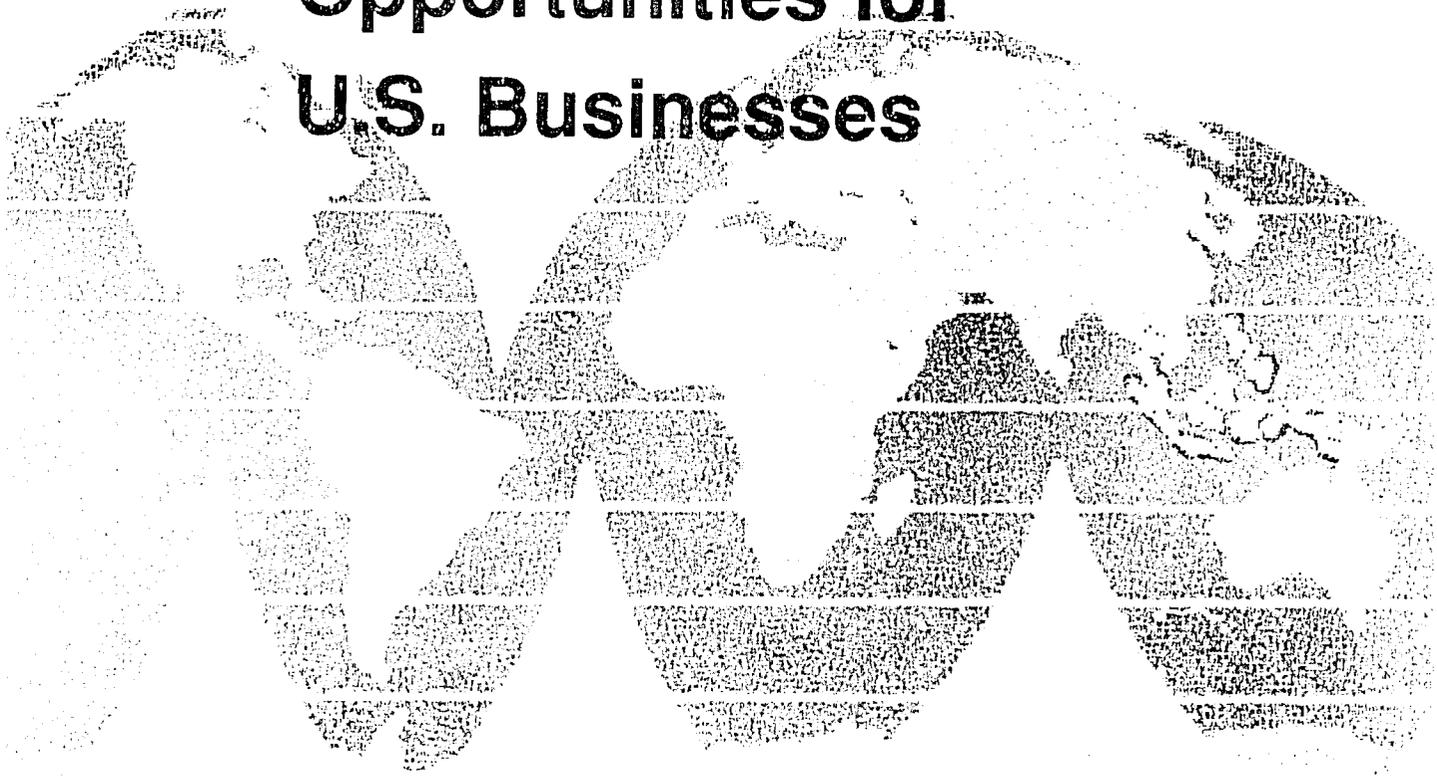


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**Business Focus Series**

# **ASEAN Wastewater Treatment Market Assessment: Opportunities for U.S. Businesses**



*Prepared by:*

**U.S. Agency for International Development**

**Office of Energy and Infrastructure**

**The ASEAN Environmental Improvement Project**

*in Cooperation with:*

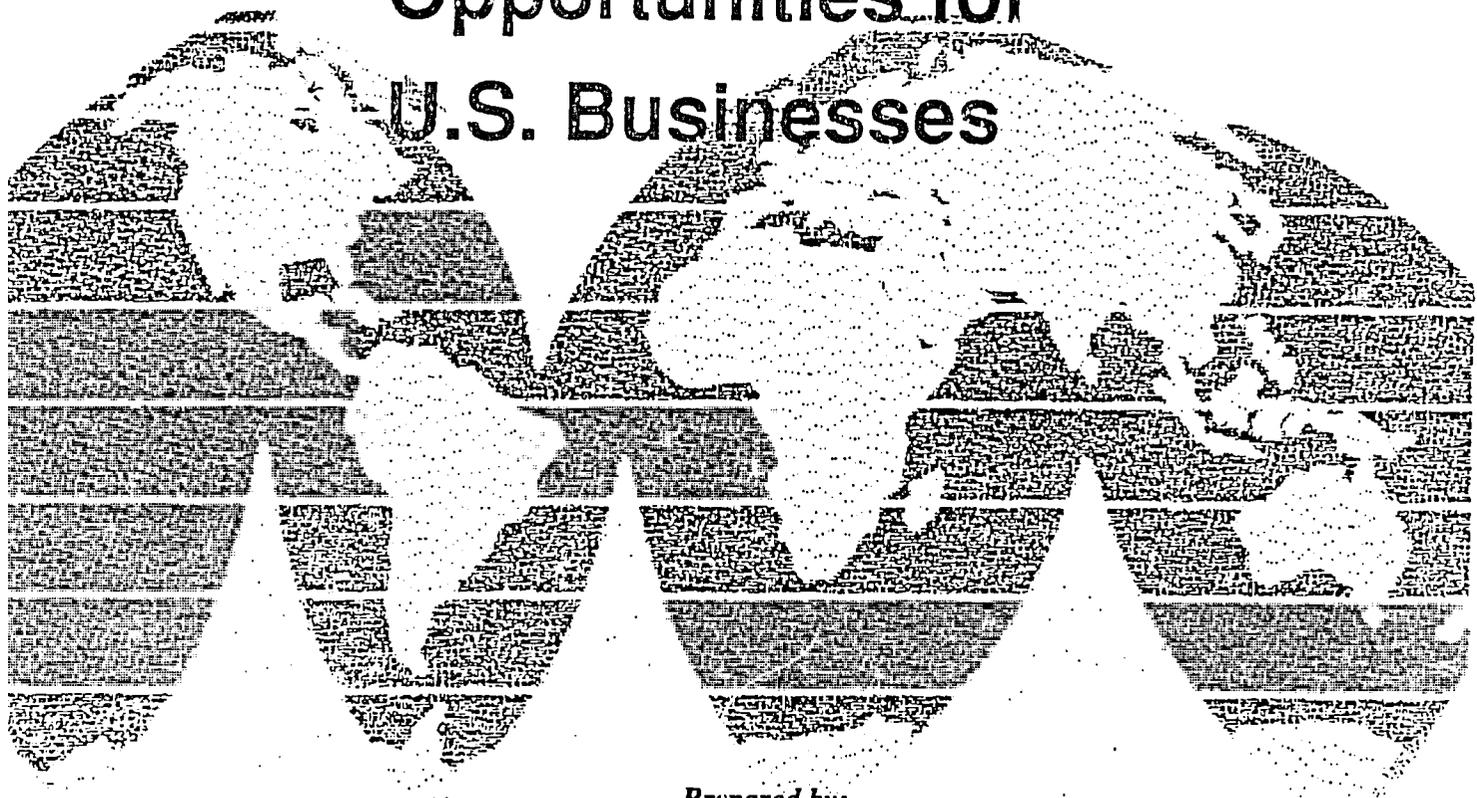
**U.S. ASEAN Council**

**for Business and Technology, Inc.**

**under the USAID/ASEAN PITO Project**

**Business Focus Series**

**ASEAN Wastewater  
Treatment Market  
Assessment:  
Opportunities for  
U.S. Businesses**



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## *Acronyms*

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
BOD	biological oxygen demand
BOO	build-own-operate
BOT	build-operate-transfer
CAD	computer-aided-design
CIDA	Canadian International Development Agency
COD	chemical oxygen demand
DOC	U.S. Department of Commerce
EIA	environmental impact assessment
EIP	Environmental Improvement Project (USAID)
GDP	gross domestic product
IFC	International Finance Corporation
JICA	Japan International Cooperation Agency
MDB	multilateral development bank
NGO	non-government organization
PITO	Private Investment and Trade Opportunities Project (USAID)
USAID	U.S. Agency for International Development

### **Indonesia**

BAPEDAL	Agency for Environmental Impact Protection
GOI	Government of Indonesia
KLH	Ministry of State for Population and Environment
MPW	Ministry of Public Works
Prokasih	Program Kali Bersih - Clean Rivers Program

### **Malaysia**

DOE	Department of Environment
EQA	Environmental Quality Act
GOM	Government of Malaysia
SEDC	State Economic Development Corporation

