental contamination and its residues in biological samples, wildlife, especially birds, had caused concern worldwide resulting in banning or restricting the use of DDT since 1980. Thailand, as other countries, has ceased the use of DDT in agriculture since 1983. DDT is only allowed to use in malarial control to continue for public health until officially banned in 2003. During 1994-2003, the use of DDT in Thailand for health purposes such as anti-malarial program and other vector control could be done only under the operation of Ministry of Public Health. Since then, several monitoring studies have been carried out by Ministry of Agriculture, Ministry of Public Health and Pollution Control Department. The results obtained from those studies could identify residues of DDT and metabolites in several commodities and environment, and revealed that their trends have been decreasing according to time.

**Endrin** was used on several crops such as rice, maize, cotton, sugarcane to control on Lepidoptera. It was also used to control rodents in house and storage.

**Heptachlor** was used to kill soil insects and termites. The usage was also extended to crop pests, grasshoppers and mosquitoes.

**Toxaphene** was used mainly on cotton, and sometimes mixed with DDT as Toxaphene – DDT and then used on cereal grains and fruit trees. It was also used to control ticks and mites in livestock.

### **2.3.1.2 Most recent data on Obsolete and POPs pesticides residues in fish, food products, and other agricultural products in Thailand**

The survey and monitoring of organochlorine residues in the environment was first initiated in 1976 and had continued for ten years till 1985. The work was emphasized mainly on water, sediment, soil, fish and shellfish collected from various sites in the central plain areas of the country. The analysis showed that organochlorine persisted in majority of the samples, roughly 50% in water, 90% in sediments and aquatic animals and 90% in soil samples. Since these surveys and monitoring were taken during the time that organochlorine was widely used, the maximum concentration of DDT could be detected as high as 4.0 ppb, whereas the levels in soil were found at ppm levels. Besides DDT, the other persistent organochlorine insecticides frequently found in environmental samples were  $\alpha$ BHC, endrin, aldrin, dieldrin, heptachlor and its metabolites. After the evidences that all these organochlorines had widely distributed in food chain and the environment, endrin was banned in 1981 followed by DDT, which was banned from agriculture used in 1983 and the rest were banned in 1988.

During 1987-1989, there was another nationwide monitoring program for residue levels of organochlorine insecticides in soil, water, sediment, fish and shellfish to observe levels of these chemicals after their uses had been decreasing. The results from extensive studies revealed that the persistent organochlorine such as  $\alpha$ BHC, aldrin, dieldrin, DDT and metabolites, heptachlor and heptachlor epoxide were found to have been distributed in all agricultural areas and end up in living organisms such as fish and shellfish, same situation as it was ten years ago, only the amounts of accumulation were not alarming and had tendency to decline.

### 2.3.2 PCBs

Thailand has never imported and exported PCBs in forms of liquid. The major existing PCBs sources are in forms of dielectric oil in transformers and capacitors, imported by State Enterprise Electricity producer and Distributors such as the Electricity Generating Authority of Thailand (EGAT), the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA). According to the survey, it was found that some of PCBs-containing capacitors and transformers are still being used while some were taken out of services. Among the out-of-service-equipment, some are being stored in storage sites, while some were sent out for final disposal abroad. (Figure 2)

PCBs importation has been strictly controlled by the Toxic Act Committee in Thailand since 1975 and no importation permit was granted. Not until October 2004 has the Hazardous Substance Committee approved to reclassify PCBs from Type 3, that of which the production, import, export, or having in possession must obtain a permit, to be type 4, that of which the production, import, export or having in possession is prohibited. Therefore, PCBs has been legally banned since then.

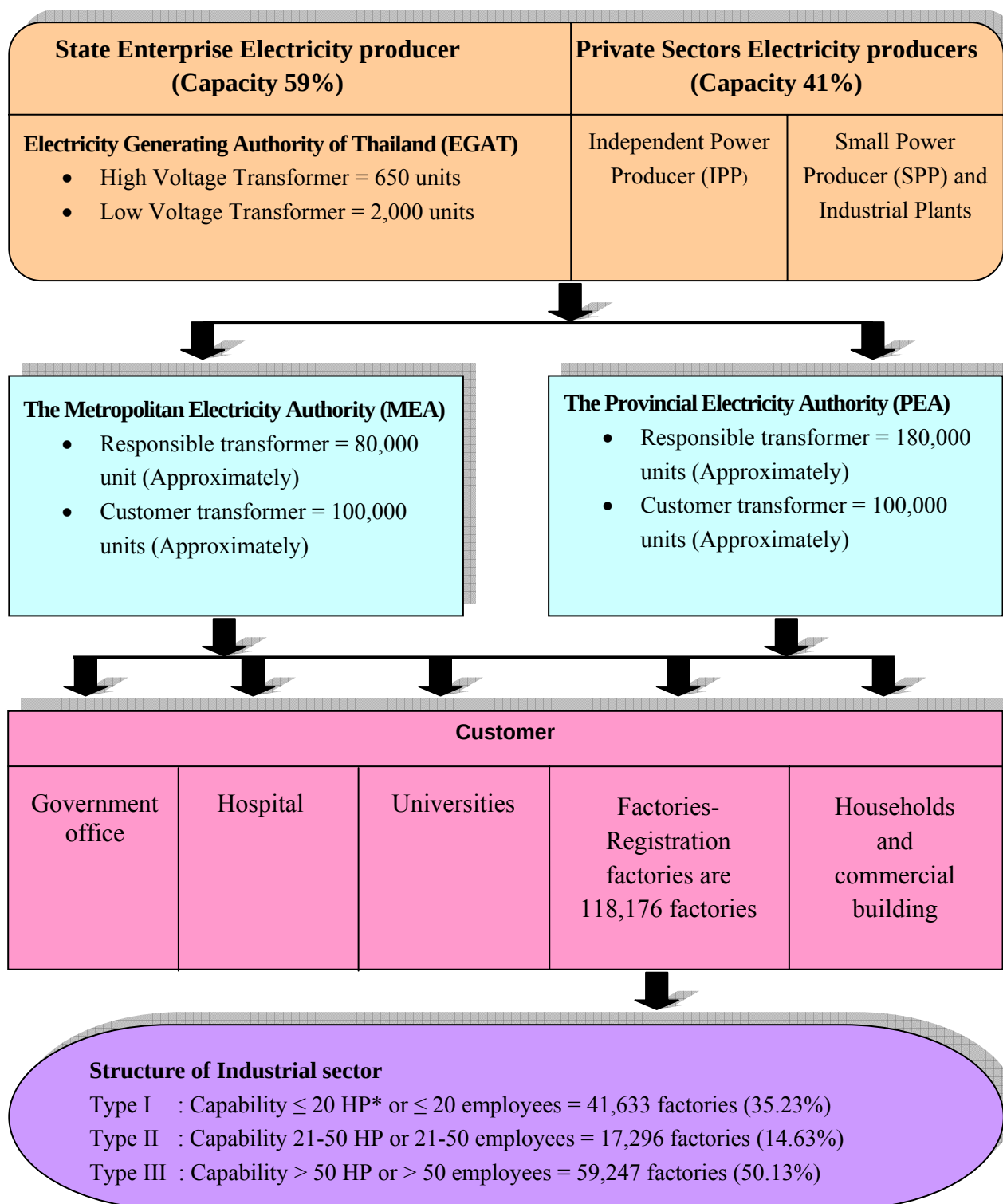


**Figure 2 Flow diagram of PCBs Responsible authorities and its distributions**

Source: Department of Industrial Works, Ministry of Energy, Electrical Generating Authority of Thailand, Metropolitan Electricity Authority, Provincial Electricity Authority, January 2005

\* HP stands for "Horse Power"

### 2.3.3 Unintentional POPs

The most recent PCDDs/PCDFs inventory has been carried out in 2005 and potential releases of PCDDs/PCDFs emission to air, water, land, product and residue were estimated from mass production (t/a) multiplying with default emission factor proposed by the UNEP's Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases, 2003. Annual releases of PCDDs/PCDFs emission to air, water, land, product and residue from source categories were summarized in Table 4 and percent releases per media in source categories inventory were summarized in Table 5.

**Table 4: Source Categories of PCDDs/PCDFs' Inventory Matrix.**

| Sector     | Source Categories                          | Annual Releases (g I-TEQ/a) |             |             |             |               |
|------------|--------------------------------------------|-----------------------------|-------------|-------------|-------------|---------------|
|            |                                            | Air                         | Water       | Land        | Product     | Residue       |
| 1          | Waste Incineration                         | 42.37                       | 0.000       | 0.000       | 0.000       | 32.45         |
| 2          | Ferrous and Non-Ferrous Metal Production   | 20.20                       | 0.000       | 0.000       | 0.000       | 99.64         |
| 3          | Power Generation and Heating               | 33.33                       | 0.000       | 0.000       | 0.000       | 14.28         |
| 4          | Production of Mineral Products             | 11.14                       | 0.000       | 0.000       | 0.000       | 0.17          |
| 5          | Transportation                             | 11.69                       | 0.000       | 0.000       | 0.000       | 0.00          |
| 6          | Uncontrolled Combustion Processes          | 144.24                      | 0.000       | 6.64        | 0.000       | 236.10        |
| 7          | Production of Chemicals and Consumer Goods | 1.52                        | 1.33        | 0.000       | 8.31        | 384.16        |
| 8          | Miscellaneous                              | 21.81                       | 0.000       | 0.000       | 0.000       | 6.48          |
| 9          | Disposal/Landfill                          |                             |             |             |             |               |
| 10         | Identification of Potential Hot-Spots      |                             |             |             |             |               |
| <b>1-9</b> | <b>Total</b>                               | <b>286.30</b>               | <b>1.33</b> | <b>6.64</b> | <b>8.31</b> | <b>773.30</b> |

Source: Pollution Control Department, 2005

**Table 5: Percent Releases per Media in Source Categories Inventory**

| Sector     | Source Categories                          | % Releases per Media |               |               |               |               |
|------------|--------------------------------------------|----------------------|---------------|---------------|---------------|---------------|
|            |                                            | Air                  | Water         | Land          | Product       | Residue       |
| 1          | Waste Incineration                         | 14.80                | 0.00          | 0.00          | 0.00          | 4.20          |
| 2          | Ferrous and Non-Ferrous Metal Production   | 7.06                 | 0.00          | 0.00          | 0.00          | 12.89         |
| 3          | Power Generation and Heating               | 11.64                | 0.00          | 0.00          | 0.00          | 1.85          |
| 4          | Production of Mineral Products             | 3.89                 | 0.00          | 0.00          | 0.00          | 0.02          |
| 5          | Transportation                             | 4.08                 | 0.00          | 0.00          | 0.00          | 0.00          |
| 6          | Uncontrolled Combustion Processes          | 50.38                | 0.00          | 100.00        | 0.00          | 30.53         |
| 7          | Production of Chemicals and Consumer Goods | 0.53                 | 100.00        | 0.00          | 100.00        | 49.68         |
| 8          | Miscellaneous                              | 7.62                 | 0.00          | 0.00          | 0.00          | 0.84          |
| 9          | Disposal/Landfilling                       | 0.00                 | 0.00          | 0.00          | 0.00          | 0.00          |
| 10         | Identification of Potential Hot-Spots      | -                    | -             | -             | -             | -             |
| <b>1-9</b> | <b>Total</b>                               | <b>100.00</b>        | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> |

Source: Pollution Control Department, 2005

The maximum emission to residue was found at the amount of 773.30 g I-TEQ/a, followed by emission to air at the amount of 286.30 g I-TEQ/a. The amount of emission to product, land and water were 8.31, 6.64 and 1.33 g I-TEQ/a, respectively. Emission to residue was found to be the highest for production of chemicals and consumer goods (384.16 g I-TEQ/a), followed by uncontrolled combustion process (236.10 g I-TEQ/a), ferrous and non-ferrous metal production (99.64 g I-TEQ/a), waste incineration (32.45 g I-TEQ/a). Emission to air was found to be the highest for uncontrolled combustion process (144.24 g I-TEQ/a), followed by waste incineration (42.37 g I-TEQ/a), power generation and heating (33.33 g I-TEQ/a), miscellaneous (21.81 g I-TEQ/a) and ferrous and non-ferrous metal production (20.20 g I-TEQ/a).

Best Available Techniques (BAT) and Best Environmental Practices (BEP) were not applied to any of source categories of PCDDs/PCDFs due to a limitation on financial and technical supports to these source categories. However, PCD has disseminated the most updated BAT/BEP Guidelines to relevant source categories of PCDDs/PCDFs releases such as municipal waste incineration; medical waste incineration; cement kiln; pulp and paper; iron sintering; secondary steel, lead, aluminium, copper, zinc production; and chemical process.

### **2.3.4 The state of contamination of POPs and remediation measures**

#### **2.3.4.1 Pesticides**

Preliminary work for inventory of obsolete stockpiles had been carried out in 2000-2001 by staff of Department of Agriculture and Department of Agriculture Extension under the support of FAO and Thai government. The work was done mainly by questionnaires and visiting surveys on the areas suspected of containing obsolete pesticides, especially organochlorines of the POPs lists. Only Chlordane could be identified with quantity of 905 kg. A small amount of DDT and dieldrin was reported as well amongst the total amount of 36 tons of obsolete pesticides.

In 2004, a pesticide task team was formed comprising the national expert consultant on POPs pesticides and PCD staff. The task team was responsible for field surveys and site visits. The task team investigated the sites based on the result of the first survey in 2001 by further investigating the government warehouses which have not been visited during the first inventory.

According to the 2001 inventory, only 36 tons of obsolete pesticides were found. Since the pesticide distributors in Thailand are in private hands, therefore they tend to avoid purchasing of large, uneconomic quantities of pesticides. This policy, consequently, prevents a build-up of excess pesticide stocks in distributors and retailers warehouses. On the other hand, the government warehouses, especially the sites belonging to Department of Agriculture and Department of Agriculture Extension involving in the use of pesticide in research and control of quality of pesticides in the markets under the government regulation, might have a large quantity of banned and unwanted pesticides in the research stations and field areas all over the country.

The Task team was trained during an extensive training sessions in December 2004. (Figure 3) After that, the task team drafted the plan and visited the major research stations and government warehouses in 2 provinces in the Central Region (Supanburi, Nakorn Pathom), 1 province in the Northern Region (Chiangmai), 2 provinces in the Northeastern Region (Mahasarakarm, Khon Kaen) and 1 province in the Southern Region (Krabi). All site visits had been conducted for 2 months, December 2004 and January 2005. Also, during the training course, the task team was practiced by visiting two warehouses in Bangkok and Prathumthani accompanied by the

International Consultant. Therefore, there were totally 11 sites visited in 9 provinces under this project. However, there may be obsolete pesticides including POPs stored in other areas, which must be further visited. (Figure 4)



**Figure 3 Pesticides Training Workshop 2004**



**Figure 4 Pesticide Inventory 2004**

The detail of all visiting was compiled and computerized into the format recommended by FAO. For overall summary, there were 11 site visits. The total obsolete pesticides products recorded in the 11 sites were 165 products, having total weight of 71, 212 kilograms of solid products and total volume of 63, 414 liters of liquid formulation, including 20 m<sup>3</sup> of empty packaging. The details are sorted into;

1. Detailed overview sorted on Site,
2. Detailed overview sorted on Manufacturer,
3. Detailed overview sorted on Active Ingredient.

