NATIONAL IMPLEMENTATION PLAN

UNDER

THE STOCKHOLM CONVENTION

ON

PERSISTENT ORGANIC POLLUTANTS

(2007)

REPUBLIC OF SINGAPORE

EXECUTIVE SUMMARY

This National Implementation Plan has been developed by an inter-agency, multi-stakeholder Working Group chaired by the National Environment Agency.

The Stockholm Convention on Persistent Organic Pollutants (POPs) is an internationally legally binding agreement that seeks to reduce and ultimately eliminate the release of POPs into the environment. The aim of the Stockholm Convention on POPs is to protect the health of living organisms and the environment against the adverse effects of POPs. It was adopted in Stockholm, Sweden, on 23 May 2001 and came into force on 17 May 2004, 90 days after the ratification by the fiftieth country.

Singapore deposited its instrument of accession to the Stockholm Convention on 24 May 2005 and the Convention came into force for Singapore on 22 Aug 2005, 90 days after the deposition of the instrument of accession. As a Party to the Stockholm Convention, Singapore will take measures to eliminate or reduce the release of POPs into the environment. These measures apply to the import, export, use and disposal of POPs. In adopting measures to reduce and eliminate POPs, Singapore will also promote the use of the best available technologies and best environmental practices for replacing POPs.

Even before becoming a Party to the Stockholm Convention, Singapore has already taken steps to reduce and minimize harmful effects of POPs to protect our general population and our environment.

The 10 POPs viz aldrin, chlordane, DDT (1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane), dieldrin, endrin, heptachlor, mirex, toxaphene, hexachlorobenzene and PCBs (polychlorinated biphenyls) have been banned from import for use in Singapore since the mid-1980s.

Emissions of dioxins and furans from incineration facilities are regulated under the Environmental Pollution Control (Air Impurities) Regulations 2000. There are four refuse incinerators operated by the National Environment Agency (NEA). Over the past five years, the NEA has incorporated the latest pollution control technologies into these plants to reduce emissions of dioxins and furans to meet the national standards.

This National Implementation Plan (NIP) serves to inform the Conference of the Parties (COP) and the public on the steps, methods and approaches to be taken by Singapore in meeting her obligations under the Stockholm Convention. The submission date for the NIP for Singapore would be on 22 Aug 2007.

Having implemented all these measures, this NIP focuses on the development and implementation of POPs monitoring in Singapore, and includes activities related to research and development, awareness-raising and information dissemination.

In developing this NIP, the views and inputs of various stakeholders have been sought and included, where relevant, so as to maintain a balanced approach in the implementation of the various programmes under the Stockholm Convention.

GLOSSARY/ABBREVIATIONS

AVA	Agri-Food and Veterinary Authority
BAT	Best Available Techniques
BEP	Best Environmental Practices
COP	Conference of the Parties
DDT	1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane
EHD	Environmental Health Department
ENV	Ministry of the Environment
EPC	Environmental Pollution Control
EPCA	Environmental Pollution Control Act
ESEA	East and South East Asia
FSSD	Fire Safety & Shelter Department
GMP	POPs Global Monitoring Programme
HS	Hazardous Substances
IP	Incineration Plant
MEWR	Ministry of the Environment and Water Resources
MOM	Ministry of Manpower
MPA	Maritime and Port Authority
NEA	National Environment Agency
NIP	National Implementation Plan
NUS	National University of Singapore
NTU	Nanyang Technological University
PCD	Pollution Control Department
PCBs	Polychlorinated Biphenyls
PM10	Particulate Matter with diameter 10 micrometer and smaller
POPs	Persistent Organic Pollutants
PUB	Public Utilities Board
SCBB	Singapore Cord Blood Bank
SCDF	Singapore Civil Defence Force
SCIC	Singapore Chemical Industry Council
TEQ	Toxic Equivalent
TIW	Toxic Industrial Waste
UNIDO	United Nations Industrial Development Organisation
UNEP	United Nations Environment Programme

Table of Contents

List of Tables and Figures

CHAPTER 1 - INTRODUCTION

1.1 BACKGROUND

Persistent organic pollutants (POPs) are organic compounds that are able to withstand degradation or destruction by light, by biological processes or through chemical reactions. This allows them to remain in the environment for a long time after their release and, being semi-volatile, they can be transported over long distances through the atmospheres before settling down. Hence, they are often found in places far remote from the POPs sources, in remote desert regions and oceans and in the Arctic and Antarctic. Many of these compounds have been or will continue to be used in large quantities and, due to their environmental persistence, have the ability to bioaccumulate and biomagnify. Some of these compounds such as PCBs may persist in the environment for periods of years and may bioconcentrate by factors of up to 70,000 folds. Humans can be exposed to POPs through diet, workplace accidents and the environment (including indoor). Exposure to POPs, either acute or chronic, can be associated with a wide range of adverse health effects, including illness and death.

The Stockholm Convention was therefore adopted in 2001 in response to the urgent need for global action to protect human health and the environment from POPs. The Convention seeks to reduce and ultimately eliminate the production of and trade in eight pesticides (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene), two industrial chemicals (hexachlorobenzene and PCBs) and two by-products (dioxins and furans) of incineration processes.

Singapore became a Party to the Stockholm Convention on 24 May 2005 and the Convention came into force for Singapore on 22 Aug 2005, 90 days after the deposition of the instrument of accession. As a Party, Singapore is obliged to develop, within two years of the Convention entering into force, a National Implementation Plan describing the national situation in respect of the substances covered by the Convention and the strategies that have been developed to fulfill its obligations under the Convention.