## *Acronyms*

### **Philippines**

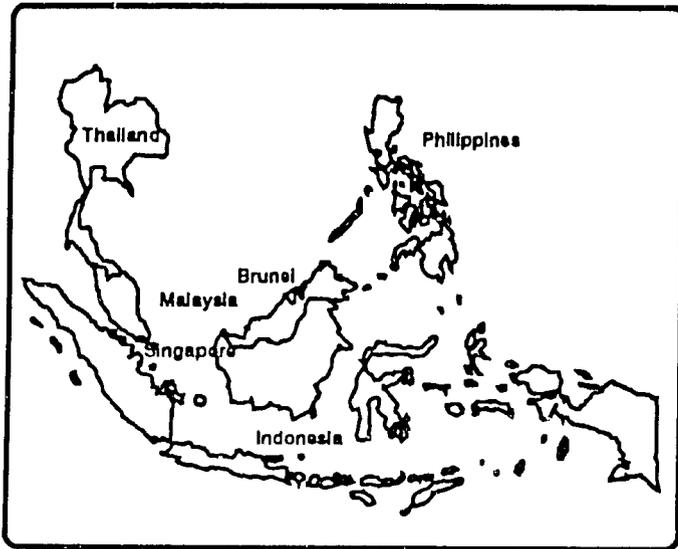
DENR	Department of Environment and Natural Resources
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industry
EMB	Environmental Management Board
EPZ	export processing zone
GOP	Government of the Philippines
IEMP	Industrial Environmental Management Project (USAID)
LWUA	Local Waterworks and Utilities Administration
MWSS	Metropolitan Waterworks and Sewerage System
PD	Presidential Decree

### **Singapore**

CBPU	Central Building Plan Unit
ENV	Ministry of the Environment
GOS	Government of Singapore
HDB	Housing and Development Board
JTC	Jurong Town Council
PCD	Pollution Control Department
SEMES	Singapore Environmental Management and Engineering Services Corporation
SISIR	Singapore Institute of Standards and Industrial Research
SPRD	Strategic Planning and Research Department
URA	Urban Redevelopment Authority

### **Thailand**

BMA	Bangkok Metropolitan Authority
DIW	Department of Industrial Works
GOT	Government of Thailand
NEB	National Environmental Board
ONEB	Office of the National Environmental Board



## *Introduction and Regional Overview*

The ASEAN (Association of Southeast Asian Nations) countries represent a growing market for environmental goods and services, particularly sewage and industrial wastewater treatment.<sup>1</sup> Rapid urbanization and industrialization, particularly in Indonesia, Malaysia, the Philippines, and Thailand, have rendered municipal and industrial wastewater treatment infrastructures insufficient to cope with pollution loads, creating massive water quality problems.

The ASEAN countries possess a land area of 1 million square miles that stretch over the Malay Peninsula and the islands to the south and east in the South China Sea. Their combined population was 333 million in 1990. Although these nations have diverse ethnic groups, religions and languages, they collaborate closely on political, trade and environmental issues.<sup>2</sup>

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<sup>1</sup> ASEAN is an organization for economic, political, social and cultural cooperation among its six member countries. ASEAN was established in 1967 with the signing of the Bangkok Declaration by Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Brunei Darussalam joined in 1984. Brunei is not covered in this report.

<sup>2</sup> The ASEAN Environmental Ministers signed the Singapore Resolution in February 1992, agreeing to collaborate on improving environmental quality, harmonizing standards, and promoting the application, transfer, and development of appropriate environmental technologies.

## *Introduction and Regional Overview*

### *Economic Development Trends*

The ASEAN region is one of the world's economic success stories in agriculture, industry and trade. The economies of these countries range from resource-rich but largely agricultural Indonesia, with a per capita GDP of \$505, to the highly industrialized city-state of Singapore, with a per capita GDP of \$12,720. The ASEAN nations are mainly committed to market- and export-oriented economic growth strategies. Their dynamic economies averaged over 5 percent annual growth in GDP during the 1980s, with the exception of the Philippines. This strong growth has continued in the early 1990s.

#### ASEAN Socio-Economic Indicators

Country	1990 Population <sup>1</sup> (millions)	GDP Per Capita <sup>2</sup> (US \$)	1980-1990 GDP Growth Rate <sup>3</sup> (%)	1991 GDP Growth Rate <sup>4</sup> (%)	1992 GDP Growth Rate <sup>4</sup> (%)
Indonesia	184.3	505	5.5	6.4	6.7
Malaysia	17.9	2,393	6.4	8.6	8.5
Philippines	62.4	766	0.9	(1.0)	2.8
Singapore	2.7	12,720	5.2	7.0	6.1
Thailand	55.7	1,408	7.6	7.5	8.0

<sup>1</sup> United Nations Population Division.

<sup>2</sup> U.S. Department of State, Bureau of Public Affairs, 1992.

<sup>3</sup> World Bank, 1992.

<sup>4</sup> Asian Development Bank, 1992.

The ASEAN countries have also experienced rapid urban growth. Although their population densities range from 140 people per square mile in Malaysia to nearly 12,000 in Singapore, the percentage of people living in urbanized areas has grown substantially since 1960. Southeast Asia is noted for its mega-cities -- Jakarta, Indonesia (9.6 million); Manila, Philippines (8.0 million); and Bangkok, Thailand (6.3 million) -- where population growth and industrial concentration have seriously affected environmental quality, particularly that of surface water.