According to survey data available countrywide, the POPs pesticides and other persistent organochlorines can be arranged in the following manner;

**Table 6: Total amounts and formulations of POPs pesticides and other persistent organochlorines.**

| POPs pesticides* & other OC | Amounts remained (kg or L) | Formulation  |
|-----------------------------|----------------------------|--------------|
| Chlordane*                  | 30 kg                      | 40% WP       |
| DDT*                        | 180 kg                     | 75% WG       |
| Heptachlor*                 | 10 kg                      | 2.96% dust   |
| Endosulfan                  | 20 L                       | 35% EC       |
| Endosulfan + BPMC           | 2,865 kg                   | 2.5 + 2.0% G |
| dicofol                     | 41 L                       | 18.5% EC     |

**Source:** Department of Agriculture

**Remark:** \* Chemicals classified as Persistent Organic Pollutants

In comparison of the inventory carried out in 2001 with the inventory carried out in 2004, the amount of obsolete stockpile was significantly declined. The 2001 inventory found 905 kilograms of chlordane while 2004 inventory found only 30 kilograms of chlordane. According to the report of other countries, stating that 15 - 20%, or even 30% of obsolete pesticides can be assumed POPs pesticides, this statement may not be applied to the situation in Thailand. It must be noted, however, that not the entire obsolete pesticides warehouses have been investigated. As

a result, the total amount of obsolete stockpile can not be absolutely reported. Nevertheless, the POPs obsolete stockpile being left in Thailand tends to be minimal.

The amount of 36 tons of obsolete pesticides found in 2001 inventory was used as basis for the 2004 inventory. The task team, in turn, investigated the government warehouses, where have not been visited in the 2001 inventory. The 2004 inventory found approximately 136 tons of obsolete and POPs pesticides. Among those, 220 kilograms were obsolete POPs pesticides, which were chlordane, DDT and heptachlor. We, therefore, are able to estimate from this basis that the total POPs in Thailand has a tendency of decline and are not expected to create any significant problem in the future. With regard to other organochlorines such as endosulfan, dicofol and organophosphates (such as monocrotophos and methamidophos), the problem is still existing due to the stocks from banning or confiscating which are kept in many places.

The storage conditions of POPs pesticides warehouses are generally acceptable by means of utilities, structure, segregation of chemicals, except the one in Bangkok, which stored lots of banned and confiscated pesticides without good separation and under poor condition.

#### **2.3.4.2 PCBs**

Between 2000 and 2001, Pollution Control Department carried out a small project of "Implementation of PCB inventory", supported jointly by UNEP Chemicals and the German Technical Cooperation (GTZ). It was found that approximately 102 out of 834 units were PCBs containing equipment; nearly all the others were classified as "unknown dielectric". This illustrated the difficulty in obtaining data on actual PCBs content of the transformers, due to lack of explicit information on the manufacturer's transformer labelling.

The National Implementation Plan (NIP) was developed through a consultation process that involved regulatory agencies and other stakeholders, including associations, and others. A series of workshops were carried out. The first "PCB Inventory Workshop" was held on November 11<sup>th</sup> and 12<sup>th</sup> 2004, at PCD. The workshop was attended by stakeholders from government and non-government organizations, in particular from the electrical generating agency, EGAT, and from two electrical distributors, MEA and PEA, to discuss the development of the Preliminary PCBs Inventory. (Figure 5)

In 2004, a PCBs task team was formed comprising the national expert consultant on POPs PCBs and PCD staff. The task team was responsible for field surveys and site visits. The task team conducted the PCBs preliminary inventory by launching questionnaires and visiting several sites (e.g. factories, hospitals, universities). (Figure 6) Results from the survey showed that there were a total of 633 transformers consisting of 60 units of PCBs transformers, 382 units of Transformers of over 25 years of age, 152 units of unknown age transformers and 39 units of unknown dielectric oil transformers. In addition, 379 PCBs capacitors were found. The 573 out of 633 transformers could not be identified and need further investigation. 379 PCBs-containing capacitors were both in and out of services. This research assumed that there were 973 PCBs-containing transformers and capacitors--except for unknown dielectric oil--with a total weight of 1,912 tons required a final disposal. (Table 7).



Figure 5 PCBs Training Workshop 2004



Figure 6 PCBs Inventory 2004

Table 7: PCB Inventory in 2004

| Type of equipment                      | number       | Oil volume (litre) | Oil weight (ton)  | Total weight (ton)  |
|----------------------------------------|--------------|--------------------|-------------------|---------------------|
| PCBs Transformers                      | 60           | 11,945.94          | 18,217.56         | 117,486.00          |
| PCBs capacitor                         | 379          | -                  | -                 | 20,480.00           |
| Transformers of over 25 years          | 382          | 516,955.00         | 439,411.75        | 1,661,517.00        |
| Transformers of unknown ages           | 152          | 45,845.00          | 38,968.25         | 192,473.00          |
| Transformers of unknown dielectric oil | 39           | 24,505.00          | 517,426.81        | 92,606.00           |
| <b>Total</b>                           | <b>1,012</b> | <b>599,250.94</b>  | <b>517,426.81</b> | <b>2,084,562.00</b> |

Source: Thailand PCBs' Preliminary Inventory Final Report (2004), Pollution Control Department

Thailand currently has not had an appropriate facility to dispose of PCBs waste. Most of PCBs were found in forms of PCBs-containing transformers. They were exported to developed countries, where disposal facilities are available. According to the Department of Industrial Works, data collected under the Basel Convention showed that approximately 761 tons of PCBs wastes were exported for disposal during 1992-2002. The countries, where PCBs wastes were exported, were, such as, France, United Kingdom, Belgium. (Table 8)

Table 8: Disposal of PCBs wastes from 1992 – 2002

| Destination countries | Volume (ton)  |
|-----------------------|---------------|
| France                | 20.00         |
| England               | 452.00        |
| Belgium               | 32.66         |
| Others                | 256.22        |
| <b>Total</b>          | <b>760.88</b> |

Source: Department of Industrial Works, 2002

#### 2.3.4.3 Unintentional POPs

Since PCDDs/PCDFs are unintentional production chemicals creating during the thermal and chemical processes; therefore, stockpile of PCDDs/PCDFs is not found. However, in the past there were certain evidences relating to the contamination of PCDDs/PCDFs in the environment.

### 2.3.5 Future production, use and releases of POPs requirements for exemptions

There is no POPs' requirement for exemptions in Thailand. 9 POPs-Pesticides, including PCBs were legally banned under the Hazardous Substance Act 1992 (B.E. 2535).

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

#### 2.3.6.1 Pesticides

All of POPs pesticides had already been banned in Thailand. Therefore, there is no existing programmes for monitoring releases carried out by Department of Agriculture who is in charge of the controlling of pesticide use in agriculture. However, the Ministry of Public Health and the Pollution control Department who are the concerned agencies for health and environmental issues still look after the impacts of POPs pesticides and occasionally have projects to find out whether or not the impacts of those pesticides still exist, however the findings are not adequate to confirm the existing impacts of POPs.

#### 2.3.6.2 PCBs

Between 1990 and 1992, the distribution of PCBs from storage site in Bangkok was studied. A survey was done in soil on concrete floor and ground floor, canal, runoff, sediment and air born around the storage sites. The result showed that PCBs were detected in all layers of soil from surface soil up to 20 cm. It was estimated that 25% of PCBs emanated from the capacitor oil and 75% of PCBs from soil. There were evidences that transport of PCBs from storage sites to the environment was possible. Similarity Index (SI) value was calculated and used to identify the possible source of PCBs. It concluded that PCBs migration from concrete floor to the ambient soil during rainy season through runoff and soil erosion to canal and deposit into sediment. The transport of PCBs might be from canal to estuary as well as sea. It was assumed that PCBs storage site can be a possible source of PCBs in sediment core. The highest PCBs concentration was ranged around 38-40 cm, of which the concentration was ranged around 1,500-2,200 pg (total-PCBs).g<sup>-1</sup>(dry weight). The trend of PCBs concentrations in sediment core from 29 cm to surface layer was decreasing and almost constant varying around 200-1000 pg (total-PCBs).g<sup>-1</sup>(dry weight). The estimation of depositional activity was 0.8 ppm/cm<sup>2</sup> per year as maximum deposition rate, consistent with PCBs concentration in sediment core. After PCBs has been strictly controlled in Thailand in 1975, it was found that PCBs concentration in sediment has been chronologically decreasing.

PCBs can cause adverse effects to human health. The type and severity of the effects depends on many factors, including the concentration of chemical mixtures, dose, frequency of exposure and duration of exposure. The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage.

The International Agency for Research on Cancer (IARC) and U.S.EPA have determined that PCBs are probably carcinogenic to humans. The weight of babies delivered from pregnant women who were exposed to relatively high levels of PCBs will slightly less than babies from women who did not have these exposures. To avoid or eliminate the risk of PCBs exposure, mothers or pregnant women should avoid contacting with old electrical equipment such as

transformers since they may contain PCBs and also should not gain access to hazardous waste sites or the areas where there was a transformer fire.

### **2.3.6.3 Unintentional POPs**

Thailand has not had laboratory for PCDDs/PCDFs analysis due to limitations of financial and technical supports. However, the government realized the important of capacity building on PCDDs/PCDFs analysis and has approved, in principle, a feasibility study for establishment of PCDDs/PCDFs laboratory expecting to complete in 2010. Currently, the cost of PCDDs/PCDFs analysis per sample is very expensive depending on types of samples. For instance, air sample analysis costs approximately US\$2,000, while the cost is slightly cheaper in other media; e.g. food, water, soil and products. Therefore, the routine monitoring for PCDDs/PCDFs is not scheduled by any source category even though there are a few industries sending their samples to foreign laboratory for PCDDs/PCDFs analysis. These are such as cement, PVC, pulp and paper, aluminium production. Furthermore, Pollution Control Department with a technical and financial cooperation from German Government through German Technical Cooperation (GTZ) conducted Thailand Dioxin sampling and analysis programme in 2001, analysing dioxins/furans in certain source categories such as municipal incineration, medical waste incineration, crematoria, secondary ferrous and non-ferrous production, and cement production.

### **2.3.7 Current information, awareness and education among target groups, communication of information, mechanism for information exchange**

Adequate and accurate information on pesticides has not been sufficiently gained access through consumers and public in general. The updated information has been circulated only among the academic community. With this, public and consumers are not being properly or adequately advised.

Pollution Control Department, Ministry of Natural Resources and Environment, serves as national focal point for the Stockholm Convention on Persistent Organic Pollutants. To comply with the obligations of the Stockholm Convention, public awareness is campaigned via brochure, internet, television and radio to alert community on the health effect of POPs.

Furthermore, Thailand has also nominated representatives to join in related international meetings and conferences at all levels such as the Conference of the Parties of the Stockholm Convention, Persistent Organic Pollutants Review Committee (POPRC), and Expert Group on [Best Available Techniques and Best Environmental Practices \(EGBAT/BEP\) and so on.](#)

### **2.3.8 Relevant activities of non-governmental stakeholders**

The participation with regard to educating the public and raising awareness on POPs issues from independent agencies and academic organizations as well as non-governmental stakeholders are relatively low.

NGOs such as private sector and education institute are often invited to join in seminars, meetings and workshops to exchange views and experiences on POPs issues.

### **2.3.9 Overview of technical infrastructure for POPs assessment, measurement, analysis, alternatives and prevention measures, management, research and development-linkage to international programmes and projects**

Thailand has actively supported activities and international actions related to chemical's management, including the Stockholm Convention on Persistent Organic Pollutants (POPs). Having recognized the impact of POPs chemicals to human health and the environment, Thailand, through several government agencies, has carried out monitoring programmes on chemical residues in soil, water and agriculture products including POPs pesticides and PCBs. Moreover, Thailand is an active member of international organizations and has several joint activities with various international organizations such as IFCS, IPCS, UNEP, WHO, FAO, UNIDO, and ILO as well as international agreements, such as Agenda 21, UNEP London Guidelines, FAO Code of Conduct, Montreal Protocol, Basel Convention, and WTO agreements.

Thailand has recognized the problem of chemical hazards as a high priority, particularly the importance of the chemical management under the chapter 19, Agenda 21. Since the 1960s it has been tackling health and environmental problems systematically and enacted legislation at the national level aiming at solving the impact caused by chemicals.

The assessment of POPs management has been done through existing legislations, which are the Hazardous Substance Act B.E. 2535 (1992) and its affiliated regulations as well as notifications, prescribing registration, permit or license issuance, monitoring, inspection and quality control, and research and development. Under the afore-mentioned Act, the Department of Agriculture, Ministry of Agriculture and Cooperatives is in charge of POPs pesticides, while the Department of Industrial Works, Ministry of Industry is in charge of PCBs.

With regard to PCDDs/PCDFs releases, relevant stakeholders should critically review and clearly identify their own functions and responsibilities in order to appropriately determine measures to reduce or eliminate releases of PCDDs/PCDFs. Currently research and development linkage to international programmes and projects are not available. However, it is proposed as one of the priorities that needs to be studied for environmental and health safety.

### **2.3.10 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**

Pesticides may be extremely harmful to human beings and animals through the contamination of food crops, meat and dairy products. The levels of contamination may vary from one situation to another. Once the food is consumed by people or animals, the pesticides and/or their residues are transmitted through the food chain. This is indicated in a series of summary reports on disease warning and monitoring compiled by Ministries of Agriculture and Cooperatives and Ministry of Public Health during 1980-1995, the period in which POPs pesticides were still in use and subsequently were banned from use. The data was compiled by Ministry of Public Health at that time based on the categorized occupation groupings. The result indicated that the most affected occupation group is the farmers, whereas the conclusion on environmental effects could not be made.

According to PCDDs/PCDFs inventory in 2005, identification of impacted populations or environment can be roughly estimated for population at risk from PCDDs/PCDFs exposure from each source category. As shown in Table 4, the scale and magnitude of threats to public health

and environment arisen from PCDDs/PCDFs releases to residue from production of chemicals and consumer goods (384.16 g I-TEQ/a), uncontrolled combustion process (236.10 g I-TEQ/a), ferrous and non-ferrous metal production (99.64 g I-TEQ/a), waste incineration (32.45 g I-TEQ/a) and power generating and heating (14.28 g I-TEQ/a), and releases to air from uncontrolled combustion process (144.24 g I-TEQ/a), waste incineration (42.37g I-TEQ/a), power generating and heating (33.33 g I-TEQ/a), miscellaneous (21.81 g I-TEQ/a) and ferrous and non-ferrous metal production (20.20 g I-TEQ/a). (Figure 7 and 8)



**Figure 7 PCDDs/Fs Training Workshop 2005**



**Figure 8 PCDDs/Fs Inventory 2005**

According to U.S.EPA, monitoring of food consumption contaminated by PCDDs/PCDFs from above mentioned source categories is essential for evaluation of health risk assessment from PCDDs/PCDFs exposure since 90-95% of human exposure occurs through the diet, primarily foods derived from animals and products.