This report presents the Singapore's National Implementation Plan (NIP). It covers the current status on the control of POPs within Singapore and the proposed actions to be taken to reduce and ultimately eliminate POPs release into the environment.

1.2 NIP PREPARATION

In Singapore, the National Environment Agency (NEA) is entrusted with taking the lead in the preparation of Singapore's NIP. The NEA's mission is to ensure a sustainable quality environment in Singapore. The NEA implements programmes to monitor, reduce and prevent environmental pollution, and to ensure high standard of public health.

To include the participation of stakeholders in the preparation of the NIP, a Working Group comprising members from the relevant government agencies, academia, industry and NGOs was formed. The Members in the Working Group are listed at **Annex A**.

1.3 STRUCTURE OF THE IMPLEMENTATION PLAN

The NIP is structured as follows:

(a) **Chapter 1**: Introduces the purpose and structure of this NIP, as well as outlines the methodology adopted to draft this report.

(b) **Chapter 2**: Presents Singapore's background information, general socio- demography, economy, environment and health.

(c) **Chapter 3**: Describes the current status of POPs in Singapore. This includes legislation governing control of chemicals and pesticides in Singapore, role of different government agencies and Ministries, the academia, industry and the NGOs in managing chemicals and pesticides and in health monitoring of the population. Existing monitoring programmes and research on POPs are also described.

(d) **Chapter 4**: Lists the strategies, actions and specific activities and programmes to be taken with regard to POPs reduction and elimination, and prioritises them. This addresses the monitoring of POPs and other actions to be taken to meet Singapore's obligations under the Stockholm Convention. This also includes processes for reviewing additional chemicals to be controlled under the Convention, and processes for reviewing and updating the NIP.

(e) **Chapter 5**: Conclusion of the NIP.

CHAPTER 2 – COUNTRY PROFILE

2.1 GEOGRAPHY AND CLIMATE

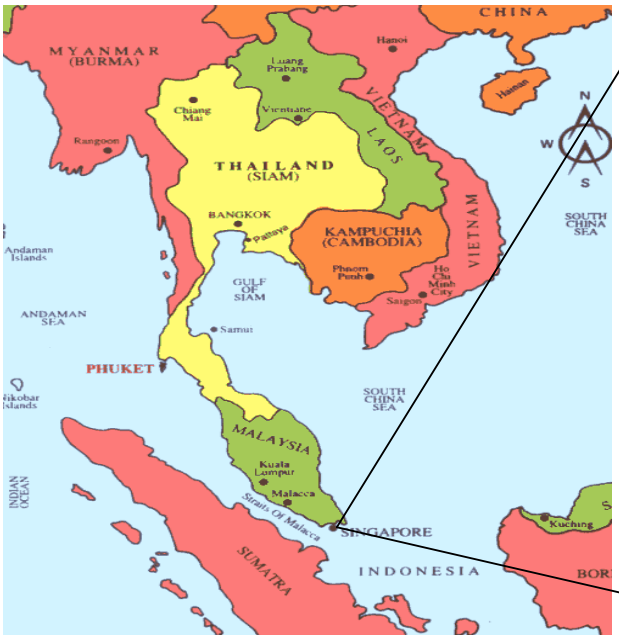

Figure 1: Geographical Location of Singapore

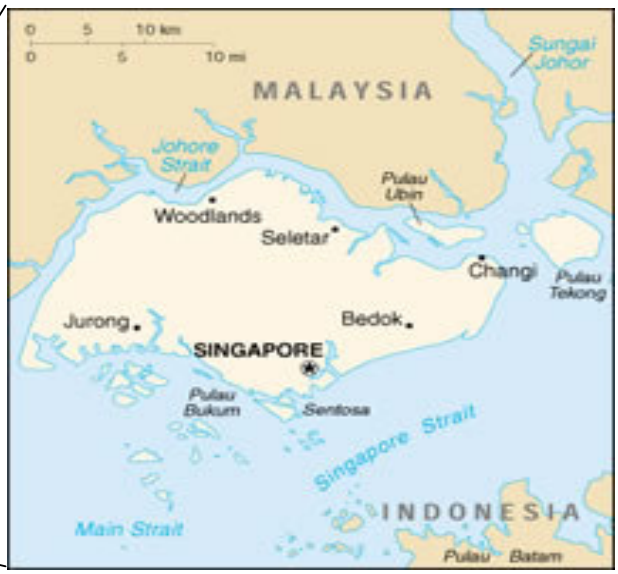

Figure 2: Geographical Map of Singapore

Singapore is a tropical island centered on latitude 1° 22'N, 103° 48'E, near the Equator. The island is approximately 704 sq km[1].

Being near the equator, Singapore experiences tropical climate, with relatively uniform temperature, high humidity and abundant rainfall. The climate of Singapore can be divided into two main seasons, the Northeast Monsoon and the Southwest Monsoon season, separated by two relatively short inter-monsoon periods[2]. The average daily temperatures range from 25 to 31°C. The relative humidity ranges from 70 to 80%. The country experiences the Northeast Monsoon during the months November through January and the Southwest Monsoon during the months June to October. The annual rainfall is 2,136 mm with more rains during the Northeast Monsoon period.