**Urbanization Trends in ASEAN**

Country	Area (1,000 sq. miles)	Population Density (per sq. mile)	1960 Urban Population (%)	1990 Urban Population (%)	1960-1990 Urban Population Growth Rate (%)
Indonesia	740.89	248	14.6	30.5	4.7
Malaysia	127.41	140	25.2	43.0	4.5
Philippines	115.32	539	30.3	42.6	3.9
Singapore	0.23	11,739	100.0	100.0	1.7
Thailand	198.45	281	12.5	22.6	4.6

Source: United Nations Population Division.

Coastal and inland waters in the region are being polluted by point and non-point sources. Industries and households are the major point source of pollution. Agricultural runoff, which contains fertilizers, pesticides and salt from farmland, together with siltation from soil erosion, are major non-point sources of pollution. This report focuses on point sources of pollution in ASEAN, and the market opportunities created in the prevention, minimization, and control of industrial and domestic effluent.

***Industrial Wastewater Treatment Market***

The industrial wastewater treatment market is made up of on-site treatment and centralized treatment at industrial estates (although municipal treatment plants also receive industrial effluent). With the exception of Singapore, approximately half of the industrial plants in ASEAN countries discharge their untreated liquid waste directly into surface waters. Among those that do treat their effluent, the most common practice is to employ low-cost, physical treatment technologies such as screening and settling. In some cases, pretreatment is required before effluent is discharged to municipal treatment plants.

The governments of ASEAN have been setting up publicly and privately owned industrial estates to shift industrial concentration away from major urban centers and to establish the infrastructure necessary to accommodate new industrial plants. Wastewater treatment is

## *Introduction and Regional Overview*

among a number of utilities that foreign investors are concerned about when setting up manufacturing operations in ASEAN countries.<sup>3</sup>

The rapid proliferation of industries discharging untreated effluent in Southeast Asia has brought about previously unknown risks to human health and has endangered aquatic life. This effluent often contains toxic substances such as heavy metals, acids, and other corrosive chemicals, as well as synthetic organic compounds. As a result of palm oil and rubber effluent, in addition to other industrial wastes and sewage, Malaysia has labeled 42 of its rivers as "dead"; they are no longer able to sustain significant aquatic life.

Pollution prevention (including source reduction and recycling) offers opportunities to reduce the cost of industrial wastewater treatment. For example, large volumes of metals from electroplating processes can be recovered and recycled from wastewater prior to its discharge. The U.S. Agency for International Development (USAID), together with private organizations like the World Environment Center, are fostering programs to improve industrial environmental management by introducing these techniques to the ASEAN countries.<sup>4</sup>

## *Municipal Wastewater Treatment Market*

Domestic sources are the major cause of organic pollution in ASEAN countries. Their governments' provision of urban infrastructure has been unable to keep pace with population growth. The percentage of urban population served by sewerage facilities currently ranges from over 96 percent in Singapore to less than 1 percent in Indonesia. New housing developments or estates are required to install their own systems in most of the ASEAN countries. Hotels and coastal resorts are also investing in packaged treatment plants.

In Indonesia, Malaysia, the Philippines and Thailand, funding from the central government is insufficient to meet the sewage needs of rapidly growing urban populations. As a result, multilateral development banks (MDBs) and bilateral donor agencies are playing a major role in financing the design and construction of municipal wastewater treatment systems. Furthermore, each of these countries is trying to set up a means by which local governments

---

<sup>3</sup> Other utilities include water, transportation, electric power, and communications.

<sup>4</sup> USAID has environmental projects in Indonesia, Thailand and the Philippines. In 1992, the USAID representative to ASEAN, located in Bangkok, launched the Environmental Improvement Project, which will provide assistance to all six ASEAN countries (see box).

**Environmental Improvement Project**

The U.S. Agency for International Development, through the Office of the ASEAN representative and the Bureau for Research and Development's Office of Energy and Infrastructure, is sponsoring the Environmental Improvement Project (EIP) to help control urban and industrial pollution in ASEAN. This six-year, \$17.5 million project will have three integrated components:

- ▶ **Policy and Institutional Development.** This component is assisting ASEAN government agencies, private organizations and non-governmental organizations (NGOs) to develop and implement effective environmental policies and programs. It helps develop regional, national, and local standards and regulations, and effective compliance mechanisms.
- ▶ **Technical Assistance and Training.** This component provides technical assistance from industrial environmental experts and assists private and public sector organizations and NGOs in developing the skills needed to evaluate and implement effective environmental practices and technologies.
- ▶ **Technology Commercialization and Investment Promotion.** This component promotes environmental technology transfer and commercialization activities within the region and between the ASEAN and U.S. private sectors. It helps U.S. and ASEAN firms identify business opportunities through market assessments, co-funds feasibility studies and technology demonstrations, and assists in accessing potential funding sources such as the World Bank and Asian Development Bank.