### **2.3.11 Relevant system for the assessment and listing of new chemicals**

The assessment and listing of new chemicals can be done through the Hazardous Substance Act 1992 and its related regulations. For the purpose of prevention and cessation of hazard that may be inflicted upon the persons, animals, plants, property, or environment, the Minister of Industry in consultation with Hazardous Substance Committee shall have the power to publish in the Government Gazette designating the names or qualification and responsible agencies for the control of prescribed hazardous substances.

### **2.3.12 Relevant system for the assessment and regulation of chemicals already in the market.**

The assessment and regulation of chemicals already in the market can be done through the Hazardous Substance Act 1992 and its related regulations.

### **3. Strategy and action plan element of the national implementation plan**

#### **3.1 Policy statement**

The policy is to ensure that the National Implementation Plan (NIP) be carried out with efficient management resulting in safeguarding of humans, and the environment. This policy will be integrated with the national environmental policy and administration management system into a consolidated strategy to meet the standards of both national and international.

The policy is set up and addressed into 3 main themes as follows;

- reduction/elimination of production, use and releases of POPs
- development of database and inventory data in relation to POPs
- protection of human health and environment from the harmful impact of POPs

The above-mentioned policy aims at achieving an efficient, effective and sustainable management; strengthening institutional capacity building; having well-organized registration and database; formulating practicable legislation and raising public awareness on unintentional production of POPs.

#### **3.2 Implementation strategy**

Thailand has outlined a framework mechanism to coordinate NIP activities including review, reporting, evaluating and updating of the NIP to be implemented effectively and efficiently by authorized Ministries. Strategic plan is initiated by the Thai Government to relevant Ministries and subsequently implemented through different action plans and activities to achieve objective and goal of the policy. The implementation strategy is consistent with the policy as follows;

- institutional capacity building and its infrastructure,
- database and POPs inventory
- human resource development,
- technical and financial support for BAT/BEP and alternative substance used in the process to reduce/eliminate releases of POPs,
- legislation and regulation relevant to POPs
- public awareness and education on generation, source categories and harmful effect of POPs
- monitoring of POPs releases from source categories,
- research and development on health risk assessment from POPs exposure.

#### **3.3 Strategies, action plans and activities**

Thailand has ratified the Stockholm Convention on Persistent Organic Pollutants on 31 January 2005; therefore, it is committed to develop a National Implementation Plan within 2 years of the date of entry into force of this Convention.

##### **3.3.1 Strategy: identification of stockpiles, articles in use and wastes**

As POPs are no longer be produced, imported and used in Thailand, the stockpiles of POPs were left over from the past years or, in case of PCBs-containing equipment, being stored or used in

some places. As the Party of the Stockholm Convention, Thailand is obliged to initiate the POPs preliminary inventory; however, data have not been fully assessed. The continuation and completeness of inventory will help to formulate the action plans in accordance with the actual situation.

### **3.3.2 Strategy: identification of contaminated sites (Annex A, B and C Chemicals) and remediation in an environmentally sound manner**

The issues of identification of contaminated site and remediation are quite complicated especially where there is no compliant. However, the practicable strategy is to identify the contaminated sites by conducting complete POPs inventory based on the procedure of preliminary inventory. The management and remediation of POPs contamination sites needs to be carried out carefully and systematically and in compliance with the obligation of the international agreement in which Thailand fell into such as Basel Convention. Consequently, the impact pose to human health and the environment can be avoided.

Disposal and management of hazardous waste deriving from POPs is very important and needed. This may be done by establishing of high temperature incineration in Thailand. In the absence of local high temperature incineration, the alternative is to ship those hazardous wastes overseas whereby the appropriate technology is available and they are willing to receive those hazardous wastes. Therefore, it is required that hazardous wastes are managed in a manner that will not cause any adverse effect to human health and the environment and also in consistent with obligations of International Conventions with which Thailand is involved such as Basel Convention.

### **3.3.3 Activity: production, import and export, use, identification, labeling, removal storage and disposal of PCBs and equipment containing PCBs and equipment containing PCBs (Annex A, part II chemicals)**

Given that the Government of Thailand has sufficient laws and regulations in place to control the use of PCBs containing equipment, efforts within the NIP will primarily be made to strengthen operational procedures and capacity of the agencies to monitor and enforce these regulations. The following measures are proposed.

1. Issue the notification or order to allow those having PCBs containing equipment in possession to store the equipment in an environmentally sound manner for safe disposal.
2. Registration of PCBs containing equipment owners in accordance with the relevant Act.
3. Update the registration database and link it with other relevant agencies.
4. Development of action plans in order to be able to eliminate the use of PCBs containing equipment by 2012 in accordance with the obligation of the Convention.
5. Organizing a series of workshops to inform objectives and needs to eliminate PCBs containing equipment to all stakeholders.
6. Development of enforcement mechanism in parallel with the clearing house system on PCBs containing equipment since the change of PCBs containing equipment can not be tracked by the existing enforcement system.

### **3.3.4 Action plan: measures to reduce releases from unintentional production (article 5)**

Action plan to reduce the releases of unintentional production of PCDDs/PCDFs includes the following elements;

## 1. Updating inventory and projecting releases of PCDDs/PCDFs from all source categories.

Inventory data for PCDDs/PCDFs emissions are compiled by various Ministries relevant to source categories. Information on production per annual, incineration process (temperature, residence time and turbulence), air pollution control system, type of boiler, type of fuel use, type of waste treatment, etc. are extracted and estimated PCDDs/PCDFs releases in the unit of “g I-TEQ/a”. The production per annual is calculated by multiplying the amount of production per annual with the default emission factor as indicated in UNEP’s Toolkit 2003. Due to variety of source categories and sub-categories for PCDDs/PCDFs emission, there are various Ministries that are responsible for these inventory data as summarized in Table 3.6.3.

Short term action plan should be implemented by

- assigning competent authority from relevant Ministries to be responsible for collecting data pertinent to source categories of PCDDs/PCDFs.
- ensuring adequate human resources and budget for preparation of database.
- relevant Ministries collect data on amount of production per annual from all source categories.

Long term action plan should be implemented by

- relevant Ministries maintain and update database for PCDDs/PCDFs emission.
- allocating of budget for maintenance and updating of database.
- promoting PRTR as a mechanism to develop a comprehensive and complete national inventory data in electronic database.

## 2. Revise and update the existing legislations as well as establishing new legislations to include all potential source categories for PCDDs/PCDFs.

At present, there is legislation and regulation prescribing PCDs/PCDFs emission standard of less than 0.5 ng I-TEQ/Nm<sup>3</sup> for municipal and hazardous waste incineration. There is no emission standard for medical waste incineration; however, there is Ministerial notification on medical waste storage room required for storage temperature at 4°C. In addition, the legislation and regulation for PCDDs/PCDFs emission has not been issued for the cremation. Therefore, the existing legislation should be revised and updated to include all source categories.

Short term action plan should be implemented by

- amendment of laws and regulations to include standard allowance for PCDDs/PCDFs emission from source categories to environment, product, residue and food residue.
- amendment of laws and regulations to include penalty for those who violate the laws especially from uncontrolled combustion on agricultural, household and open burning; waste incineration and those who intentionally polluted the environment with PCDDs/PCDFs.

Long term action plan should be implemented by

- updating laws and regulations for new source category for PCDDs/PCDFs emission.

- banning on importation of chlorinated chemicals that have high potential of PCDDs/PCDFs formation.

3. Develop and promote strategies in accordance with national policy and review every 5 years.

4. BAT requirement for new sources and BAT promotion for existing sources. BAT is required for new source after 4-year entry into force as identified in Part II, Annex C while BAT is promoted for existing sources as identified in Part II and III, Annex C and new sources as identified in Part III, Annex C.

5. BEP promotion for new and existing sources as identified in Part II and III, Annex C.

### **3.3.5 Activity: measures to reduce or eliminate releases from unintentional production (article 5)**

1. Open burning of household and agricultural residue should be prohibited in accordance with the national master plan on opening control proposed by PCD, MNRE in 2003 and punishment should be applied to those who violate.

2. All waste incinerations should install air pollution control devices such as bag house filter, fabric filter, cyclone, wet scrubber, NO<sub>x</sub> treatment.

3. Campaign of using natural gas or liquefied petroleum gas as fuel in household, street vendor, hotel, restaurant, etc. should be promoted to replace charcoal and other firewood.

4. All crematoria should install air pollution control devices such as bag house filter, wet scrubber, etc.

5. Training for undertaker for cremation should be provided for operation such as optimum temperature for the first and second chamber incineration that reduce or eliminate PCDDs/PCDFs emission. In addition, instruction to reduce or eliminate PCDDs/PCDFs formation should be advised to the undertaker, i.e.

- removal of all plastic decoration on the coffin as well as coffin cover before cremation,
- loading of other belongings of corpse into the coffin should be prohibited,
- campaign for eliminating the use of plastic device in artificial flower and using natural flower for cremation should be promoted.

### **3.3.6 Activity: production, import and export, use, stockpiles and wastes of DDT (Annex B Chemicals) if used in the country**

DDT, the chemical listed in Annex B, had its production, import, export, use, been prohibited in Thailand since 1983 for agricultural purposes. The use for malarial and vector control had been prolonged until 1994, thereafter the use could be done only under the operation of Ministry of Public Health. The total ban of DDT came into effect in 2003. The amount of stockpile of DDT identified during the inventory activities in 2004 was 180 kg which was left over from agricultural use long time ago.

### **3.3.7 Activity: register for specific exemptions and the continuing need for exemptions (article 4)**

Article 4 of Stockholm Convention allows specific exemption for the use and production of chemicals in Annex A and B. Those who need to use, the specific exemption has to submit to

the Secretariat. However, Thailand has ceased using and producing all POPs pesticides, including DDT for many years. Therefore, Thailand does not need exemptions for further uses of POPs.

With regard to PCBs, a registration for specific exemption depends on technical and financial cooperation from both Thai government and international organizations. According to PCBs inventory in 2004, there were certain amounts of PCBs containing equipment being stored and/or used within a country, even though the Government of Thailand has already scheduled PCBs as a banned chemical. We, thus, have to seek for technical and financial cooperation to assist the possessors of PCBs containing equipment to eliminate their equipment in an environmentally sound manner. Thailand as a Party of the Stockholm Convention is obliged to report on the use of PCBs to the Secretariat every 5 years and request a specific exemption if we could not cease PCBs' use by the given year.

### **3.3.8 Activity: institutional and regulatory strengthening measures**

#### **3.3.8.1 Institutional strengthening measures**

- Capacity building of relevant organizations concerning POPs management
- Capacity building of both government agencies and private sector on the good practice and management of PCBs containing equipment from maintenance, transportation to final disposal.
- Establish regional laboratory for PCDDs/PCDFs analysis
- Update and improve the POPs database at national and regional levels.

#### **3.3.8.2 Regulatory strengthening measures**

- Amend law and regulation to facilitate the control and management of obsolete stockpile
- Ban on the importation of PCBs containing equipment
- issue the notification or order to allow those having PCBs containing equipment in possession to store the equipment in an environmentally sound manner for safe disposal.
- Schedule the period to which the use of PCBs containing equipment must be banned and publish to all stakeholders
- The notification for a registration of PCBs containing equipment owners in accordance with the relevant Act must be formulated.
- Review the existing law and regulation in relation to releases of PCDDs/PCDFs
- Issue law and regulation to control the releases of PCDDs/PCDFs from source categories to the environment and consumer products.

### **3.3.9 Activity: measures to reduces or eliminate releases from intentional production and waste**

#### **3.3.9.1 Pesticides**

- Update the POPs pesticides database
- Monitor the POPs residue in agriculture products, food and the environment
- Training on the management of obsolete stockpile
- Develop action plans for management of obsolete stockpile
- Amend laws and regulations to control obsolete stockpile

#### **3.3.9.2 PCBs**

- Update the POPs PCBs database

- Ban on the use of PCBs containing equipment by 2012
- Develop and improve PCBs information center
- Issue the notification to control a transportation and having in possession of PCBs containing equipment

### **3.3.10 Activity: manage stockpiles and appropriate measures for handling and disposal of articles in use**

#### **3.3.10.1 Pesticides**

Activities relating to handling and dispose of obsolete POPs-pesticides are as follows;

- Update obsolete pesticides inventory
- Develop recommendations or manual for good practice of obsolete stockpile management
- Preparation for final disposal of obsolete stockpile in accordance with best available techniques in order to avoid creating impact to human health and the environment

#### **3.3.10.2 PCBs**

Activities relating to handling and dispose of PCBs-containing equipment are as follows;

- Update PCBs inventory
- Monitor PCBs residue in organisms, food, and the environment
- Evaluate a risk to human health and the environment
- Develop an action plan to schedule the period to which the use of PCBs containing equipment must be banned.

#### **3.3.10.3 Socio-Economic impact due to POPs uses**

The assessment of POPs issue will require laboratories and resources for monitoring, sampling, and analyzing and technically skilled staff to conducts various types of analyses. Database and information about costs of these assessment activities is a key ingredient for the applications of socio-economic analysis on POPs reduction and elimination measures.

However, there is a very limit capability to conduct socio-economic analysis due to the fact that the least information about costs of POPs elimination options has been collected in any media.

Since research on socio-economic analysis of measures and options for POPs reductions and eliminations have not been done previously, technical training in order to be able to do research in this area would be essential.

### **3.3.11 Activity: production, import and export, use, stockpiles and wastes of Annex A POPs pesticides (Annex A, part 1)**

Based on the inventory in 2004-2005, it was revealed that among the six POPs pesticides, which had been used in Thailand namely aldrin, dieldrin, endrin, chlordane, heptachlor, and toxaphene, only small amount of obsolete stockpile were found. They were 30 kgs of chlordane and 10 kgs of heptachlor. The other POPs-pesticides, mirex and HCB, have never been used in a country. Applications of these pesticides have been banned for many years through the withdrawal of registrations. The inventory mentioned above, however, has not yet completed and needed to be continued throughout the country.

### **3.3.12 Activity: facilitating or undertaking information exchange and stakeholder involvement**

In general, Thailand has actively supported activities and international actions on chemical's management. Several government agencies have carried out monitoring programs on chemical residues in environment and their risks to human health. The national and international conference and workshop had been organized regularly on the issues of chemical risk assessment and information was exchanged among participants and observers.

National Coordination Unit on POPs, located at PCD, MNRE functions to facilitate and undertake information exchange among stakeholder to reduce and/or eliminate the use of POPs and releases of PCDDs/PCDFs. In addition, BAT/BEP available for existing and new source categories will also be disseminated to the relevant stakeholder for an effective control of PCDDs/PCDFs. However, there are several activities to strengthen the information exchange capability as follows;

- Improve and integrate an existing database to link with electronic media
- Training/workshop on data and questionnaire management of all source categories
- Disseminate information on hazard and source categories of PCDDs/PCDFs

### **3.3.13 Activity: public awareness, information and education (article 10)**

In Thailand, information on environmental and human health impacts from using POPs is available and accessible to public only from scientific journals articles, workshops, symposium or meetings at national and international levels. However, information was not disseminated thoroughly to farmers and public in general who needed to be informed all about POPs use and safety measures. Therefore, the following measures should be made as follows;

1. Raising Awareness and educating public on impacts of POPs on human health and the environment
2. Disseminating information to public and community through mass media campaign via television, radio, newspaper, article, brochure, leaflet and internet.
3. Launching a curriculum on POPs in schools and universities as well as vocational training institution to strengthen knowledge on the formation of POPs from potential source categories and how to reduce or eliminate releases of POPs.
4. Organizing the training workshop for staffs and workers of potential sources of PCDDs/PCDFs to give them a better understanding on formation of PCDDs/PCDFs and health hazard from such exposure.