2.2 POPULATION STATISTICS

As of 2006, Singapore's population stood at 4,483,900[1]. Singapore has a high population density of 6,369 per sq km[1]. The Chinese forms 75.2% of the resident

[1] Statistics Singapore
[2] Meteorological Services Division, NEA

population, with the Malays and Indians forming 13.6% and 8.8% respectively. The remaining 2.4 % comprises Eurasians and people of other ethnic groups.

The main religions are Islam, Taoism, Buddhism, Christianity, Hinduism, Sikhism and Judaism. According to the 2000 census, the religious breakdown was as follows: Buddhists, 42.5%; Christians, 14.6%; Muslims, 13.9%; Taoists, 8.5%; Hindus, 4%; others (including Sikhs and Jews), 1.6%; while 14.9% identified themselves as followers of no religion.

There are four official languages in Singapore: Malay, Mandarin, Tamil and English. English is the language of business and administration, and is widely spoken and understood. Most Singaporeans are bilingual, and speak their mother tongue as well as English. Malay is the national language.

2.3 ECONOMY AND BUSINESS

2.3.1 The Port

The Port of Singapore has played a key role in Singapore's transformation into a global trading power. Due to its strategic location in the heart of Asia, the port has served as a gateway to major cities and regional markets, and it remains a focal point for some 200 shipping lines with links to more than 600 ports in over 120 countries worldwide.

On average, Singapore attracts some 140,000 vessel calls[3] annually. Besides efficient cargo handling, bunkering, oil refining, shipbuilding and ship repairing, the port is noted for its wide range of marine services including pilotage, towage, heavy lift services, offshore support, salvage work, fresh water supply, crew change, ship supplies and slop disposal, among others.

The Maritime and Port Authority of Singapore (MPA) is the regulatory body for the Republic's port and maritime affairs. It is also the champion agency tasked to further develop and promote Singapore's maritime services.

2.3.2 Industry

Before 1960, the Singapore economy depended on entreport trade. There were only a few small-scale industries. These included food and beverage, wood-working and rubber processing factories. Most of the companies were locally incorporated, catering to the home market.

In the 1960s, Singapore was a third world country with a GNP per capita of less than US$320[4]. Infrastructure was poor, there was little capital, and the handful of

[3] Maritime and Port Authority of Singapore
[4] Economic Development Board

industries produced only for domestic consumption. Low-end commerce was the mainstay of the economy, and there was little or no direct foreign investment.

To alleviate an unemployment problem and to promote economic growth, the government decided to develop industries on a large scale. New industrial estates were set up and tax incentives were granted to attract foreign investment, especially in the manufacturing industries. This attracted many foreign companies which set up factories, manufacturing textile, garments, electric appliances, paper and plastic products as well as wood-working industries.

In the 1970s, Singapore's industrial base widened. The products manufactured became more sophisticated and included electronics, oil and petroleum and transport equipment. With the achievement of full employment, Singapore embarked on a new phase in its development strategy. Government attempted to restructure the industrial base toward more capital and skill – intensive activities in order to produce high-value goods.

Foreign investments in high technology industries were encouraged. Enterprises that were already operating in Singapore were also offered incentives to upgrade the skill levels of their employees, to improve the technological level of new investments, and to increase automation.

Among the important modern industries that were further developed in the 1970s were the chemical, oil refining and pharmaceutical industries.

Another modern industry that required high technical skill was the making of electronic products, such as colour television sets, programmable calculators, car radios, cassette recorders, computer parts and other electric instruments. Yet another industry producing higher value goods was that making modern machinery and transport equipment. This included shipbuilding and construction of oil-rigs.

Singapore was so successful in this phase of industrialization that it became one of the largest oil refining centres and a major shipbuilding and repairing centre.

The 80s saw Singapore moving into knowledge-intensive activities such as research and development in biotechnology, engineering design, computer software services, microelectronics, aerospace industry, petrochemicals, pharmaceuticals, and manufacturing of computer peripherals, software packages and silicon wafers. Two major construction projects also took place – a petrochemical complex and a mass rapid transit system, both involving massive technology transfer.

By 1990, globalisation became the new target. Though Singapore still sought to attract foreign investments, especially in high value-added industries, the development of an external economy linked to the domestic economy was crucial to Singapore's economic competitiveness, and the concept of creating economic

space beyond Singapore was shaped. The idea was to get local companies and Singapore-based multinationals to participate in the region's growth by distributing resource-dependent operations to resource-rich countries.

As Singapore enters the new millennium, she consistently ranks among the world's top three oil trading locations and is recognised as a global leader in oil refining. With unwavering focus on relevant infrastructure, technology and a total-solutions approach - integrating innovation, manufacturing, regional distribution, marketing and other services - Singapore offers a cost-competitive and synergistic environment for some of the world's leading petroleum and petrochemicals, and specialty chemicals giants.

Singapore has made remarkable progress since the early 1960s. Some 7,000 multinational companies operate in Singapore, with about half having regional operations. Strong manufacturing and services sectors are the twin pillars of the economy, and there is a wide range of businesses, particularly in the higher value-adding activities.

2.3.3 Farming and Agriculture

Singapore is not an agricultural country. However, there are farms occupying some 765 hectares of land. These include layer farms for egg production, freshwater fish farms, marine fish farms, vegetable farms, goat and cattle farms, orchid and floriculture farms, and ornamental fish farms. In 2005, these farms generated a total of $224.6 million worth of produce. This produce comprises 378 million hen eggs, 5,916 tonnes of fish, 17,396 tonnes of food crops, 144 million aquarium fish, 12 million stalks of orchids and 36 million ornamental plants.