For information on the EIP, contact Richard Stevenson, EIP chief of party, Louis Berger International, Inc., 116 Herrera Street, Legaspi Village, Makati, Philippines, telephone (63-2) 812-1647, fax (63-2) 815-4107.

and municipalities can collect revenues to cover the cost of operating these systems. As the mechanisms take shape, a market may emerge for privately-owned and operated municipal sewerage systems.

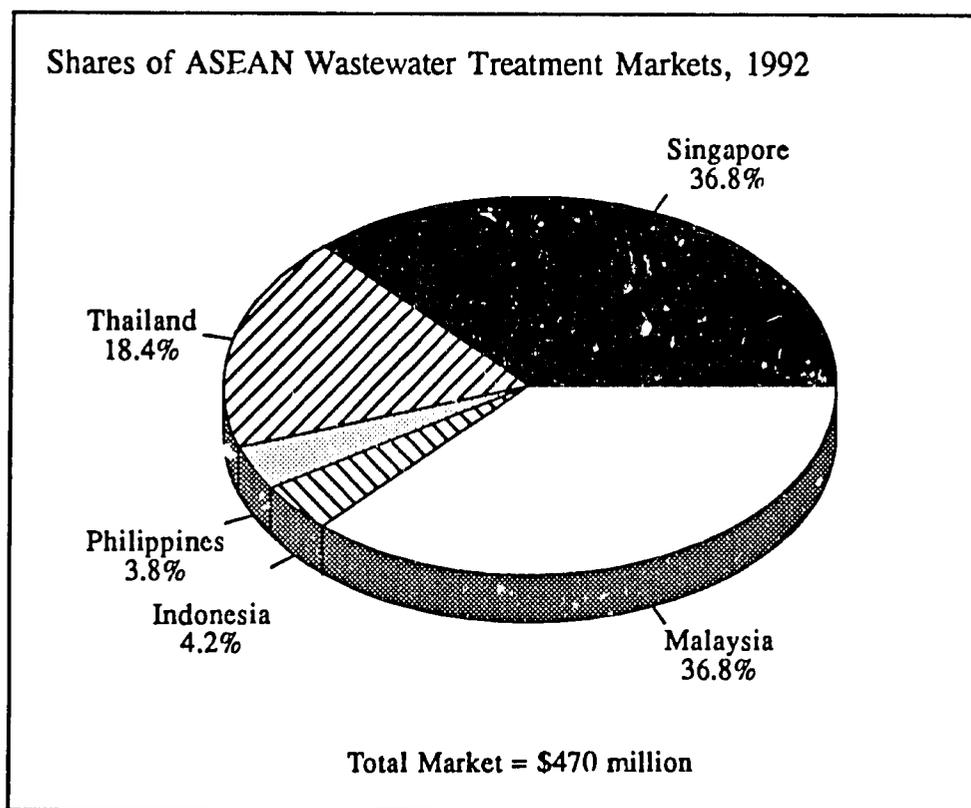
***Wastewater Treatment Technologies***

A variety of wastewater treatment technologies are used in the ASEAN region. These technologies can be broken down into three main categories.

## Introduction and Regional Overview

- ▶ **Physical** - Physical processes extract or separate pollutants from effluent waste streams. Examples range from settling ponds to activated carbon adsorption, clarification, evaporation processes, and other filtration and separation processes such as ion exchange and membrane processes.
- ▶ **Biological** - Biological processes harness microorganisms (and sometimes plants) to break down organic pollutants into less harmful components and reduce the overall organic load. Aerobic and anaerobic digestion, lagooning, and aquaculture are all biological treatment methods.
- ▶ **Chemical** - Chemical treatment technologies make pollutants less harmful or decompose them altogether. Some of the chemical processes used to treat water for a particular use or reuse include chemical oxidation and reduction, coagulation-precipitation processes, neutralization, and ozonation.

The 1992 market for municipal and industrial wastewater treatment equipment and services in the five ASEAN countries examined in this report is estimated to be over US \$470 million. Together, Malaysia, Singapore, and Thailand account for 92 percent of this market.



## *Introduction and Regional Overview*

In the 1990s, Thailand and Malaysia will offer the largest wastewater markets in the ASEAN region. They already account for 55 percent of the ASEAN market and are continuing to undergo rapid economic growth and industrialization. To put these markets in perspective, if per capita expenditures on wastewater treatment in Thailand were to reach one quarter of Singapore's current levels by the end of the decade, the total market would exceed \$1 billion.