### **3.3.14 Activity: effectiveness evaluation (article 16)**

As a Party to the Stockholm Convention, Thailand is committed to evaluate effectiveness of the Convention to be commenced 4 years after the date of entry into force of this Convention. The effectiveness evaluation will include implementation performance monitoring and periodic review mechanisms of POPs in accordance with technical and financial capabilities that are prospected to get supports from developed countries and international funding sources. The evaluation would be conducted on the basis of available scientific, environmental, technical and economic information, including;

1. Reports and other monitoring information provided pursuant to Article 16, Paragraph 2
2. National reports submitted pursuant to Article 15
3. Non-compliance information provided pursuant to Article 17

### 3.3.15 Activity: research, development and monitoring (article 11)

Research, development and monitoring of POPs in all source categories should be performed in accordance with the national policy as well as the preparedness of institutional capacity building, human resource and budget allocation for such activities. At present, Thailand does not have laboratory facility to monitor PCDDs/PCDFs due to limitation on expertise, financial support and health safety concerns. Therefore, activities for research, development and monitoring under article 11 are summarized as follows;

1. Establish reference national laboratory for PCDDs/PCDFs analysis that meets quality accreditation of international standard.
2. Research on disposal technology for obsolete stockpile appropriate for Thailand
3. Monitor residue in food, agriculture products and releases of PCBs and PCDDs/PCDFs from all source categories.
4. Research on a life-cycle analysis (LCA) of PCDDs/PCDFs formation from thermal and/or chemical process so that prevention of PCDDs/PCDFs formation can be accomplished.
5. Research on alternative substance to substitute the existing substance that has high potential of PCDDs/PCDFs formation.
6. Research development on incineration process to reduce or eliminate releases of PCDDs/PCDFs.
7. Research development on an effective air pollution control device to reduce PCDDs/PCDFs emission from the process.
8. Research development on the production process to reduce or eliminate releases of PCDDs/PCDFs.

### 3.3.16 Activity: technical and financial assistance (articles 12 and 13)

Thai government attempts to encourage all possible measures to reduce or eliminate releases of POPs for a better health among Thai population. However, technical assistance on BAT/BEP application for waste incineration, cremation and industrial production processes to reduce or eliminate releases of PCDDs/PCDFs should be provided and supported from the developed countries. PCDDs/PCDFs are related to various source categories; therefore, the implementation to reduce or eliminate their releases to environment needs tremendous financial support from both Thai government and international organizations such as GEF, World Bank, GTZ, UNEP, UNIDO, UNDP, etc.

Activities for technical and financial cooperation that are considered to be the top priorities of action plan element of NIP are summarized as follows:

1. Study on appropriate technology for POPs obsolete pesticides and stockpile final disposal as well as cost-benefit with regard to elimination of PCBs
2. Technical support for incineration and thermal process and air pollution control devices for potential sources of PCDDs/PCDFs.
3. Establish regional laboratory for PCDDs/PCDFs analysis to monitor releases or PCDDs/PCDFs.
4. Training workshop for mechanical technician on operation and maintenance for incineration process, cremation, air pollution control devices of potential sources of PCDDs/PCDFs should be provided so that effective control of reduced or eliminated emission is achieved.
5. Promote the use of BAT/BEP in industries.
6. Study on biodegradation or bioremediation of PCDDs/PCDFs in soil, products, sludge or ash.

### **3.4 Goals and outcomes**

#### **3.4.1 Implementation of NIP relating to POPs pesticides**

- Goal 1: ensure Environmentally Sound Management of pesticides stockpiles and wastes, elimination from use and production of all POPs pesticides by 2009
- Goal 2: An obsolete POPs pesticides Inventory is completed by 2009
- Goal 3: POPs pesticides obsolete stockpile are totally eliminated by 2009
- Goal 4: Data on POPs pesticides residue in human, animal, food products, and the environment are available by 2012

#### **3.4.2 Implementation of NIP relating to POPs PCBs**

- Goal 1: The use of PCBs is totally ceased by 2012
- Goal 2: PCBs containing equipment are managed in an environmentally sound manner by 2012

#### **3.4.3 Implementation of NIP relating to POPs PCDDs/PCDFs**

- Goal 1: reduce the total releases derived from anthropogenic sources with the goal of their continuing minimization, and, where feasible, ultimate elimination by 2012.
- Goal 2: Establish a regional laboratory for PCDDs/PCDFs analysis by 2010
- Goal 3: PCDDs/PCDFs releases database is available by 2012
- Goal 4: Pollutant Release and Transfer Register (PRTR) mechanism is developed and used in Thailand by 2012
- Goal 5: Thai people are aware of hazard and impact of PCDDs/PCDFs by 2009
- Goal 6: BAT/BEP is applied by Thai industries by 2012
- Goal 7: Law and regulations prescribing PCDDs/PCDFs emission standards are set up for all sources categories by 2012

#### **3.4.4 Implementation of NIP relating to socio-economic impact caused by POPs uses**

- Goal: Research on Socio-Economic due to POPs uses are available by 2009

### **3.5 Development and capacity-building proposals and priorities**

In order to achieve the implementation of the Stockholm Convention and its objectives, the capacity building of relevant agencies including government and private sectors should be prioritized. The following elements are recommended;

- Disposal of PCBs containing equipment and POPs pesticides obsolete stockpile
- Technical support for incineration and thermal process and air pollution control devices for potential sources of PCDDs/PCDFs.
- Register of Pollutant Release and Transfer Register (PRTR)
- Establish regional laboratory for PCDDs/PCDFs analysis
- Evaluate risk assessment of PCDDs/PCDFs to human health and the environment

### 3.6 Table of Action plans, success indicators, and financial sources

#### 3.6.1 Action Plans on POPs –pesticides

| Priorities<br>(Objectives)                                                                                                                               | Activities                                                                                                                                                   | Success<br>Indicator                                              | Responsible Authorities |                                                     | Time<br>period | Estimated<br>budget<br>(USD) | Source of Funding |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------|-----------------------------------------------------|----------------|------------------------------|-------------------|
|                                                                                                                                                          |                                                                                                                                                              |                                                                   | Main<br>authorities     | Supporting<br>authorities                           |                |                              |                   |
| GOAL 1 : Ensure Environmentally Sound Management of pesticides stockpiles and wastes, elimination from use and production of all POPs pesticides by 2009 |                                                                                                                                                              |                                                                   |                         |                                                     |                |                              |                   |
| 1. Technical and financial support                                                                                                                       | 1.1 Training workshops for implementing personnel to become more efficient in applying or enforcing relevant laws, rules and regulation and admin-management | -number of training workshops held<br><br>-number of participants | MOAC                    | M-IND<br><br>MOPH<br><br>MNRE<br><br>private sector | 2008 – 2009    | 20,000 \$                    | Thai government   |
| 2.Improvement of public awareness and education                                                                                                          | 1.2 Encouraging the agencies concerned with pesticide management to draft the plan of operation with support from international organization.                | -organize consultations/ workshops<br><br>-number of participants | MOAC                    | M-IND<br><br>MOPH<br><br>OPM                        | 2008 – 2009    | 10,000 \$                    | Thai government   |
|                                                                                                                                                          | 2.1 Distributing information on toxicity of the chemicals to human health and                                                                                | -decreasing of number of patients suffered from being exposed to  | MOPH                    | MOAC<br><br>MNRE<br><br>OPM<br><br>MOI              | 2008 – 2009    | 100,000 \$                   | Thai government   |

| Priorities<br>(Objectives) | Activities                                                                                                                                          | Success<br>Indicator                                                                                           | Responsible Authorities |                                       | Time<br>period | Estimated<br>budget<br>(USD) | Source of Funding |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------|----------------|------------------------------|-------------------|
|                            |                                                                                                                                                     |                                                                                                                | Main<br>authorities     | Supporting<br>authorities             |                |                              |                   |
|                            | environment to all levels of population                                                                                                             | pesticides<br>-number of PR on TV, Newspaper<br>- number of meetings/seminars on awareness raising Conferences |                         |                                       |                |                              |                   |
|                            | 2.2 Training program to the concerned people (general public, NGOs, sale promoter, etc.) on proper storage condition, handling and waste management | -number of workshop / training, Conferences<br>-number of trained personnel in handling wastes                 | MOAC                    | M-IND<br>MOPH<br>Private sector       | 2008 – 2009    | 50,000 \$                    | Thai government   |
|                            | 2.3 Provide public relation and dissemination of knowledge on pesticides to people at all levels                                                    | -number of PR on TV, Newspaper.<br>- Awareness Raising Conferences                                             | MOAC                    | MNRE<br>MOPH<br>OPM<br>Private sector | 2008 – 2009    | 100,000 \$                   | Thai government   |
|                            | 2.4 Transferring of knowledge on the dangerous use of pesticides to students                                                                        | - number of students and youth knowledgeable                                                                   | MOE                     | MOAC<br>MOPH<br>Private sectors       | 2008 – 2009    | 50,000 \$                    | Thai government   |

| Priorities<br>(Objectives)                                                       | Activities                                                                                                    | Success<br>Indicator                                                                                                                  | Responsible Authorities |                           | Time<br>period | Estimated<br>budget<br>(USD) | Source of Funding              |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------|----------------|------------------------------|--------------------------------|
|                                                                                  |                                                                                                               |                                                                                                                                       | Main<br>authorities     | Supporting<br>authorities |                |                              |                                |
|                                                                                  | and youth                                                                                                     | in danger of<br>pesticides<br>-number of<br>Curriculum,<br>- number of<br>workshops                                                   |                         |                           |                |                              |                                |
| 3. Preparation<br>of new &<br>amendment<br>of existing<br>legislation            | 3.1 Amendment of<br>laws and regulations<br>to remove the legal<br>loopholes                                  | -number of laws<br>and regulations<br>amended<br>- number of<br>Training /<br>Workshops<br>-number of<br>recommendations<br>received. | MOAC                    | M-IND<br>MOPH             | 2008 – 2009    | 20,000 \$                    | Thai government                |
| <b>GOAL 2: An obsolete POPs pesticides Inventory is completed by 2009</b>        |                                                                                                               |                                                                                                                                       |                         |                           |                |                              |                                |
| 4. Updating<br>Inventory<br>Data for<br>pesticides                               | 4.1 surveys of POPs<br>pesticides stockpiles<br>in the concerned<br>warehouses all over<br>the country.       | -POPs pesticides<br>database is<br>available and<br>updated                                                                           | MNRE                    | MOAC<br>MOPH              | 2008 – 2009    | 100,000 \$                   | Thai government                |
| <b>GOAL 3: POPs pesticides obsolete stockpile are totally eliminated by 2009</b> |                                                                                                               |                                                                                                                                       |                         |                           |                |                              |                                |
| 5. Preparation<br>of the action<br>plan for<br>waste<br>disposal &               | 5.1 Practical training<br>on environmental<br>sound management of<br>waste disposal to<br>concerned agencies. | -number of<br>training<br>-numbr of<br>attendants who                                                                                 | MNRE                    | MOAC                      | 2008 – 2009    | 100,000 \$                   | GEF and<br>Bilateral agreement |

| Priorities<br>(Objectives)                                                                                                | Activities                                                                                                                          | Success<br>Indicator                                                                                                            | Responsible Authorities |                           | Time<br>period | Estimated<br>budget<br>(USD) | Source of Funding |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------|----------------|------------------------------|-------------------|
|                                                                                                                           |                                                                                                                                     |                                                                                                                                 | Main<br>authorities     | Supporting<br>authorities |                |                              |                   |
| management                                                                                                                |                                                                                                                                     | have completed<br>the training<br><br>- number of<br>Demonstrations                                                             |                         |                           |                |                              |                   |
|                                                                                                                           | 5.2 Prepare<br>guidelines,<br>recommendations for<br>storage conditions<br>and proper handling<br>of wastes from POPs<br>pesticides | -number. of<br>guidelines<br>/brochures/docum<br>ents                                                                           | MNRE                    | MOAC<br>M-IND             | 2008           | 50,000 \$                    | Thai government   |
|                                                                                                                           | 5.3 Disposal of<br>obsolete pesticides<br>and wastes in an<br>environmentally<br>sound manner                                       | -number. of cases<br>of efficient waste<br>disposal<br><br>- amount of<br>obsolete<br>pesticides and<br>wastes deposited<br>of. | MNRE                    | MOAC<br>M-IND             | 2008 – 2009    | 250,000 \$                   | request for GEF   |
| <b>GOAL 4: Data on POPs pesticides residue in human, animal, food products, and the environment are available by 2012</b> |                                                                                                                                     |                                                                                                                                 |                         |                           |                |                              |                   |
| 6. Monitoring of<br>POPs pesticides<br>and<br>bioaccumulation<br>on the living<br>organisms                               | 6.1 Monitoring of<br>POPs pesticides in<br>agricultural product,<br>environment, food<br>products and tissues                       | -types of<br>pesticides having<br>impacts on<br>human beings                                                                    | MOAC<br>MNRE<br>MOPH    |                           | 2008-2012      | 300,000 \$                   | Thai government   |

| Priorities<br>(Objectives)                       | Activities                                                                                  | Success<br>Indicator                                                                                                   | Responsible Authorities |                                | Time<br>period | Estimated<br>budget<br>(USD) | Source of Funding              |
|--------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------|----------------|------------------------------|--------------------------------|
|                                                  |                                                                                             |                                                                                                                        | Main<br>authorities     | Supporting<br>authorities      |                |                              |                                |
| 7. Evaluation of adverse effects on human health | 7.1 Compiling facts and figures on harmful effects of pesticides on farmers and applicators | -list of substances proven to be harmful to farmers and applicators<br>- Questionnaires<br>- Site visits<br>- Analysis | MOPH                    | MNRE<br>MOAC<br>Private sector | 2008-2012      | 100,000 \$                   | GEF and<br>Bilateral agreement |
|                                                  | 7.2 Projects on dietary exposure and risk assessment from consuming food in Thailand        | data base for risk assessment<br>- Questionnaires<br>- Site visits<br>- Analysis                                       | MOPH                    | MOAC<br>MNRE                   | 2008-2012      | 100,000 \$                   | GEF and<br>Bilateral agreement |