Nearly 95% of fresh fruits and vegetables are imported into Singapore from all over the world such as China, Indonesia, Malaysia, Thailand and USA. Only about 5% of the fresh vegetables are locally produced. To date, about 64 local farms produce fresh vegetables on a commercial scale.

2.4 ENVIRONMENTAL OVERVIEW

2.4.1 Air and Water Quality

In Singapore, power generation, manufacturing and transport are the main sectors that generate air pollutants.

The ambient air quality in Singapore is routinely monitored through the Telemetric Air Quality Monitoring and Management System (TAQMMS). The system, which comprises 13 remote air monitoring stations linked to a Central Control System (CCS) via dial-up telephone lines, provides an efficient means of obtaining air quality data.

Eleven of the air monitoring stations monitor ambient air quality and two stations measure roadside air quality. Automatic analysers and equipment are deployed at the stations to measure the concentrations of major air pollutants, such as sulphur dioxide, oxides of nitrogen, carbon monoxide, ozone and respirable suspended particulate matter 10 micrometer and below in diameter (PM10).

Singapore has consistently maintained a high air quality standard through setting stringent emission standards, promoting energy efficiency and using energy sources such as natural gas that emit lower levels of pollutants. As a result, the concentrations of major air pollutants (sulphur dioxide, nitrogen oxides, carbon monoxide, ozone, and PM10) meet the United States Environmental Protection Agency (USEPA) Ambient Air Standards.

Water is a scarce and precious resource. With an ever-increasing demand for water, Singapore has to make every drop of water count. Rainwater that falls within the catchment areas is collected in reservoirs. Today, about half of Singapore is being utilised as catchments for rainwater collection. With new projects to build more reservoirs, drains and canals, local catchments will be expanded to about two-thirds of the island. In addition to existing local sources, desalinated water has been supplied by the private sector since 2005. To multiply every drop, NEWater, which is high-grade water obtained from water reclamation, was introduced in 2003. NEA carries out regular monitoring of inland waters. The water quality of our inland waters remains good and is able to support aquatic life.

2.4.2 Solid Waste Management

With limited land available for waste disposal, NEA's policy for solid waste management necessitates the reduction of volume of waste by incineration. Incineration reduces the volume of wastes by 90%. All incinerable wastes that are not recovered, reused or recycled are incinerated while the remaining wastes such as sludge, silt, shipyard waste, construction waste and incineration ashes, are disposed of at the offshore Semakau Landfill. The Semakau landfill is specially designed and constructed with protected impermeable linings and leachate treatment systems. The ratio of refuse incinerated to landfilled waste is about 90:10.

Besides incineration and landfilling of waste, a parallel policy of waste minimisation is gradually proving to be an important part of the overall solid waste management programme and provides us with a sustainable solution to cope with the increasing amount of wastes disposed every year. Waste minimization was actively promoted in all sectors of the industry and community to accommodate land constraints and offset the rising costs of waste disposal. The following strategies are implemented to achieve a "Towards Zero Landfill":

(a) Reduce waste disposed of at incineration plants;

(b) Reuse incineration ash to divert it from landfill; and

(c) Recycle waste that is disposed of directly at landfill.

Toxic industrial wastes (TIW) are controlled under the Environmental Public Health (Toxic Industrial Waste) Regulations and are collected and disposed of by licensed collectors.

2.4.3 Chemical Management

The chemical industry is one of the key pillars of Singapore's economy. With a vibrant manufacturing sector, large amounts of chemicals are being imported and distributed for various purposes. The high population densities also make it imperative for hazardous substances to be controlled so that public exposure to accidental release is, if not avoided, minimised. In addition, large parts of Singapore are used as water catchment areas. It is necessary to ensure that chemical storage facilities and transport avoid catchment areas as far as possible. This is to prevent pollution and to protect drinking water sources against contamination.

The control of hazardous chemicals is especially important, as some of them (e.g. chlorine, ammonia) can pose a mass-disaster potential while others (e.g. cyanides, phenols) are highly toxic and pollutive. Some factories may also generate wastes such as PCBs and chlorobenzenes that cannot be safely and adequately disposed of.

It therefore becomes imperative for Singapore, being a small country with competitive land use, to have an effective chemical management system. The Environmental Protection Division (EPD) of the NEA is the designated competent authority in charge of the control of hazardous substances in Singapore. The Pollution Control Department (PCD) controls environmentally hazardous chemicals under the Environmental Pollution Control Act (EPCA), the Environmental Pollution Control (Hazardous Substances) Regulations and the Environmental Pollution Control (Ozone Depleting Substances) Regulations.

The Fire Safety & Shelter Department (FSSD) of the Singapore Civil Defence Force (SCDF) controls flammable petroleum products under the Fire Safety Act while the Centre for Radiation Protection and Nuclear Science (CRPNS) of NEA regulates radioactive materials.