Malaysia and Thailand's demand for centralized treatment systems for large industrial estates and compact wastewater treatment systems for new housing estates and tourist developments will continue to grow rapidly. The enforcement of existing and new environmental regulations will also create opportunities for firms offering pollution prevention services among high-growth industries such as food processing, textiles and metal finishing, as well as among some small and medium-sized companies. The market for testing and monitoring equipment will also take on greater importance as governments improve their enforcement efforts.

The Singaporean market is already largely developed and is expected to continue to grow, but only at a moderate pace. The best opportunities will lie in the rehabilitation of existing municipal wastewater treatment plants and in a few major industries such as oil refining, petrochemicals, and chemicals. Singapore's companies are already positioning themselves to provide environmental services to the ASEAN region.

The best opportunities in Indonesia are expected to lie in supplying the major polluting industries (e.g., pulp and paper, metal finishing, textiles, palm oil, tapioca, leather tanning) with wastewater treatment facilities, as they are expected to be targeted first by government regulatory initiatives. Suppliers of centralized treatment systems for industrial estates should also see an emerging market later in the decade. The municipal wastewater treatment market will be driven by donor funding in the near term.

The Philippine wastewater market has also been slow in developing. Donor aid to the Philippines will continue to grow, so that in the near term, municipal wastewater treatment markets will be largely driven by donor funding. As in Indonesia, major Philippine industries are expected to be targeted first by government action, and markets will develop for appropriate treatment systems in the near term, particularly for low-cost systems. The Philippine Government is only now beginning to devote attention and resources to environmental improvement. USAID technical assistance will help identify industrial markets that will be served initially by low-cost systems. As in Indonesia, MDB projects will drive the municipal markets in the Philippines.

# Summary of ASEAN Wastewater Market Opportunities

	1992 Market Size \$US Million	Industrial Treatment Near term (1992-1995)	Municipal Treatment Near term (1992-1995)	Industrial Treatment Long term (1996-1995)	Municipal Treatment Long term (1996-2000)	Opportunities for U.S. Companies in Industrial Sector	Opportunities for U.S. Companies in Municipal Sector
INDONESIA	23	○	◐	◐	●	◐	●
MALAYSIA	125	◐	◐	●	●	●	◐
PHILIPPINES	22	○	○	◐	◐	◐	○
SINGAPORE	200	◐	◐	◐	◐	◐	◐
THAILAND	100	◐	●	●	●	●	●

**KEY**  
**Anticipated Market**  
 ○ = Limited  
 ◐ = Modest  
 ● = Strong



## *Indonesia*

### ***Market Overview***

Preliminary estimates from the U.S. Department of Commerce indicate that the Indonesian wastewater treatment market reached about \$23 million in 1992 and will grow at 15 percent per year through 1994. The Asian Development Bank (ADB) estimates that on-site and centralized industrial wastewater treatment will require a \$2.3 billion investment over the period 1991-2000.

The best business opportunities for U.S. companies in the industrial market will exist among industries identified as major pollution sources and for which the Government of Indonesia (GOI) has established effluent standards (e.g., pulp and paper, metal finishing, textiles, food processing, leather and tanning). Several opportunities also exist to build centralized systems for privately developed industrial estates. In the municipal wastewater treatment market, the best near-term business opportunities exist in projects funded by multilateral development banks. The Asian Development Bank and World Bank have urban water and wastewater projects totalling \$2.5 billion in the pipeline. Over the longer term, a market will develop for privately owned and operated municipal sewerage systems.

### ***Policy Environment***

The Indonesian Ministry of Health issued a decree on water quality and discharge limits for industrial effluent in 1977. These limits are based on World Health Organization guidelines developed in the 1970s. To date, Indonesia has legislated water quality standards for four classifications of receiving bodies: 1) potable water sources not requiring treatment, 2)

## *Indonesia*

potable water sources requiring treatment, 3) water used for fisheries and breeding, and 4) water used for agricultural purposes, municipal utilities, industry and hydroelectric projects. In 1991, the government developed effluent standards for 14 industry categories: metal finishing, textiles, leather tanning, oil refining, palm oil processing, pulp and paper, rubber, sugar, caustic soda, tapioca, fertilizer, ethanol, monosodium glutamate, and plywood. All of Java's provinces, as well as several of Sumatra's and East Kalimantan's, have enacted provincial water quality standards to accompany the national regulations.