## 3.6.2 Action Plans on POPs-PCBs

| Priorities<br>(Objectives)                                     | Activities                                                                                                                                                         | Indicator of<br>success                                          | Responsible Institute |                                                                         | Time<br>period | Estimated<br>Budget<br>(USD) | Source of Financing            |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------|----------------|------------------------------|--------------------------------|
|                                                                |                                                                                                                                                                    |                                                                  | Main<br>authorities   | Supporting<br>authorities                                               |                |                              |                                |
| GOAL 1 : The use of PCBs is totally ceased by 2012             |                                                                                                                                                                    |                                                                  |                       |                                                                         |                |                              |                                |
| 1. Institutional<br>strengthenin<br>g for PCB<br>management    | 1.1 Set up an<br>Implementation Unit                                                                                                                               | PCBs<br>Management<br>Unit was<br>established and<br>operational | M-IND                 | MNRE<br><br>MOF<br><br>MOL<br><br>MOE<br><br>MOI<br><br>MOEN<br><br>BMA | 2008           | 375,000                      | GEF and Bilateral<br>agreement |
| 2. Capacity<br>building/tr<br>aining for<br>human<br>resources | 2.1 Set up training<br>programme for<br><ul style="list-style-type: none"><li>• Government Agencies</li><li>• Private/Enterprises</li><li>• NGOs</li></ul>         | -Number of<br>training courses                                   | M-IND                 | MNRE<br><br>MOF<br><br>MOI<br><br>BMA<br><br>MOEN                       | 2008           | -                            | Thai government                |
|                                                                | 2.2 Develop a<br>standard training<br>manual for<br><ul style="list-style-type: none"><li>• Good code of<br/>practice for PCBs<br/>containing equipments</li></ul> | -number of<br>manual                                             |                       |                                                                         | 2008           | 33,000\$                     | GEF and<br>Bilateral Agreement |

| Priorities<br>(Objectives)                                                                             | Activities                                                                                                                                                                                                          | Indicator of<br>success                                                                                | Responsible Institute |                                                               | Time<br>period | Estimated<br>Budget<br>(USD) | Source of Financing         |
|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------------------|---------------------------------------------------------------|----------------|------------------------------|-----------------------------|
|                                                                                                        |                                                                                                                                                                                                                     |                                                                                                        | Main<br>authorities   | Supporting<br>authorities                                     |                |                              |                             |
|                                                                                                        | <ul style="list-style-type: none"> <li>Standard procedure for maintenance, removal and disposal of PCBs and PCBs contaminated materials</li> </ul>                                                                  |                                                                                                        |                       |                                                               |                |                              |                             |
|                                                                                                        | 2.3 Production of other training materials                                                                                                                                                                          | -number of training material                                                                           |                       |                                                               | 2008           | 37,000\$                     | GEF and Bilateral Agreement |
|                                                                                                        | 2.4 organizing training workshops                                                                                                                                                                                   | -number of training workshops<br>-Number of trainees                                                   |                       |                                                               | 2009-2012      | 29,500\$                     | GEF and Bilateral Agreement |
|                                                                                                        | 2.5 Undertake follow-up evaluation and monitoring                                                                                                                                                                   |                                                                                                        |                       |                                                               |                | 39,500\$                     | GEF and Bilateral Agreement |
| 3. Develop a monitoring system for PCBs, including strengthening of data collection/ex change and data | 3.1 Updating PCBs Inventory<br><b>Sub-activity A:</b> Strengthen the existing data base by<br><ul style="list-style-type: none"> <li>Preparation of questionnaires/fact sheet and lists of target group.</li> </ul> | -Additional PCBs containing equipment users.<br>-Updating PCBs inventory<br>-Electronic Clearing house | MNRE                  | M-IND<br>MOF<br>BMA<br>MOI<br>MOEN<br>Thai Hotel Associations | 2008-2012      | 110,500\$                    | GEF and Bilateral Agreement |

| Priorities<br>(Objectives)                                                                      | Activities                                                                                                                                                                                                                                                                                                                                                    | Indicator of<br>success                         | Responsible Institute |                           | Time<br>period | Estimated<br>Budget<br>(USD) | Source of Financing |
|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-----------------------|---------------------------|----------------|------------------------------|---------------------|
|                                                                                                 |                                                                                                                                                                                                                                                                                                                                                               |                                                 | Main<br>authorities   | Supporting<br>authorities |                |                              |                     |
| management                                                                                      | <ul style="list-style-type: none"> <li>•Distribute questionnaires/ fact sheet and interview with target group</li> <li>•Verification and analysis of the data</li> <li>•Consultation workshops or meeting with target groups</li> <li>•Meeting with concerned stakeholders</li> <li>•Prepare a lists of additional PCBs containing equipment users</li> </ul> | for PCBs Containing Equipment has put in place. |                       | MOE<br>MOPH               |                |                              |                     |
|                                                                                                 | <b>Sub-activity B :</b><br>Facilitate effective recording and monitoring of PCBs containing equipment                                                                                                                                                                                                                                                         |                                                 |                       |                           |                |                              |                     |
|                                                                                                 | <b>Sub-activity C:</b><br>Operate the Electronic Clearinghouse (ECH)                                                                                                                                                                                                                                                                                          |                                                 |                       |                           |                |                              |                     |
| <b>GOAL 2: PCBs containing equipment are managed in an environmentally sound manner by 2012</b> |                                                                                                                                                                                                                                                                                                                                                               |                                                 |                       |                           |                |                              |                     |
| 4. Technology transfer and                                                                      | 4.1 Feasibility Study for the implementation                                                                                                                                                                                                                                                                                                                  | -PCBs Best Available                            | MNRE                  | M-IND                     | 2008-2009      | 52,000\$                     | GEF and             |

| Priorities<br>(Objectives) | Activities                                                                                                                                                                                                    | Indicator of<br>success          | Responsible Institute |                                  | Time<br>period | Estimated<br>Budget<br>(USD) | Source of Financing |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------|----------------------------------|----------------|------------------------------|---------------------|
|                            |                                                                                                                                                                                                               |                                  | Main<br>authorities   | Supporting<br>authorities        |                |                              |                     |
| public<br>awareness        | of Best Available Technologies related to the temporary storage and final disposal of PCBs in Thailand<br><br><b>Sub-activity A:</b><br>Establish a Ad Hoc working group to supervision the feasibility study | Techniques suitable for Thailand | MOEN                  | MOF<br>BMA<br>MOI<br>MOE<br>MOPH |                |                              | Bilateral Agreement |
|                            | <b>Sub-activity B:</b><br>Develop an implementation framework                                                                                                                                                 |                                  |                       |                                  |                |                              |                     |
|                            | <b>Sub-activity C:</b><br>Consultation workshop with concerning agencies to hearing their concerns and recommendations                                                                                        |                                  |                       |                                  |                |                              |                     |
|                            | <b>Sub-activity E:</b><br>Priority and criteria setting for PCBs containing equipment that will be eliminated                                                                                                 |                                  |                       |                                  |                |                              |                     |

| Priorities<br>(Objectives) | Activities                                                                                                                                         | Indicator of<br>success                                                           | Responsible Institute |                                       | Time<br>period | Estimated<br>Budget<br>(USD) | Source of Financing            |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------|---------------------------------------|----------------|------------------------------|--------------------------------|
|                            |                                                                                                                                                    |                                                                                   | Main<br>authorities   | Supporting<br>authorities             |                |                              |                                |
|                            | <b>Sub-activity F:</b><br>Submit to sub<br>committee of<br>Stockholm<br>Convention and<br>National<br>Environmental<br>Board for their<br>approval |                                                                                   |                       |                                       |                |                              |                                |
|                            | <b>Sub-activity G:</b><br>Selection of the most<br>appropriate strategy<br>and technology<br>(environmentally<br>and economically<br>sound         |                                                                                   |                       |                                       |                |                              |                                |
|                            | <b>Sub-activity H:</b><br>Implementation                                                                                                           |                                                                                   |                       |                                       |                |                              |                                |
|                            | <b>Sub-activity I:</b><br>Follow up,<br>monitoring and<br>progress report                                                                          |                                                                                   |                       |                                       |                |                              |                                |
|                            | 4.2 Increase<br>information<br>dissemination about<br>legal regulations and<br>procedures<br><br><b>Sub-activity A:</b>                            | - number of<br>booklets or<br>pamphlets<br>published and<br>release to<br>public. | M-IND<br><br>MNRE     | BMA<br><br>MOI<br>MOEN<br>MOPH<br>OPM | 2009-2012      | 198,000\$                    | GEF and<br>Bilateral Agreement |

| Priorities<br>(Objectives) | Activities                                                                                                                                                                      | Indicator of<br>success | Responsible Institute |                           | Time<br>period | Estimated<br>Budget<br>(USD) | Source of Financing |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------|---------------------------|----------------|------------------------------|---------------------|
|                            |                                                                                                                                                                                 |                         | Main<br>authorities   | Supporting<br>authorities |                |                              |                     |
|                            | Disseminate information related to the Government's strategy to dealing with PCBs and PCBs containing equipment                                                                 |                         |                       |                           |                |                              |                     |
|                            | <b>Sub-activity B:</b> Raise public awareness of the environmental and economic impacts of Pops (PCBs) to the public via radio spots newsletters, news articles, seminars, etc. |                         |                       |                           |                |                              |                     |
|                            | <b>Sub-activity C:</b> Formulate campaigns to encourage the management of PCBs in Thailand                                                                                      |                         |                       |                           |                |                              |                     |
|                            | <b>Sub-activities D:</b> Organize a promotional program to encourage the public to have their PCBs containing Equipment maintained by certified technicians                     |                         |                       |                           |                |                              |                     |

| Priorities<br>(Objectives)                       | Activities                                                                                                                                         | Indicator of<br>success                                                                                                                                                                                                        | Responsible Institute |                           | Time<br>period | Estimated<br>Budget<br>(USD) | Source of Financing |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------------|----------------|------------------------------|---------------------|
|                                                  |                                                                                                                                                    |                                                                                                                                                                                                                                | Main<br>authorities   | Supporting<br>authorities |                |                              |                     |
| 5. Regulations,<br>Monitoring<br>and Enforcement | 5.1 Issue the<br>notification to ban on<br>importation of PCBs<br>containing equipment                                                             | -Notification on<br>import control of<br>PCBs containing<br>equipment has<br>put in place and<br>operational<br><br>-Notification<br>specifying the<br>target year of<br>banning the use<br>of PCBs<br>containing<br>equipment | M-IND<br><br>MOC      | MNRE<br><br>MOF           | 2008           | -                            | Thai government     |
|                                                  | 5.2 Issues the<br>notification to allows<br>the PCBs possessors<br>to keep them in a<br>secure storage till<br>sending out for a final<br>disposal |                                                                                                                                                                                                                                | M-IND                 |                           |                | -                            | Thai government     |
|                                                  | 5.3 Put in place an<br>elimination schedule<br>for PCBs containing<br>equipment, for the<br>period 2008-2013                                       |                                                                                                                                                                                                                                | M-IND                 |                           |                | -                            | Thai government     |
|                                                  | 5.4 Issues the<br>notification to require<br>the PCBs users<br>register with DIW                                                                   |                                                                                                                                                                                                                                | M-IND                 |                           |                | -                            | Thai government     |

| Priorities<br>(Objectives)                                                                            | Activities                                                                                                                  | Indicator of<br>success                                        | Responsible Institute |                                             | Time<br>period | Estimated<br>Budget<br>(USD) | Source of Financing |
|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------|---------------------------------------------|----------------|------------------------------|---------------------|
|                                                                                                       |                                                                                                                             |                                                                | Main<br>authorities   | Supporting<br>authorities                   |                |                              |                     |
| 6. Research on health and environmental impact and monitoring program for PCBs from source categories | 6.1 Monitoring of PCBs in environmental including residue from source categories and food products from nearby environment. | -Database on PCBs residue in the environment and food products | MNRE                  | M-IND<br>MOEN<br>MOI<br>MOE<br>MOPH<br>MOAC | 2008-2012      | 143,000\$                    | Thai government     |
|                                                                                                       | 6.2 Evaluate health risk assessment from PCBs exposure                                                                      |                                                                | MOPH                  | M-IND<br>MOEN<br>MOI<br>MOE<br>MNRE<br>MOAC | 2009-2011      | 143,000\$                    | Thai government     |

## 3.6.3 Action Plans on unintentional POPs

| Priorities<br>(Objectives)                                                                                                                                               | Activities                                                                                                                                                                                                       | Success<br>Indicator                                                                                                          | Responsible Authorities |                                  | Time<br>Period | Estimated<br>Budget<br>(USD) | Source of Funding |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------------|----------------|------------------------------|-------------------|
|                                                                                                                                                                          |                                                                                                                                                                                                                  |                                                                                                                               | Main                    | Supporting                       |                |                              |                   |
| GOAL 1 : reduce the total releases derived from anthropogenic sources with the goal of their continuing minimization, and, where feasible, ultimate elimination by 2012. |                                                                                                                                                                                                                  |                                                                                                                               |                         |                                  |                |                              |                   |
| 1. Technical and financial cooperation is acquired                                                                                                                       | 1.1 Technical support for implementing effective incineration-based approaches, thermal processes and air pollution control systems in order to address identified potential sources of PCDDs/PCDFs emissions.   | PCDDs/PCDFs releases are controlled and complied with emission standard                                                       | MNRE<br>M-IND           | MOL<br>MOE<br>MPOH<br>MOI<br>BMA | 2008-2012      |                              |                   |
|                                                                                                                                                                          | <b>Sub-activity A :</b><br>Training programme for mechanical technicians on operation and maintenance for <ul style="list-style-type: none"><li>- incineration processes</li><li>- cremation processes</li></ul> | -number of trainings/work shops<br><br>-number of trainees<br><br>- Increased knowledge level regarding equipment maintenance | MNRE                    | MOL<br>MOPH<br>MOE               | 2008-2012      | 51,000\$                     | Thai Government   |

| Priorities<br>(Objectives) | Activities                                                                                                                                                                       | Success<br>Indicator                                                                                                   | Responsible Authorities |                                           | Time<br>Period | Estimated<br>Budget<br>(USD) | Source of Funding              |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------------------------|----------------|------------------------------|--------------------------------|
|                            |                                                                                                                                                                                  |                                                                                                                        | Main                    | Supporting                                |                |                              |                                |
|                            |                                                                                                                                                                                  | techniques relevant to PCDDs/PCDFs reductions                                                                          |                         |                                           |                |                              |                                |
|                            | <b>Sub-activity B:</b><br>Technical cooperation on installation of air pollution controls for potential source categories of PCDDs/PCDFs emissions.                              | - Reduction of PCDDs/PCDFs emission from enterprises that have installed such controls.                                | MNRE                    | M-IND<br>OPM<br>MICT<br>MOF<br>MOI        | 2008-2012      | 3,286,380\$                  | GEF and<br>Bilateral agreement |
|                            | <b>Sub-activity C:</b><br>Development and implementation of tax incentives and honour awards granted for enterprises that demonstrate a reduction or elimination of PCDDs/PCDFs. | -Application of BAT/BEP in production process to reduce PCDDs/PCDFs emission in facilities affected by tax incentives. | MNRE                    | MOF<br>M-IND<br>OPM<br>BMA<br>MOI<br>MICT | 2008-2012      | 247,500\$                    | Thai Government                |