The Occupational Safety and Health Division of the Ministry of Manpower (MOM) administers the Workplace Safety and Health Act to safeguard the health and safety of persons at work. The law requires all stakeholders to take reasonably practicable measures to ensure the safety and health of persons at work. Any person who manufactures or supplies any hazardous substance for use at work must provide information about the safe use of the hazardous substance. Under the Workplace Safety and Health (General Provisions) Regulations, all hazardous

substances in a factory must be placed under the control of a competent person. They shall be kept, stored, used, handled or disposed of in such a manner as not to pose a risk to the health and safety of any person at work. Certain classes of factories are required to implement a safety and health management system, which includes a key element on control of movement and use of hazardous chemicals. The safety and health management system must be audited regularly. Under the Workplace Safety and Health (Risk management) Regulations, employers must conduct a risk assessment in relation to the safety and health hazards associated with any work carried on at the workplace. They must take all reasonably practicable measures to eliminate or minimise any foreseeable risk.

2.4.4 Environmental Policy and Legislation

Various legal and regulatory frameworks and policies for air and water pollution, solid waste disposal, public health, nature conservation, and resources conservation and management and control of hazardous substances and toxic industrial wastes have been promulgated in Singapore.

Environmental laws and regulations are established and effectively administered through a comprehensive planning process and stringent enforcement system. These environmental laws and regulations are reviewed and updated regularly. The control and management of hazardous substances, including POPs, and toxic industrial wastes are discussed in Chapter 3.

2.4.5 Relevant International Commitments and Obligation

Singapore is a party to many international agreements, and has participated actively in international and regional forums, working groups and meetings, such as conventions on biodiversity, climate change, endangered species, hazardous wastes, nuclear test ban, ozone layer protection, and ship pollution, some of which are related to POPs. Comprehensive programmes are in place to fulfill the obligations of the international conventions.

The following table shows the list of Environmental Agreements signed by Singapore.

Table 1: International Conventions Ratified/Acceded by Singapore

Agreement	Ratified/ acceded
Vienna Convention for the Protection of the Ozone Layer	5 Jan 1989
Montreal Protocol on Substances that Deplete the Ozone Layer and the following amendments: • London Amendment • Copenhagen Amendment • Montreal Amendment • Beijing Amendment	5 Jan 1989 2 Mar 1993 22 Sep 2000 22 Sep 2000 10 Jan 2007
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	2 Jan 1996
Stockholm Convention on Persistent Organic Pollutants	24 May 2005
Rotterdam Convention - Prior Informed Consent	24 May 2005

CHAPTER 3 – CURRENT STATUS OF POPs IN SINGAPORE

3.1 INSTITUTIONS AND LEGISLATION

3.1.1 Institutions

The overall management of the environment lies with the Ministry of the Environment and Water Resources (MEWR). MEWR was formerly known as the Ministry of the Environment (ENV) that was set up in 1972 to provide a quality living environment and high standard of public health in Singapore, and to protect the population against the spread of communicable diseases. Today, MEWR has two statutory boards, the NEA and the Public Utilities Board (PUB). With the new setup, the responsibilities of MEWR have expanded to include management of water resources – from sourcing, collection, purification and supply of drinking water to treatment of used water and reclaiming into NEWater as well as storm water drainage.

The PCD of NEA is in charge of environmental planning and building development control, air and water pollution control and regulation of hazardous substances and wastes. Due to the government's strong commitment to pollution control the NEA has been successful in implementing its pollution control programmes in Singapore.

The following is a list of government agencies with competence in environmental protection, health and safety matters:

Table 2: Government Agencies and Their Respective Functions

	Institution	Functions
1	MEWR	
	(a) NEA	Environmental management covering, air, water, noise pollution, chemicals, vector control, environmental health, and nuclear science
	(b) PUB	Provision of sewerage and drainage services, storm water management and supply of drinking water
2	MOM	Occupational health and safety issues at workplaces
3	Ministry of Health (MOH)	Providing health information and education; raising health awareness; ensuring accessibility of health services; monitoring the quality of health services; prevention and control of illnesses and diseases

	Institution	Functions
4	Ministry of Home Affairs (MHA) (a) SCDF (FSSD)	 Controls flammable petroleum products under the Fire Safety Act
5	Ministry of National Development (MND) (a) Agri-Food and Veterinary Authority of Singapore (AVA)	 Ensures food safety, resilience in food supply, safeguarding animal welfare and animal and plant health, promoting agri- technology, investment in research and development and protecting endangered wildlife

3.1.2 Control of chemicals in Singapore

3.1.2.1 Import, sale and use of chemicals

The main legislation controlling import, sale, transport, use and storage of chemicals is the Environmental Pollution Control Act (EPCA) and the Environmental Pollution Control (Hazardous Substances) Regulations. The PCD of the National Environment Agency is the key department administering the EPCA and its regulations. The hazardous substances covered under the EPCA are those that are toxic and have the potential to have significant offsite impacts in the event of an accident.

Under the same Act, PCD also controls the import of chemicals used as pesticides, and allows only approved termiticides for use in soil treatment for the prevention and control of water pollution.

Flammables such as Liquefied Petroleum Gas and solvents such as benzene are controlled by the FSSD of the SCDF.