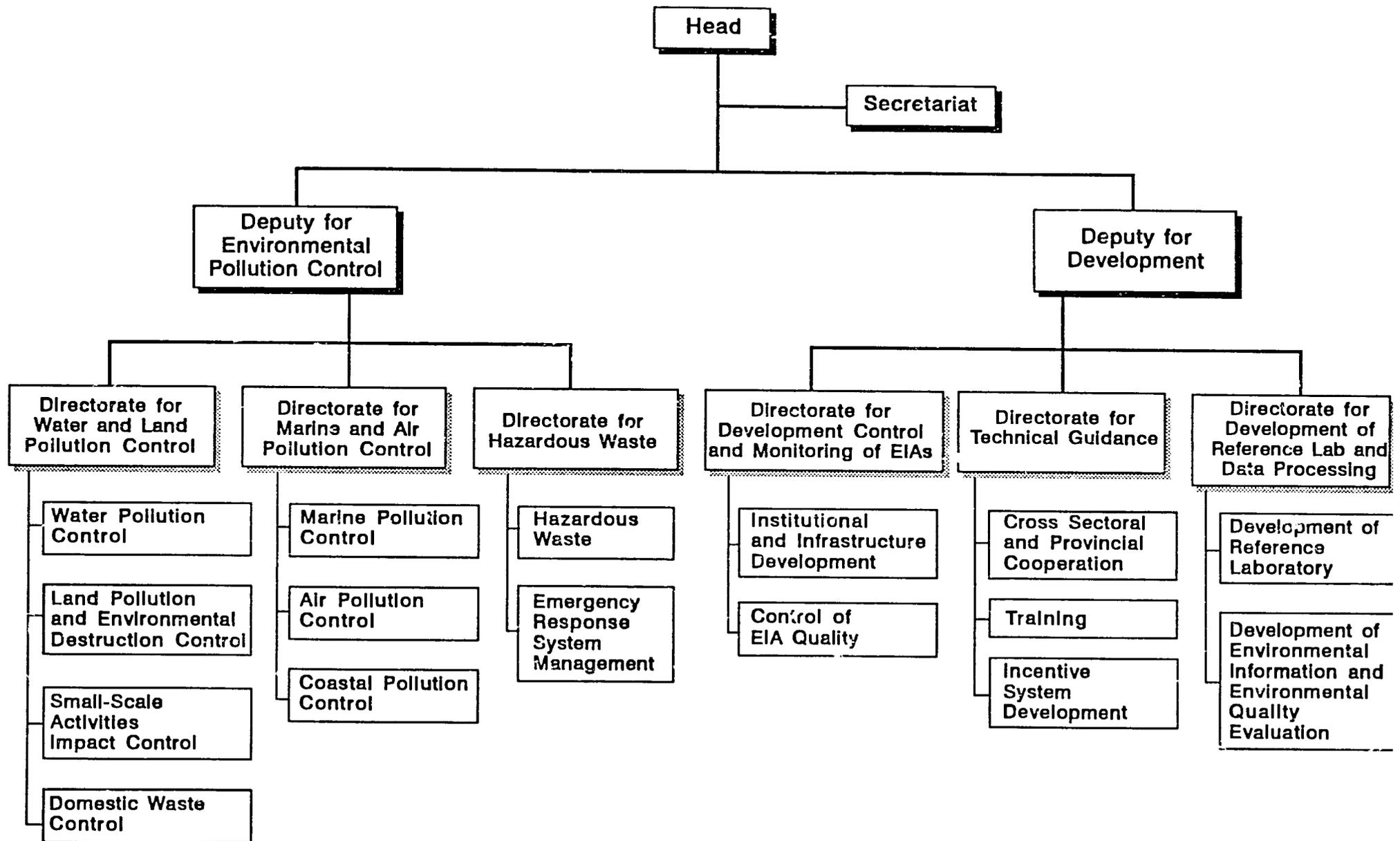
The Ministry of State for Population and Environment (KLH) is responsible for environmental policy in Indonesia. KLH implements Indonesia's environmental policy in cooperation with other central government agencies and provincial government offices. In June 1990, the Agency for Environmental Impact Protection, or Badan Pengendalian Dampak Lingkungan (BAPEDAL), was created to coordinate the implementation of national environmental regulations.

BAPEDAL has several key responsibilities: assisting the president in formulating pollution control policy, monitoring activities with a significant environmental impact, collecting and analyzing pollution data, and improving community participation in pollution control. The Directorate for Water and Land Pollution Control is the division of BAPEDAL responsible for implementing Indonesia's effluent standards.

Despite the traditionally weak enforcement of Indonesia's water pollution control regulations, the establishment of BAPEDAL and the currently high level of political support for environmental initiatives have increased industry compliance in recent years. Nevertheless, BAPEDAL's enforcement powers are limited to suing polluting companies in court and focusing public pressure toward the worst offenders. In 1992, a law was passed requiring that environmental disputes be settled through negotiations and mediation before legal means are pursued. Most disputes brought to court by BAPEDAL and KLH are dismissed because of a lack of skilled prosecutors and questionable results from laboratory tests of water samples.

BAPEDAL is also short on funding and qualified personnel. Several bilateral assistance programs are currently underway to strengthen BAPEDAL's management and enforcement capabilities. These programs include the Environmental Management and Development Project funded by the Canadian International Development Agency (CIDA), a World Bank study to prepare an institutional development strategy for BAPEDAL, and a program funded by the Japan International Cooperation Agency (JICA) to build a national reference environmental laboratory and training center for BAPEDAL.