| Priorities<br>(Objectives)                                                                                                      | Activities                                                                                                                                                                                   | Success<br>Indicator                                                                        | Responsible Authorities |                                                    | Time<br>Period | Estimated<br>Budget<br>(USD) | Source of Funding              |
|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------|----------------------------------------------------|----------------|------------------------------|--------------------------------|
|                                                                                                                                 |                                                                                                                                                                                              |                                                                                             | Main                    | Supporting                                         |                |                              |                                |
| GOAL 2: Establish a regional laboratory for PCDDs/PCDFs analysis by 2010                                                        |                                                                                                                                                                                              |                                                                                             |                         |                                                    |                |                              |                                |
|                                                                                                                                 | 1.2 Establish a national laboratory center for PCDDs/PCDFs analysis                                                                                                                          | -an accredited PCDDs/PCDFs laboratory.                                                      | MNRE                    | M-IND<br>MOPH<br>MOAC                              | 2010           | 8,285,000\$                  | GEF and<br>Bilateral agreement |
| GOAL 3: PCDDs/PCDFs releases database is available by 2012                                                                      |                                                                                                                                                                                              |                                                                                             |                         |                                                    |                |                              |                                |
|                                                                                                                                 | 1.3 Monitoring programme for PCDDs/PCDFs in environment including air, water, land, product, residue from source categories and food products including breast milk from nearby environment. | -Database on contamination of PCDDs/PCDFs in the environment, humans and products.          | MNRE<br>MOE             | M-IND<br>MOPH<br>MOAC                              | 2008-2012      | 59,275,000\$                 | GEF and<br>Bilateral agreement |
| 2. Update inventory data for PCDDs/PCDFs releases from all source categories (focusing on large PCDDs/PCDFs emission source) in | 2.1 Update PCDDs/PCDFs inventory from all source categories.                                                                                                                                 | -Complete and up to date inventory data of PCDDs/PCDFs emission from all source categories. | MNRE                    | M-IND<br>MOPH<br>MOAC<br>MOI<br>BMA<br>MOEN<br>MOT | 2008-2012      | 1,830,550\$                  | Thai Government                |

| Priorities<br>(Objectives)                                        | Activities                                                                                                  | Success<br>Indicator                                                                                  | Responsible Authorities |                                                   | Time<br>Period | Estimated<br>Budget<br>(USD) | Source of Funding              |
|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------|----------------|------------------------------|--------------------------------|
|                                                                   |                                                                                                             |                                                                                                       | Main                    | Supporting                                        |                |                              |                                |
| accordance with registration and record from relevant ministries. |                                                                                                             |                                                                                                       |                         | MICT<br>MOF<br>MOC<br>ONAB                        |                |                              |                                |
|                                                                   | 2.2 Training workshop on questionnaire completion for source categories of PCDDs/PCDFs.                     | -number of training/<br>workshops<br>-number of trainees                                              | MNRE                    | M-IND<br>MOPH<br>MOI<br>BMA<br>CULTURE            | 2007-2012      | 136,000\$                    | GEF and<br>Bilateral agreement |
|                                                                   | 2.3 Surveillance programme on open burning and agricultural residue burning to reduce PCDDs/PCDFs emission. | -Reduction or elimination of PCDDs/PCDFs emission from open burning and agricultural residue burning. | MNRE                    | MOAC<br>MOI<br>BMA                                | 2008-2010      | 110,000\$                    | Thai Government                |
|                                                                   | 2.4 trainings/workshops on controlling of open burning and agricultural residue burning.                    | -Reduction or elimination releases of PCDDs/PCDFs                                                     | MNRE                    | MOI<br>OPM<br>MICT<br>MOAC<br>BMA<br>MOT<br>M-IND | 2008-2012      | 410,400\$                    | Thai Government                |

| Priorities<br>(Objectives)                                                                                  | Activities                                                                                                                       | Success<br>Indicator                                                 | Responsible Authorities |                                                                                               | Time<br>Period | Estimated<br>Budget<br>(USD) | Source of Funding              |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------|----------------|------------------------------|--------------------------------|
|                                                                                                             |                                                                                                                                  |                                                                      | Main                    | Supporting                                                                                    |                |                              |                                |
| GOAL 4: Pollutant Releases and Transfer Register (PRTR) mechanism is developed and used in Thailand by 2012 |                                                                                                                                  |                                                                      |                         |                                                                                               |                |                              |                                |
| 3. Develop Pollutant Releases and Transfer Register (PRTR) mechanism                                        | 3.1 develop pollutants release and transfer register (PRTR)                                                                      | -Complete and up to date PRTR database of PCDDs/ PCDFs releases.     | MNRE                    | M-IND<br>MOI<br>BMA<br>MICT<br>MFA<br>MOAC<br>MOC<br>MOF<br>MOL<br>MOPH<br>MOT<br>OPM<br>ONAB | 2008-2012      | 800,000\$                    | GEF and<br>Bilateral agreement |
| GOAL 5: Thai people are aware of hazard and impact of PCDDs/PCDFs by 2009                                   |                                                                                                                                  |                                                                      |                         |                                                                                               |                |                              |                                |
| 4. Strengthen public awareness and develop education programmes on POPs in general,                         | 4.1 Disseminate information on sources and generation of PCDDs/PCDFs and their health hazard effects through: the development of | -public are aware of health hazard effects from PCDDs/PCDFs exposure | MNRE                    | MOE<br>OPM<br>MICT<br>M-IND<br>MOPH<br>MOAC                                                   | 2008           | 578,000\$                    | Thai Government                |

| Priorities<br>(Objectives)                                                                                                               | Activities                                                                                                                                                                                                           | Success<br>Indicator                                                  | Responsible Authorities |                                            | Time<br>Period | Estimated<br>Budget<br>(USD) | Source of Funding              |
|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-------------------------|--------------------------------------------|----------------|------------------------------|--------------------------------|
|                                                                                                                                          |                                                                                                                                                                                                                      |                                                                       | Main                    | Supporting                                 |                |                              |                                |
| including PCDDs/PCDFs in particular.                                                                                                     | POPs-related curricula in schools; media awareness-raising campaigns; development of other awareness raising materials (e.g. brochures) for placement in public facilities (e.g. post offices, schools, banks, etc). |                                                                       |                         |                                            |                |                              |                                |
| 5. Development and implementation of a research programme on health impact from PCDDs/ PCDFs exposure and biodegradation of PCDDs/PCDFs. | 5.1 Evaluate health risk assessment from PCDDs/ PCDFs exposure from source categories.                                                                                                                               | -Report on health risk assessment from PCDDs/ PCDFs exposure.         | MOE<br>MNRE             | M-IND<br>MOPH<br>MOAC<br>OPM (TRF)<br>NRTC | 2008-2012      | 1,350,000\$                  | GEF and<br>Bilateral agreement |
|                                                                                                                                          | 5.2 Research on biodegradation of PCDDs/PCDFs in water, land, products and residue.                                                                                                                                  | -Reduction of PCDDs/ PCDFs contamination in environment and products. | MOE                     | MNRE<br>M-IND<br>MOPH<br>MOAC              | 2008-2012      | 1,215,000\$                  | GEF and<br>Bilateral agreement |

| Priorities<br>(Objectives)                                       | Activities                                                                                                           | Success<br>Indicator                                      | Responsible Authorities |                                          | Time<br>Period | Estimated<br>Budget<br>(USD) | Source of Funding              |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------|------------------------------------------|----------------|------------------------------|--------------------------------|
|                                                                  |                                                                                                                      |                                                           | Main                    | Supporting                               |                |                              |                                |
|                                                                  |                                                                                                                      |                                                           |                         | OPM (TRF)<br>NRCT                        |                |                              |                                |
| <b>GOAL 6: BAT/BEP is applied by Thai industries by 2012</b>     |                                                                                                                      |                                                           |                         |                                          |                |                              |                                |
| 6) Implement BAT/BEP for reduction or elimination of PCDDs/PCDFs | 6.1 Promote the use of BAT/BEP in new industries which are the potential sources of PCDDs/PCDFs emission.            | -Reduction or elimination of PCDDs/PCDFs emission         | MNRE<br>M-IND           | MFA<br>MOI<br>BMA<br>MOPH<br>MOE<br>ONAB | 2008-2012      | 400,000\$                    | GEF and<br>Bilateral agreement |
|                                                                  | 6.2 Incentive and honour award granted for enterprises that use BAT/BEP to reduce or eliminate PCDDs/PCDFs emission. | -number of industries applying BAT/BEP                    | MNRE                    | OPM<br>MICT                              | 2008-2012      | 67,500\$                     | Thai Government                |
|                                                                  | 6.3 Training workshop on BAT/BEP to relevant industries of potential sources of PCDDs/ PCDFs emission.               | -number of trainings/<br>workshops<br>-number of trainees | MNRE                    | MFA<br>MOE<br>M-IND<br>MOL               | 2008-2010      | 71,500\$                     | GEF and<br>Bilateral agreement |
|                                                                  | 6.4 Develop pilot project on the use of alternative                                                                  | -number of industries participating in                    | M-IND<br>NNRE           | MOE                                      | 2008-2012      | 1,894,250\$                  | GEF and<br>Bilateral agreement |

| Priorities<br>(Objectives)                                                                                                                                         | Activities                                                                                                                                       | Success<br>Indicator                                                                     | Responsible Authorities |                                   | Time<br>Period | Estimated<br>Budget<br>(USD) | Source of Funding |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------|-----------------------------------|----------------|------------------------------|-------------------|
|                                                                                                                                                                    |                                                                                                                                                  |                                                                                          | Main                    | Supporting                        |                |                              |                   |
|                                                                                                                                                                    | chemicals<br>substituting<br>elemental chlorine<br>in major industries                                                                           | the pilot project                                                                        |                         |                                   |                |                              |                   |
| 7. Development<br>of sub-Action<br>plan for good<br>practice and<br>management of<br>PCDDs/PCDFs<br>' waste disposal<br>in landfill,<br>sewage and<br>incineration | 7.1 Implementation on<br>good manufacturing<br>practice for<br>PCDDs/PCDFs' waste<br>management.                                                 | -Reduction or<br>elimination of<br>PCDDs/PCDFs<br>emission.                              | M-IND<br>MNRE           | MOI<br>BMA<br>MOPH<br>ONAB        | 2008-2012      | 135,000\$                    | Thai Government   |
|                                                                                                                                                                    | 7.2 Training workshop<br>on disposal and<br>management of<br>PCDDs/PCDFs' waste<br>in all source categories                                      | -number of<br>trainings/<br>workshops<br>-number of<br>trainees                          | M-IND<br>MNRE           | MOE<br>MOI<br>BMA                 | 2007-2009      | 41,000\$                     | Thai Government   |
| <b>GOAL 7: Law and regulations prescribing PCDDs/PCDFs emission standards are set up for all sources categories by 2012</b>                                        |                                                                                                                                                  |                                                                                          |                         |                                   |                |                              |                   |
| 8) Revise and<br>update the<br>existing<br>legislations as<br>well as<br>establishing<br>new legislations                                                          | 8.1 Amendment of<br>legislations and<br>regulations to include<br>standard allowance<br>for PCDDs/PCDFs<br>emission from source<br>categories to | -Effectiveness<br>of enforcement<br>and reduced<br>number of<br>violation to the<br>laws | MNRE<br>M-IND           | MFA<br>OPM<br>MOPH<br>MOAC<br>MOI | 2008-2010      | -                            | Thai Government   |

| Priorities<br>(Objectives)                                                                                               | Activities                                                                   | Success<br>Indicator                                      | Responsible Authorities |             | Time<br>Period | Estimated<br>Budget<br>(USD) | Source of Funding |
|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------|-------------|----------------|------------------------------|-------------------|
|                                                                                                                          |                                                                              |                                                           | Main                    | Supporting  |                |                              |                   |
| to include all potential enterprises that have unintentional product of PCDDs/PCDFs from the process, product and waste. | environment and food products.                                               |                                                           |                         | BMA<br>ONAB |                |                              |                   |
|                                                                                                                          | 8.2 Training workshop on legislation and regulation on PCDDs/PCDFs emission. | -number of trainings/<br>workshops<br>-number of trainees | MNRE<br>M-IND           |             | 2008-2010      | 99,000\$                     | Thai Government   |

**3.6.4 Action Plans on Socio Economic Analysis due to uses of POPs**

| Priorities                                                                        | Activities                                                                                                                                                                                                                                                                             | Success Indicator                                       | Responsible Authorities |                                                     | Time period | Estimated Budget (USD) | Source of Funding              |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------|-----------------------------------------------------|-------------|------------------------|--------------------------------|
|                                                                                   |                                                                                                                                                                                                                                                                                        |                                                         | Main authorities        | Supporting authorities                              |             |                        |                                |
| GOAL : Research on Socio-Economic due to POPs uses are available by 2009          |                                                                                                                                                                                                                                                                                        |                                                         |                         |                                                     |             |                        |                                |
| 1.Establishment of Research Programs on the Area of Socio-Economic Analysis (SEA) | 1.1 Training the trainers on SEA and its assessments on options and measures of POPs reduction and eliminations                                                                                                                                                                        | Numbers of potential attendant and capacity of trainers | MNRE                    | MOPH<br>OPM (TRF)<br>NRTC<br>TDRI<br>Private sector | 2008        | 2,000,000\$            | GEF and<br>Bilateral agreement |
|                                                                                   | 1.2 Research areas on BAT and its investment costs and returns on options of dioxins reductions for major emission sources:<br><br>- Backyard household waste burning,<br><br>- Waste incineration,<br><br>- Open-field agricultural residual waste burning,<br><br>- Crematoria, etc. | -numbers of published research produced                 | MNRE                    | OPM (TRF)<br>NRTC                                   | 2008-2009   | 7,000,000\$            | GEF and<br>Bilateral agreement |

| Priorities | Activities                                                                                        | Success Indicator                       | Responsible Authorities |                        | Time period | Estimated Budget (USD) | Source of Funding              |
|------------|---------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------|------------------------|-------------|------------------------|--------------------------------|
|            |                                                                                                   |                                         | Main authorities        | Supporting authorities |             |                        |                                |
|            | 1.3 Research on cost comparisons of elimination options of stockpiles of POPs pesticides and PCBs | -numbers of published research produced | MNRE<br>M-IND           | OPM (TRF)<br>NRTC      | 2008-2009   | 1,000,000\$            | GEF and<br>Bilateral agreement |

**Remark :****Criteria for considering main and supporting authorities:****Main authorities :**

1. Authorities responsible for this particular issue in accordance with law assigned to them
2. Authorities conducting lots of programmes relating this particular issue

**Supporting authorities:**

1. Authorities participating in these issues but are not the main authorities
2. Authorities that are interested in joining the projects

**Functions:**

**Main authorities** coordinating with relevant authorities for the implementation of NIP

**Supporting authorities** collaborating with main authorities upon request, attending the meetings, workshops, consultations etc.