3.1.2.2 Registration of pesticides used in farming and agriculture

The AVA imposes stringent control on the usage of pesticides in commercial cultivation of plants and pesticides used for veterinary purposes under the Control of Plants Act and Control of Plants (Registration of Pesticides) Regulations. All pesticides used in the cultivation of any crops for commercial sale in the farm need to be registered with AVA. Moreover, the application of these pesticides must be done or supervised by a pesticide operator who is certified by AVA. AVA also conducts regular checks and inspections on the farms to check for any non-compliances with regard to whether the pesticides application is carried out/supervised by certified operator, whether the pesticides are stored in

accordance with the regulations in the Control of Plants Act, whether the empty containers & packages of pesticide were properly disposed of in accordance with the regulations in the Control of Plants Act and also, whether pesticides are used properly and correctly in the farms. Samples of vegetables, fruits and ornamental plants produced in the farms will also be taken for laboratory analysis to check for any residues of unregistered pesticides or residues of registered pesticides above the permitted levels. For any non-compliances found during inspection, enforcement actions will be taken against the licensee or the pesticide operators of the farm.

3.1.2.3 Registration of pesticides used in vector control

The registration of pesticides for use in vector control, such as insecticides and pesticides, comes under the purview of the Environmental Health Department (EHD) of NEA. EHD requires all public health pesticide/repellent products intended for use against the five vectors (namely mosquitoes, flies, cockroaches, rodents and fleas) to be registered prior to local sales under the Control of Vectors and Pesticides Act.

3.1.2.4 Protection of workers against exposure to chemicals

The Ministry of Manpower looks into the occupational health and safety of the workforce in Singapore. The main legislation governing occupational health and safety are the Workplace Safety and Health Act and its subsidiary legislation. Material safety data sheets must be obtained for hazardous substances and appropriate measures must be taken to ensure the safe use of these substances. Containers of toxic substances must be properly labelled. Persons at work in a factory who are liable to be exposed to hazardous substances shall be warned of the hazards involved and the precautionary measures to be taken. Practical measures must be taken to control airborne contaminants. These measures include the use of local exhaust or dilution ventilation system. Regular workplace monitoring by a competent person is required if any toxic substance is given off. The permissible exposure levels of toxic substances are specified. Pre-employment and periodic medical examinations are required if workers are exposed to certain toxic chemicals.

3.1.2.5 Control of fumigants and their uses

Fumigation using hydrogen cyanide, methyl bromide or hydrogen phosphide is controlled under the Hydrogen Cyanide Fumigation Act and its Regulations. The Act and its Regulations are enforced by the EHD of the NEA.

3.1.3 Control of Hazardous Wastes

3.1.3.1 Generation, handling and disposal of hazardous wastes in Singapore

The generation, collection, transport, storage, treatment and disposal of hazardous wastes are controlled under the Environmental Public Health (Toxic Industrial Waste) Regulations. A person shall be licensed under the Environmental Public Health (Toxic Industrial Waste) Regulations to handle hazardous wastes. Licensed Toxic Industrial Waste collectors operate facilities such as waste incinerators, solvent/oil recycling plants and wastewater treatment plants to treat hazardous wastes.

3.1.3.2 Transboundary movements of hazardous wastes

Transboundary movements of hazardous wastes are controlled under the Hazardous Waste (Control of Export, Import and Transit) Act and its Regulations. The Hazardous Waste Act enables Singapore to fulfill its obligations as a party to the Basel Convention on Transboundary Movements of Hazardous Wastes and their Disposal.

3.2 MANAGEMENT AND CONTROL OF POPs IN SINGAPORE

3.2.1 POPs Pesticides and Industrial Chemicals

In Singapore, 10 of the 12 POPs (except dioxin and furans) are listed as hazardous substances for control under the Environmental Pollution Control Act. The use of the eight pesticides POPs namely, aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene, has already been banned.

The two industrial chemicals, namely hexachlorobenzene and PCBs have also been banned for use in Singapore. The import and use of PCBs, including electrical transformers and capacitors containing PCBs have been banned since the 1980s and an intensive programme to phase out PCB transformers and PCB capacitors has been implemented. The PCB transformers and capacitors were sent to approved overseas facilities for environmentally sound treatment and disposal.

3.2.2 Unintentional POPs: Dioxins and Furans

In keeping with internationally accepted practices to control such emissions, NEA has introduced air emission standards under the Environmental Pollution Control (Air Impurities) Regulations 2001 to limit dioxins and furans releases. Under these Regulations, the emission limits for dioxins and furans from waste incinerators are:

- 0.1 ng TEQ/m^3 for waste incinerators commissioned after 1 Jan 2001.
- 1 ng TEQ/m^3 for waste incinerators commissioned before 1 Jan 2001.

In Singapore, there are no significant industrial sources of dioxin other than the incineration plants for municipal solid waste, toxic industrial waste and medical wastes.

The municipal solid waste incinerators operated by the National Environment Agency are fitted with modern combustion control measures, flue gas cleaning devices and dioxin abatement process. Stack monitoring is carried out regularly and measurements of dioxins and furans emissions are conducted annually. The toxic industrial waste incinerators (capacities ranging from six to 50 ton/day) and hospital waste incinerators (capacities of about six ton/day) are operated by private companies. Operators of these incinerators are required to carry out dioxin and furans measurement, and to submit the results to NEA annually.

3.3 CURRENT MONITORING PROGRAMMES ON POPs

3.3.1 Monitoring of POPs in inland waters

NEA conducts annual monitoring of POPs in the inland waters and reservoirs. The POPs measured are aldrin, endrin, chlordane, dieldrin, DDT, heptachlor, toxaphene, hexachlorobenzene, dioxins and furans. The monitoring showed that POPs in the inland waters and reservoirs are not detected.