### 3.6.5 Forecasted budget for the implementation of NIP

| Activities                                                      | Grand total       |                | GEF Funding       |               | Thai government  |              |
|-----------------------------------------------------------------|-------------------|----------------|-------------------|---------------|------------------|--------------|
|                                                                 | USD               | %              | USD               | %             | USD              | %            |
| Action plans on POPs-pesticides                                 | 1,350,000         | 1.45%          | 550,000           | 41.00%        | 800,000          | 59.00%       |
| Action plans on POPs-PCBs                                       | 1,160,500         | 1.25%          | 874,500           | 75.00%        | 286,000          | 25.00%       |
| Action plans on POPs-PCDDs/PCDFs                                | 80,265,080        | 86.52%         | 76,695,130        | 96.00%        | 3,569,950        | 4.00%        |
| Action plans on socio-economic analysis due to the uses of POPs | 10,000,000        | 10.78%         | 10,000,000        | 100.00%       | 0                | 0.00%        |
| <b>Total</b>                                                    | <b>92,775,580</b> | <b>100.00%</b> | <b>88,119,630</b> | <b>94.98%</b> | <b>4,655,950</b> | <b>5.02%</b> |

**Annex A List of Abbreviations**

| <b>Abbreviation</b> | <b>Full name</b>                                           |
|---------------------|------------------------------------------------------------|
| 1 BMA               | Bangkok Metropolitan Administration                        |
| 2 COP               | The Conference of the Parties                              |
| 3 CULTURE           | Ministry of Culture                                        |
| 4 FAO               | Food and Agriculture Organization of the United Nations    |
| 5 GEF               | Global Environment Facility                                |
| 6 IFCS              | Intergovernmental Forum on Chemical Safety                 |
| 7 ILO               | International Labour Organization                          |
| 8 MFA               | Ministry of Foreign Affairs                                |
| 9 MICT              | Ministry of Information and Communication Technology       |
| 10 M-IND            | Ministry of Industry                                       |
| 11 MNRE             | Ministry of Natural Resources and Environment              |
| 12 MOAC             | Ministry of Agriculture and Cooperatives                   |
| 13 MOC              | Ministry of Commerce                                       |
| 14 MOE              | Ministry of Education                                      |
| 15 MOEN             | Ministry of Energy                                         |
| 16 MOF              | Ministry of Finance                                        |
| 17 MOI              | Ministry of Interior                                       |
| 18 MOL              | Ministry of Labour                                         |
| 19 MOPH             | Ministry of Public Health                                  |
| 20 MOT              | Ministry of Transport                                      |
| 21 NGO              | Non-Governmental Organization                              |
| 22 NIP              | National Implementation Plan                               |
| 23 Non-OECD         | Non-Organization for Economic Co-operation and Development |
| 24 NRCT             | The National Research Council of Thailand                  |
| 25 OECD             | Organization for Economic Co-operation and Development     |
| 26 ONAB             | Office of National Buddhism                                |
| 27 OPM              | Office of the Prime Minister                               |

| Abbreviation |        | Full name                                             |
|--------------|--------|-------------------------------------------------------|
| 28           | POPs   | Persistent Organic Pollutants                         |
| 29           | PRTR   | Pollutant Releases and Transfer Register              |
| 30           | TDRI   | The Thailand Development Research Institute           |
| 31           | THA    | Thai Hotels Association                               |
| 32           | TICA   | Thailand International Development Cooperation Agency |
| 33           | UNEP   | United Nations Environment Programme                  |
| 34           | UNIDO  | United Nations Industry Development Programme         |
| 35           | UNITAR | United Nations Institute for Training and Research    |
| 36           | WHO    | World Health Organization                             |

## **Annex B Available Reports and Papers Addressing POPs Management**

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( <http://www.helcom.fi/pollution.hazardous/html> )

PCB Inventory form (<http://www.pops.int/documents/guidance/>)

PCB Transformers and Capacitors – From Management to Reclassification and Disposal  
(<http://www.chem.unep.ch/pops/pdf/PCBtranscap/pdf>)

PCB transformer and capacitor survey and inspection guideline, The Provincial Electricity Authority of Thailand, 1993

Pollution Control Department, 2004

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Power transformers (TIS.384-2000), Thai Industrial Standard Institute, Ministry of Industry, 2000

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Standard for capacitors for use in tubular fluorescent and other discharge lamp circuits (TIS.191-1988), Thai Industrial Standard Institute, Ministry of Industry, 1988.

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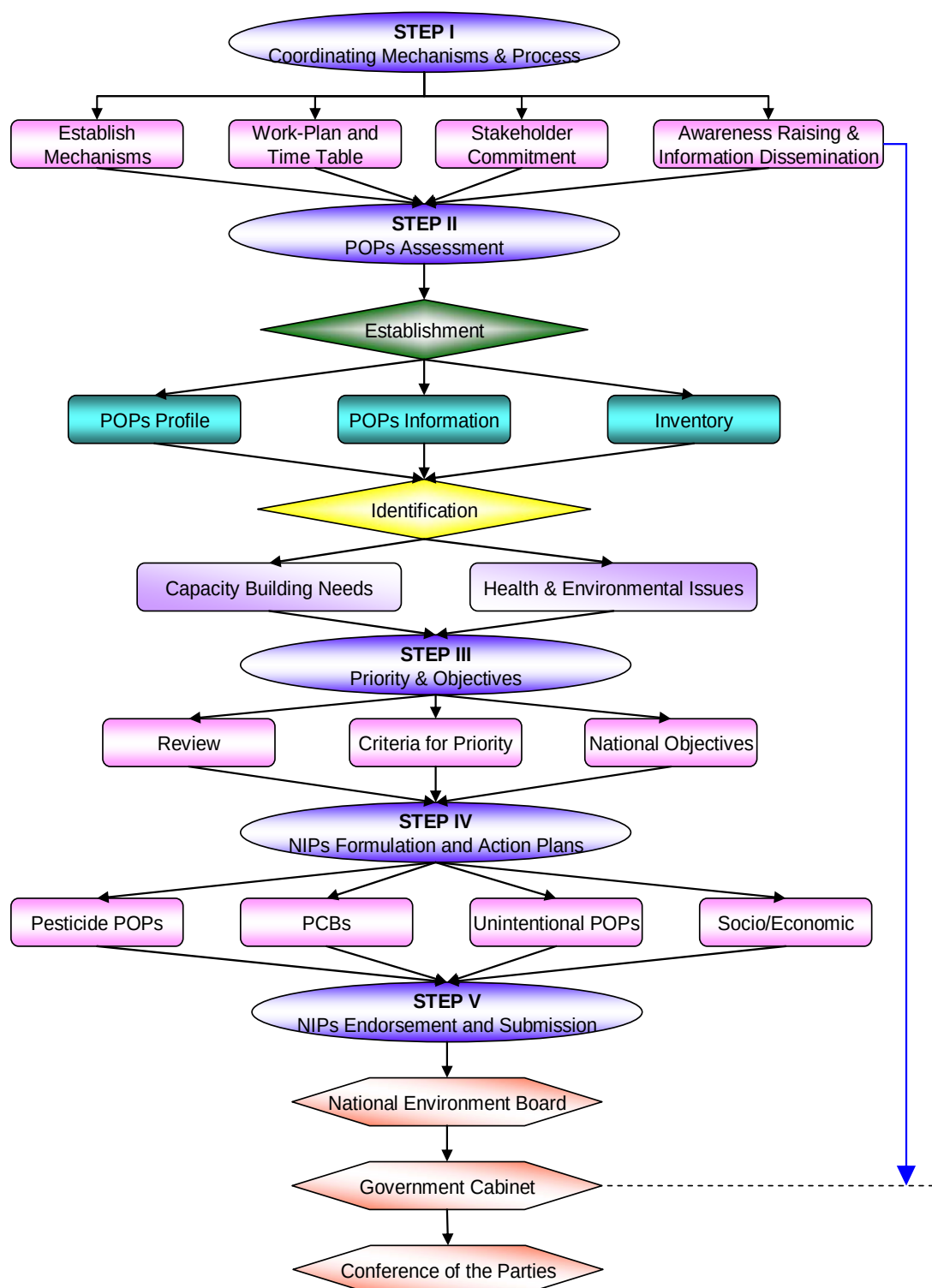
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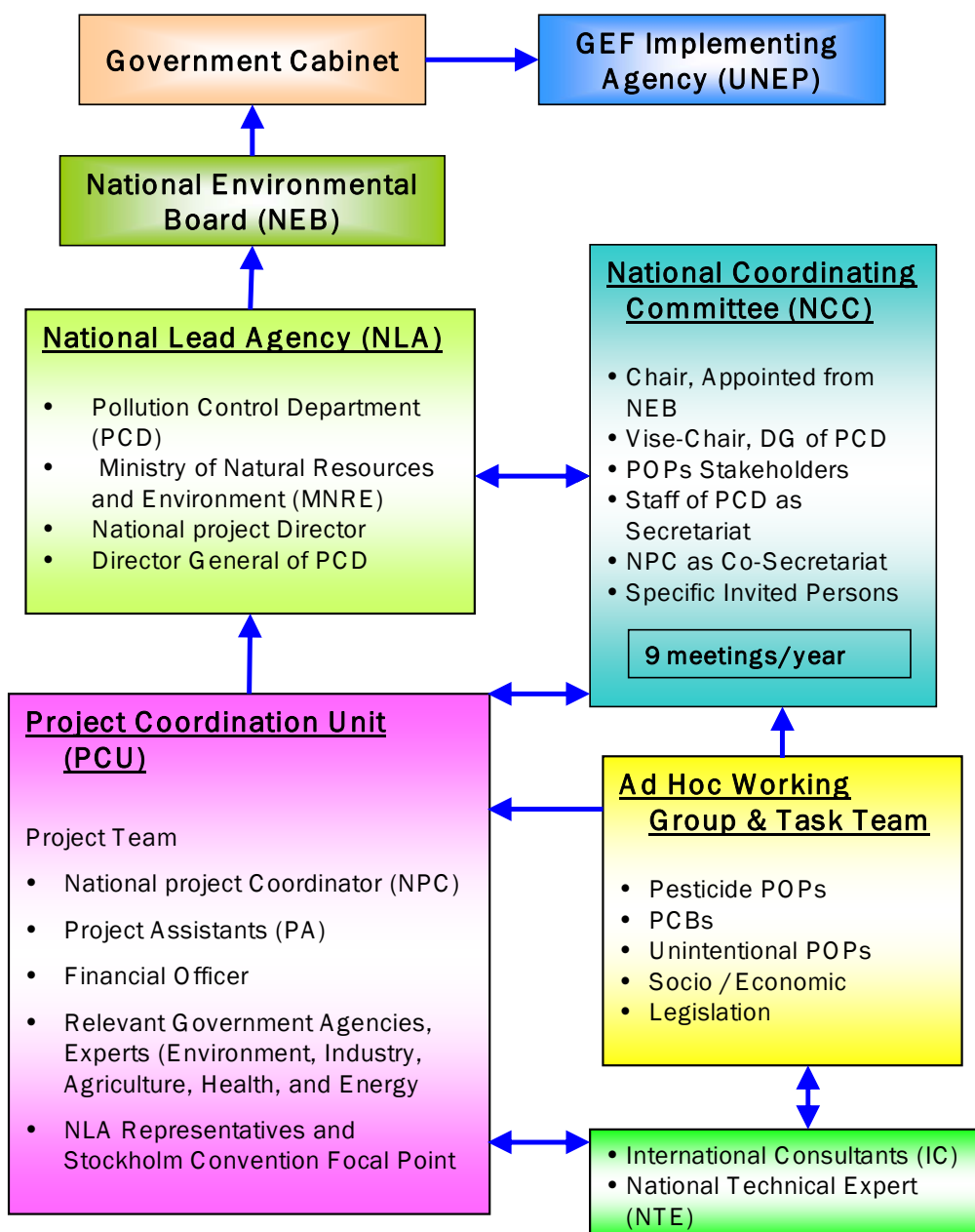
## Annex C Coordinating Mechanism and Process



## Overall Project Plan

[illegible]

## Annex D Project Management Structure



## Annex E Key individuals and Organizations

### National Coordination Committee (NCC)

| Names                                                                                        | Positions            | Organizations                                                                                                                 |
|----------------------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------|
| 1. Dr. Vichien Keeratinijakal                                                                | Chairman             | Department of Agronomy<br>Faculty of Agriculture<br>Kasetsart University<br>50 Phahon Yothin Rd., Chatuchak,<br>Bangkok 10900 |
| 2. Director General of Pollution Control Department                                          | Vice-Chairman        | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd., Phayathai Bangkok 10400                             |
| 3. Director of Waste and Hazardous Substance Management Bureau, Pollution Control Department | Secretary            | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd., Phayathai Bangkok 10400                             |
| 4. Dr. Jarupong Boon-Long                                                                    | Co-Secretary         | 2/195 Muangthong 1, Jangwatana<br>Soi Chienkam Mai, Laksi Bangkok 10210                                                       |
| 5. Officers of Waste and Hazardous Substance Management Bureau, Pollution Control Department | Secretary assistance | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd., Phayathai Bangkok 10400                             |
| 6. Director General of Department of Industrial Works or representatives                     | Member               | Department of Industrial Works<br>75/6 Rama VI Rd., Ratchathewi, Bangkok 10400                                                |
| 7. Director General of Department of Agriculture or representatives                          | Member               | Department of Agriculture<br>Phahon Yothin Rd., Chatuchak, Bangkok 10900                                                      |
| 8. Director General of Department of Health or representatives                               | Member               | Department of Health<br>Tiwanond Rd., Amphoe Muang, Nonthaburi 11000                                                          |
| 9. Director General of the Customs Department or representatives                             | Member               | The Customs Department<br>Sunthornkosa Rd., Khlong Toey, Bangkok 10110                                                        |
| 10. Director General of Department of International Organizations or representatives         | Member               | Department of International Organizations<br>Sri Ayudhya Rd., Bangkok 10400                                                   |
| 11. Director General of Department of Treaties and Legal Affairs or representatives          | Member               | Department of Treaties and Legal Affairs<br>Sri Ayudhya Rd., Bangkok 10400                                                    |
| 12. Director General of Department of Foreign Trade or representatives                       | Member               | Department of Foreign Trade<br>44/100 Sanum Bin Nam-Nonthaburi Rd.,<br>Muang District, Nonthaburi 11000                       |

| <b>Names</b>                                                                                                | <b>Positions</b> | <b>Organizations</b>                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 13. Director General of Environmental Quality Promotion or representatives                                  | Member           | Department of Environmental Quality Promotion 49 Rama VI, Soi 30, Rama VI Rd., Bangkok 10400                                                |
| 14. Secretary General of Food and Drug Administration or representatives                                    | Member           | The Food and Drug Administration Tiwanond Rd., Amphoe Muang, Nonthaburi 11000                                                               |
| 15. Director of Office of International Cooperation on Natural Resources and Environment or representatives | Member           | Office of International Cooperation On Natural Resources and Environment 92 Soi Phahon Yothin 7 Phahon Yothin Rd., Phayathai Bangkok 10400  |
| 16. Chair of The Federation of Thai Industry or representatives                                             | Member           | The Federation of Thai Industry 4th floor Zone C Queen Sirikit National Convention Center 60 New Rachadapisek Rd., Klongtoey, Bangkok 10110 |
| 17. Director General of Department of Local Administration or representatives                               | Member           | Department of Local Administration Wang Suansunantha, Rajasima Rd., Dusit Bangkok 10300                                                     |
| 18. Governor of Bangkok Metropolitan Administration or representatives                                      | Member           | Bangkok Metropolitan Administration 173 Dinso Rd., Phra Nakhon District Bangkok 10200                                                       |
| 19. Secretary General of the Office of National Economic and Social Development Board or representatives    | Member           | Office of National Economic and Social Development Board 962 Krung Kasem Rd., Bangkok 10110                                                 |
| 20. Director of the Bureau of the Budget or representatives                                                 | Member           | The Bureau of the Budget Rama VI Rd., Bangkok 10400                                                                                         |
| 21. Governor The Industrial Estate Authority of Thailand or representatives                                 | Member           | The Industrial Estate Authority of Thailand 618 Nikhom Makksasan Rd., Makkasam, Ratchathevi, Bangkok 10400                                  |
| 22. Mr. Bhinyo Panijpan                                                                                     | Member           | Mahidol University Rama VI Rd., Phayathai, Bangkok 10400                                                                                    |