3.3.2 Monitoring of dioxins and furans in flue gas from incineration plants

NEA conducts annual monitoring of dioxins and furans in the flue gas from the municipal solid waste incineration plants to check for compliance with air emission standards under the Environmental Pollution Control (EPC) (Air Impurities) Regulations.

Toxic industrial waste and biohazardous waste incinerators operated by private companies are also required to conduct annual source emission tests to show compliance with the air emission standards under the EPC (Air Impurities) Regulations 2001.

3.3.3 Monitoring of dioxins and furans in ambient air

NEA conducts annual monitoring of dioxins and furans in ambient air since 1999. This monitoring is being carried out once a year. The monitoring showed that dioxins and furans are generally not detected in our ambient air.

3.4 RESEARCH AND STUDIES ON POPs

The National University of Singapore (NUS) and the Nanyang Technological University (NTU) are the two main institutions that have interest in conducting research and studies on the levels and distributions of POPs in the environment. A proposal on this would be put up in chapter 4. Some work is being carried out at NUS that focuses primarily on the development of novel, miniaturized techniques

for the analysis of POPs, including organochlorine pesticides and polychlorinated biphenyls.

CHAPTER 4 - ACTION PLANS ON POPs

4.1 REVIEW LEGISLATION ON POPs

4.1.1 Review the list of chemicals controlled under the EPCA

The pesticides and industrial chemicals under the Stockholm Convention are already listed under the schedule of the EPCA and the EPC (HS) Regulations for control. However, some of these chemicals are controlled under a generic chemical grouping, and not under their specific chemical names in the EPCA and the EPC (HS) Regulations.

NEA will review and amend the EPCA and its Regulations to list these POPs under their Convention names in the EPCA and its Regulations to avoid ambiguity.

4.1.2 Enact new regulations on Stockholm Convention

Currently, under the EPCA, NEA has not allowed the import and export of POPs (except for laboratory uses) by not issuing any licences. New Regulations on Stockholm Convention will also be enacted under the EPCA to address specific requirements under the Convention such as prohibition against import and export of POPs, except for destruction purposes.

4.2 REVIEW OF POSSIBLE SOURCES OF POPs

NEA had carried out an exercise in 2001 to identify the possible sources of POPs in the environment. Another review will be carried out within the next three years to determine the possible sources of POPs.

4.3 POPs MONITORING

4.3.1 Monitoring of POPs in Air

4.3.1.1 Ambient Air

The existing monitoring programme, which only monitors dioxins and furans in ambient air, would be expanded to include the other 10 POPs viz aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, toxaphene, hexachlorobenzene, and PCBs.

4.3.1.2 Flue Gas from Incineration Plants, Power Stations, Refineries and Crematoria

NEA will continue to monitor the dioxins and furans in flue gas from incineration plants.

A review will be conducted to expand the existing monitoring programme to include monitoring of dioxins and furans from power stations, refineries and crematoria.

4.3.2 Monitoring POPs in Fish and Bivalves

Monitoring of POPs in fish and bivalves meant for public consumption will be carried out. Mussels, oysters and fish are proposed as the suitable biological specimens.

4.3.3 Monitoring of POPs in Cord Blood of Humans

With Institutional Review Board's (IRB) approval, cord blood from the Singapore Cord Blood Bank will be used for the monitoring of POPs in humans.

4.3.4 Monitoring of POPs in Inland Waters

NEA will continue to conduct annual monitoring of POPs in the inland waters and reservoirs.

4.4 PARTICIPATE IN REGIONAL AND INTERNATIONAL ACTIVITIES ON POPs

4.4.1 East and South East Asia Best Available Techniques/Best Environmental Practices Forum

The Stockholm Convention has produced guidelines and guidance document to introduce the best available techniques (BAT) and best environmental practices (BEP) to the industrial sector as an obligation to comply with the requirements of the Convention. Based on the experience gained through promotion and dissemination of environmentally sound industrial technologies, the United Nations Industrial Development Organisation (UNIDO) has decided to expand its POPs program and offer technical cooperation to developing countries and countries with economies in transition to fully enable implementing the BAT/BEP related provisions of the Convention. UNIDO has taken a programmatic approach and decided to support establishing global sub regional and regional BAT/BEP forums.

The East and South East Asia (ESEA) forum of BAT and BEP is the first regional forum to be proposed in cooperation with the Pollution Control Department of the Ministry of Natural Resources and Environment (MONRE) of Thailand and the POPs Unit of the Multilateral Agreement (MEA) Branch of UNIDO.

This forum is a voluntary regional collaboration and cooperation platform on BAT and BEP and is open to all countries of the ESEA sub-region, both developed and developing countries, as well as countries with economies in transition. The forum main objective is to serve as a platform for information

dissemination and exchange of experiences between countries on different aspects of implementation of BAT and BEP and provide regular reporting on the impact of these in the industrial sector of the Convention. The development objective of the forum is to strengthen the capacities of the member countries to enable facilitation of transfer of environmentally sound technologies to the industrial sector in the region.

Singapore will continue to work on regional promotion, application and diffusion of BAT/BEP, in line with the guidelines and guidance document to assist the implementation of action plans.

4.4.2 UNEP's Global Monitoring of POPs

The primary focus of the effectiveness evaluation will be on comparable monitoring data on the presence of the POPs listed in Annexes A, B and C of the Convention as well as their regional and global environmental transport. To develop recommendations in this field UNEP Chemicals hosted a Workshop in Geneva from 24 to 27 March 2003 to develop a POPs Global Monitoring Programme (GMP) to Support the Effectiveness Evaluation of the Stockholm Convention on POPs. The outcome of the workshop was a set of conclusions and recommendations for the elements to be contained within a guidance document for the GMP.

Singapore will continue to participate in the GMP activities that evaluate the effectiveness of the Stockholm Convention.

4.5 AWARENESS RAISING PROGRAMMES ON POPs

4.5.1 Outreach to Industries

The Singapore Chemical Industry Council (SCIC) is a body officially representing the chemical industry in Singapore. SCIC also partners with the MEWR and the SCDF in developing the growth of the chemical industry and promoting a safe and pollution-free environment. NEA will work with SCIC to promote and enhance the level of awareness of POPs among the industries.

4.5.2 Outreach to Schools

The Singapore Environment Council and SCIC are two organisations that work closely with NEA to promote public awareness of and concern for the living and natural environment of Singapore. Programmes that can raise awareness on POPs are aimed at specific groups such as schools, community centres, private sector business organisations, the media, etc.

4.6 PROCESS OF EVALUATION AND INCLUSION OF NEW POP

NEA has established an Advisory Committee on Hazardous Substances and Toxic Wastes to evaluate the hazardous chemicals and wastes that are proposed for inclusion for control into the various multilateral conventions, such as the Basel Convention, Rotterdam Convention and the Stockholm Convention. This Committee conducts frequent meetings to evaluate and endorse proposed control when necessary.

4.7 PROCESS OF REVIEW AND UPDATE OF NIP

After the official submission of the NIP, the Working Group members will review and update the NIP and submit it to the Conference of Parties from time to time when the need arises. Such circumstances include the case of the addition of the chemicals designated under the Stockholm Convention, the revision of related domestic plans and also the various changes in the environment and the economy, etc.

CHAPTER 5 – CONCLUSION

5.1 SUMMARY OF ACTION PLANS AND ACTIVITIES ON POPs

Singapore will implement the action plans and activities within the time frame as stated below:

Table 3: Action Plans, Activities, and Stipulated Time Frame

Action Plans	Activities	Time Frame
Review Legislation on POPs	• NEA will review and amend the EPCA and its Regulations to list these POPs under their Convention names in the EPCA and its Regulations	2007-2008
Review Possible Sources of POPs	• A review would be conducted to determine the possible sources of POPs.	2007-2010
POPs Monitoring	• Monitoring of dioxins and furans in air	On-going
	• Monitoring of POPs in waters	On-going
	• Monitoring of other POPs in air	2007-2010
	• Monitoring POPs in fishes and bivalves	2007-2010
	• Monitoring of POPs in cord blood of humans	2007-2010

Action Plans	Activities	Time Frame
Participate in Regional and International Activities on POPs	• East and South East Asia Best Available Techniques/Best Environmental Practices Forum • UNEP's Global Monitoring of POPs	On-going On-going
Awareness Raising Programmes on POPs	• Outreach to industries • Outreach to schools	On-going On-going

REFERENCES

[1] Stockholm Convention on Persistent Organic Pollutants (POPs) (http://www.pops.int/)

[2] Interim guidance for developing a national implementation plan for the Stockholm convention, Revised, December 2003 (http://www.pops.int/documents/implementation/nips/guidance/default/htm)

[3] Global Monitoring of Persistent Organic Pollutants (http://www.chem.unep.ch/gmn/default.htm)

[4] Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (http://www.basel.int/)

[5] Rotterdam Convention-Share Responsibility (http://www.pic.int)

[6] Statistics Singapore (http://www.singstat.gov.sg/keystats/keystats.html)

[7] Maritime and Port Authority of Singapore (www.mpa.gov.sg)

[8] Economic Development Board of Singapore (www.edb.gov.sg)

[9] World Health Organisation (http://www.who.int/en/)

[10] Management of Hazardous Substances (http://app.nea.gov.sg/cms/htdocs/article.asp?pid=1433)

[11] Singapore Cord Blood Bank (http://en.wikipedia.org/wiki/Singapore_Cord_Blood_Bank)

[12] Environmental Protection Division, Annual Report 2005

[13] "Occupational Health and Environment Problems of Technology Transfer in Developing Countries – Some Occupational Health Aspects of Technology Transfer in Singapore", Dr Phoon Wai Hoong & Mr Tan Kia Tang

ANNEX A

LIST OF MEMBERS OF WORKING GROUP ON NIP DEVELOPMENT

	Organisation	**Representative**
1	National Environment Agency (**CHAIRMAN**)	Tan Quee Hong
2	Agri-Food & Veterinary Authority of Singapore	Mr Ong Keng Ho
3	Occupational Safety & Health Division, Ministry of Manpower	Mr Tan Kia Tang
4	Ministry of Health	Professor Goh Kee Tai
5	Department of Chemistry National University of Singapore	Professor Lee Hian Kee
6	Department of Community Occupational and Family Medicine National University of Singapore	Professor Ong Choon Nam
7	School of Civil & Environmental Engineering Nanyang Technological University	Dr. Lim Teik Thye
8	Waste Management & Recycling Association of Singapore	Mr Edward Goh
9	Singapore Chemical Industries Council	Mr Julian Heath
10	Singapore Chemical Industries Council	Ms. Cissie Yeung
11	Singapore Pest Management Association	Mr Ng Say Kiat
12	Singapore Environment Council	Mr Howard Shaw