## Task Team Members and their Functions

### Member of the Pesticide Inventory Working Group

- |                                                                         |                         |
|-------------------------------------------------------------------------|-------------------------|
| 1. Director General of Department of Agriculture                        | Chairperson             |
| 2. Representative of Food and Drug Administration                       | member                  |
| 3. Representative of Customs Department                                 | member                  |
| 4. Representative of Department of Health                               | member                  |
| 5. Representative of Pollution Control Department                       | member                  |
| 6. Dr. Nuansri Tayapatch                                                | member                  |
| 7. Representative of Waste and Hazardous Substance<br>Management Bureau | member and secretary    |
| 8. Representative of Department of Agriculture                          | member and co-secretary |

### Functions

1. Review and evaluate mechanisms and the impact of the use of pesticides
2. Review plans and strategies for management of pesticides
3. Review and recommend on the national pesticide inventory procedure
4. Review regulations and practices related to the control of pesticides
5. Carry out other functions assigned by the National Coordination Committee

**Member of PCBs Inventory Working Group**

|                                                                        |                         |
|------------------------------------------------------------------------|-------------------------|
| 1. Director General of Department of Industrial Works                  | Chairperson             |
| 2. Representative of Department of Health                              | member                  |
| 3. Representative of Department of Environmental Quality and Promotion | member                  |
| 4. Representative of Pollution Control Department                      | member                  |
| 5. Representative of Electrical Generating Authority of Thailand       | member                  |
| 6. Representative of Metropolitan Electrical Authority                 | member                  |
| 7. Representative of Provincial Electrical Authority                   | member                  |
| 8. Representative of Federation of Thai Industry                       | member                  |
| 9. Mrs. Somsri Suwanjarus                                              | member                  |
| 10. Mr. Phromphron Isarakura Na Ayutthaya                              | member                  |
| 11. Representative of Waste and Hazardous Substance Mgt Bureau         | member and secretary    |
| 12. Representative of Department of Industrial Works                   | member and co-secretary |

**Functions**

1. Review and evaluate mechanisms and the impact of the use of PCBs
2. Review plans and strategies for management of PCBs
3. Review and recommend on the national PCBs inventory procedure
4. Review regulations and practices related to the control of PCBs
5. Carry out other functions assigned by the National Coordination Committee

**Member of the Unintentional POPs Inventory Working Group**

|                                                                |                      |
|----------------------------------------------------------------|----------------------|
| 1. Director General of Pollution Control Department            | Chairperson          |
| 2. Representative of Department of Industrial Works            | member               |
| 3. Representative of Department of Health                      | member               |
| 4. Representative of Department of Local Administration        | member               |
| 5. Representative of Department of Agriculture                 | member               |
| 6. Representative of Bangkok Metropolitan Administration       | member               |
| 7. Representative of Federation of Thai Industry               | member               |
| 8. Representative of Industrial Estate Authority of Thailand   | member               |
| 9. Associate Professor Dr. Chalengkwan Tangbanluekal           | member               |
| 10. Representative of Waste and Hazardous Substance Mgt Bureau | member and secretary |

**Functions**

1. Review and evaluate mechanisms and the impact of the use of unintentional POPs
2. Review plans and strategies for management of unintentional POPs
3. Review and recommend on the national unintentional POPs inventory procedure
4. Review regulations and practices related to the control of unintentional POPs
5. Carry out other functions assigned by the National Coordination Committee

**Member of the Socio-Economic Analysis Working Group**

- |                                                                                   |                         |
|-----------------------------------------------------------------------------------|-------------------------|
| 1. Secretariat of the National Economic and Social Development Board              | Chairperson             |
| 2. Representative of Bureau of Budget                                             | member                  |
| 3. Representative of Food and Drug Administration                                 | member                  |
| 4. Representative of Department of Environmental Quality and Promotion            | member                  |
| 5. Representative of Department of Foreign Trade                                  | member                  |
| 6. Representative of Federation of Thai Industry                                  | member                  |
| 7. Representative of Office of Agricultural Economics                             | member                  |
| 8. Representative of Office of Industrial Economics                               | member                  |
| 9. Representative of Department of Social Development and Welfare                 | member                  |
| 10. Associate Professor Dr. Sophon Khanti-Akom                                    | member                  |
| 11. Representative of Waste and Hazardous Substance Mgt Bureau                    | member and secretary    |
| 12. Representative of Office of National Economic<br>and Social Development Board | member and co-secretary |

**Functions**

1. Review the development of data and mechanisms applied for a socio-economic analysis caused by the used of POPs
2. Recommend on guideline of socio-economic analysis in relation to the used of POPs
3. Evaluate the least impact alternative caused by the used of POPs
4. Carry out other functions assigned by the National Coordination Committee

## Consultants and Experts

| Names                     | Positions                                                                                                                                     | Organizations                                                                                                                                                                                                                                                             |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Dr. Jarupong Boon-Long | Project Manager,<br>NIP/POPs                                                                                                                  | 2/195 Muangthong 1, Jangwatana<br>Soi Chienkam Mai, Laksi Bangkok<br>10210                                                                                                                                                                                                |
| 2. Dr. Jan Betlem         | International<br>Consultant (IC)<br>Pesticide and<br>Obsolete (POPs<br>Stock)                                                                 | Tielsestraat 18<br>4043 JS Opheusden the Netherlands<br>e-mail: <a href="mailto:jlb@tauw.nl">jlb@tauw.nl</a>                                                                                                                                                              |
| 3. Dr. Jacques Ehrestmann | International<br>Consultant (IC)<br>PCBs Inventory<br>Development and<br>Disposal Options                                                     | Aptechnologies<br>35, Route des Jeunes<br>122 Geneva, Switzerland<br>Tel. + 41 22 342 71 44<br>Fax. + 41 22 342 58 18<br>e-mail: <a href="mailto:ehrestmann@swissonline.ch">ehrestmann@swissonline.ch</a>                                                                 |
| 4. Dr. Ulrich Quass       | International<br>Consultant (IC)<br>Inventory<br>Development for<br>Sources and<br>Releases of<br>PCDDs/PCDFs<br>Production and<br>Estimation | Muller-BBM GmbH<br>Am Bugapark 1<br>D-45899 Gelsenkirchen<br>Tel. + 49-(209)-983 08-0<br>Fax. + 49-(209)-983-08-11<br>e-mail: <a href="mailto:Quass@MuellerBBM.de">Quass@MuellerBBM.de</a>                                                                                |
| 5. Dr. Ute Karl           | International<br>Consultant (IC)<br>Best Available<br>Techniques<br>(BAT) and Best<br>Environmental<br>Practices (BEP)                        | European Institute for Energy<br>Research ElFER, University of<br>Karlsruhe (th), Germany c/o<br>KARL, UTE Emmy-Noether-Str. 11,<br>D-76133 Karlsruhe<br>Tel. +49 721 6105 1335<br>Fax. +49 721 6105 1332<br>e-mail; <a href="mailto:ukarl@eifer.org">ukarl@eifer.org</a> |
| 6. Mr. Craig Boljkovac    | International<br>Consultant (IC)<br>on Formulation of<br>National<br>Implementation<br>Plan                                                   | United Nations Institute for Training<br>and Research (UNITAR)<br>Palais des Nations<br>CH-1211 Geneva 10<br>Switzerland<br>Tel : +41 22 917 8524<br>Fax : +41 22 917 8047                                                                                                |
| 7. Mr. Brandon Turner     | International<br>Consultant (IC)<br>on Formulation of<br>National<br>Implementation<br>Plan                                                   | United Nations Institute for Training<br>and Research (UNITAR)<br>Palais des Nations<br>CH-1211 Geneva 10<br>Switzerland<br>Tel : +41 22 917 8524<br>Fax : +41 22 917 8047                                                                                                |
| 8. Dr. Nuansri Tayaputh   | National<br>Technical Expert<br>(NTE)<br>Assessment of                                                                                        | 8/42 Soi Tanpuying pahol<br>Ngamwongwan Rd,<br>Bangkok 10900                                                                                                                                                                                                              |

| Names                                     | Positions                                                                            | Organizations                                                                                                                           |
|-------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
|                                           | POPs Pesticides Production and Use                                                   |                                                                                                                                         |
| 9. Dr. Chalongkwan Tangbanluekal          | National Technical Expert (NTE)<br>Assessment of Unintentional Produced POPs         | Department of Pathology<br>Faculty of Medicine, Ramathibodi Hospital<br>Mahidol University<br>270 Rama VI Road, Rajthevee Bangkok 10400 |
| 10. Dr. Sophon Khanti Arkom               | National Technical Expert (NTE) Socio-Economic Analysis of POPs Use and Alternatives | 91/27 Sukhumvit 101<br>Bangjak, Phakanong<br>Bangkok 10260                                                                              |
| 11. Mrs Somsri Suwanjaras                 | National Technical Expert (NTE)<br>Assessment of Polychlorinated Biphenyls (PCBs)    | Department of Industrial Works<br>75/6 Rama VI Rd., Ratchathewi, Bangkok 10400                                                          |
| 12. Mr. Phromphron Isarakura Na Ayutthaya | National Technical Expert (NTE)<br>Assessment of Polychlorinated Biphenyls (PCBs)    | 2/301 Magmai (Watcharapol) Village, Soi Watcharapol, Ram-Indra Road, Say-Mai District, Bangkok 10220                                    |

## Staff of Pollution Control Department

| Names                              | Positions                                                      | Organizations                                                                                        |
|------------------------------------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 1. Mr. Apichai Chvajarernpun       | Director General                                               | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 2. Mr. Adisak Thongkaimook         | Deputy Director General                                        | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 3. Dr. Supat Wangwongwatane        | Deputy Director General                                        | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 4. Mrs. Sunee Piyapanpong          | Director of Waste & Hazardous Substance Management Bureau, PCD | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 5. Ms. Pornpimon Chareonsong       | Director of Hazardous Substance Management Sub-division, PCD   | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 6. Mr. Manop Boonjam               | Environmental Scientist                                        | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 7. Mr. Manorat Rittem              | Environmental Scientist                                        | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 8. Ms. Benchawan Chokchaitrakulpho | Environmental Scientist                                        | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 9. Ms. Nuchida Rungthawornwong     | Environmental Scientist                                        | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 10. Mr. Sirigun Pechklang          | Technical Assistant                                            | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 11. Mr. Krisada Ongart             | Technical Assistant                                            | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 12. Ms. Chariya Kongcharoen        | Technical Assistant                                            | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 13. Ms. Parichat Thaweethin        | Technical Assistant                                            | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 14. Mr. Thanapan Pathanth          | Technical Assistant                                            | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |

| <b>Names</b>                   | <b>Positions</b>     | <b>Organizations</b>                                                                                 |
|--------------------------------|----------------------|------------------------------------------------------------------------------------------------------|
| 15. Ms. Suwalak Yaonoon        | Technical Assistant  | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |
| 16. Mrs. Pornthip Chunsiripong | Department Secretary | Pollution Control Department<br>92 Soi Phahon Yothin 7 Phahon Yothin Rd.,<br>Phayathai Bangkok 10400 |

**Annex F List of POPs Meetings, Seminars, Workshops and Trainings**

1. Broad-Based Stakeholder Inception Workshop on National Implementation Plan POPs Thailand, Royal Hill Resort, Nakhon Nayok, 16<sup>th</sup> -18<sup>th</sup> May 2004
2. Seminar on “ Impacts of the Stockholm Convention on POPs on Industries”, Thailand, The Federation of Thai-Industry, Bangkok 4<sup>th</sup> August 2004
3. Second Workshop / meeting “ Implementation of the Project Work Plan” Royal Hill Resort, Nakhon Nayok, 16<sup>th</sup> October 2004
4. 2<sup>nd</sup> Workshop on Awareness Raising on POPs, Royal Hill Resort, 17<sup>th</sup> October 2004
5. PCBs Inventory Workshop, PCD’s Building, Bangkok, 11<sup>th</sup> -12<sup>th</sup> November 2004
6. Training on POPs Pesticides Inventory, PCD’s Building, Bangkok, 26<sup>th</sup> -30<sup>th</sup> November and 1<sup>st</sup> December, 2004
7. Workshop / Training on the Establishing of Preliminary Unintentional POPs Inventory, Pollution Control Department, 7<sup>th</sup> -8<sup>th</sup> January 2005
8. Meeting “ Review of the National Profile for POPs Management”, Mountain View Resort (Khon Yai), Nakornrajchasma, Thailand, 25<sup>th</sup> -27<sup>th</sup> February 2005
9. Training on Draft BAT/BEF Guideline, PCD’s Building, Bangkok, 1-2 March 2005
10. Training/Seminar /Workshop on Chemical Information Network and POPs Information System (IMFOMA: WebForm), Class training: Administration Dept. of Envi Quality Promotion Building, Bangkok, 25<sup>th</sup> March 2005
11. Training on “ Priority Assessment and Objective Setting”, Pollution Control Department’s Building, 29<sup>th</sup> June 2005
12. POPs Inventory Workshop, PCD’s Building, Bangkok, 8<sup>th</sup> July 2005
13. Seminar on Modification of Steel Plant to Reduce Pollution Problem, Siam City, Bangkok, 12 July 2005
14. POPs Priority and Objective Setting Workshop, PCD’s Building, 10 August 2005
15. National Implementation Plan Workshop, PCD’s Building, Bangkok, 25<sup>th</sup> -26<sup>th</sup> October 2005
16. Training in Cost/Benefit Analysis, PCD’s Building, 21<sup>st</sup> December 2005
17. Training Program for Woman can Children Group on POPs at Surin Province, 7<sup>th</sup> -9<sup>th</sup> April 2006
18. Wide-Opened Seminar/Workshop on the Draft Thailand NIPs, PCD’s Building, Bangkok, 19<sup>th</sup> July 2006

## References

1. Department of Agriculture, 2002-2006, A Policy and Master Plan of Agricultural Pesticides, Ministry of Agriculture and Cooperatives, ISBN: 974-436252-9.
2. Office of Permanent Secretary of the Ministry of Natural Resources and Environment, 2003, Policy and Strategy, MNRE.
3. Pollution Control Department, 2004, Thailand State of Pollution Report 2004.
4. Pollution Control Department, 2004, National Profile on POPs Management.
5. Pollution Control Department, 2005, Technical Report on POPs Management.
6. Tayaputch, N. 1988. Pesticide Residues in Thailand, Proceeding of the Southeast Asia Pesticide Management and Integrated Pest Management Workshop, Feb.23-27 Pataya, Thailand.
7. Tayaputch, N. 1990. Pesticides: environmental and health hazards in Thailand. Technical Report. National Epidemiology Board, Thailand.