# Organizational Structure: Central BAPEDAL



## *Indonesia*

To date, the most important GOI effort to address water pollution is the Prokasih, or Clean River Programme, initiated in 1989. Prokasih is aimed at decreasing the pollution of rivers from industrial waste, and targets 22 rivers in 11 provinces. This program's success depends heavily on cooperation between central and provincial governments, and between government and private industry. The ADB reports that as of May 1991, 62 percent of the industrial facilities in the targeted provinces had installed wastewater treatment equipment or taken some kind of action to meet the Prokasih requirements.<sup>1</sup>

### Priority Rivers in the Prokasih Program, 1992

Province	River
DKI-Jakarta	Ciliwung, Cipinang, Moorkervaart
West Java	Citarum, Cisadane, Cileungsi, Ciliwung
Central Java	Kali Garang, Bengawan Solo
East Java	Brantas, Bengawan Solo
Lampung	Way Pengubuan, Way Seputih
North Sumatra	Deli, Asahan, Semayang, Merbau
South Sumatra	Musi
Riau	Siak
Aceh	Krueng Langsa, Krueng Tamiang
East Kalimantan	Mahakam, Karang Mumus
West Kalimantan	Kapuas

Source: *Prokasih: Clean River Programme*. Environmental Impact Management Agency (BAPEDAL), 1991.

In addition to funding from the central budget, the Prokasih program is financed by the World Bank, CIDA, and other bilateral and multilateral organizations. The program currently focuses on industrial rather than municipal pollution sources, and singles out the following industries as the worst offenders: pulp and paper, cement, metal finishing, textiles,

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<sup>1</sup> *Appraisal of the Water Pollution Control Project in Indonesia*. Asian Development Bank, November 1991.

food processing, leather tanning, chemicals, and petrochemicals. Participating provinces were given the choice of two implementation strategies, one targeted at the priority industries mentioned above, and the other targeted at large and medium-sized factories. Both strategies require companies in priority industries along the 24 designated rivers to comply with national quality standards by March 1993.

### *Industrial Market*

Rapid industrial growth has created severe water pollution problems throughout the country, but particularly on the north coast of Java, where industrial discharges account for a large part of the total organic load.<sup>2</sup> Java houses 60 percent of Indonesia's total population, 76 percent of its manufacturing sector, and 80 percent of its medium and large-scale industry. One-third of all medium and large-scale industries are located in the Jakarta-Bandung corridor. The ADB projects that the number of industries requiring wastewater treatment on the island of Java alone will increase from 5,378 in 1991 to 9,473 by the year 2000, and will require a cumulative investment of around \$2.3 billion from 1991-2000, although actual expenditures are expected to be far less.

Industrial Wastewater Treatment on Java 1992-2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Projected No. of Industries	5,727	6,099	6,495	6,917	7,366	7,844	8,523	8,895	9,473
Cumulative Investment Need (\$ millions)	352	545	750	967	1,198	1,448	1,705	1,984	2,282
Pretreatment	25	40	56	74	94	117	141	168	198
Centralized	169	267	376	496	629	779	938	1,119	1,318
On-site	158	238	318	397	475	552	626	697	766

Source: *Appraisal of the Water Pollution Control Project in Indonesia*. Asian Development Bank, November 1991.

<sup>2</sup> Chemical oxygen demand (COD) from industrial and municipal sources on Java totaled 620 tons/day in 1988, according to Institute of Hydraulic Engineering data.

## *Indonesia*

Near- to medium-term business opportunities may be especially apparent in building centralized treatment systems for new industrial estates, which the GOI has been actively encouraging in recent years. There are now about 50 privately owned and 7 government owned industrial estates in Indonesia. All new estates are required to construct centralized wastewater treatment facilities. The ADB has identified 22 industrial sites where central treatment systems could be built, for a combined investment of \$1.3 billion over 10 years. Through the Indonesia Water Control Project, the ADB and the GOI are working to rehabilitate and upgrade the centralized industrial treatment system in South Bandung to serve as a prototype for the construction of other systems on Java.

The South Bandung system was developed by the Research Institute for Water Resources Development of the Ministry of Public Works (MPW). The first phase of development involved the construction of the wastewater collection systems financed by the participating industries (\$41,000); the primary treatment facilities (with a capacity of 8,640 m<sup>3</sup>/day) were financed by the MPW and KLH (\$3.3 million). The second phase is underway and involves the construction of secondary treatment facilities with a capacity of 13,000 m<sup>3</sup>/day. These facilities were scheduled for completion in 1992. When completed, this system will control wastewater discharges from 70 industries to the Citarum River. These industries are currently discharging 14,000 m<sup>3</sup> of effluent per day.

Business opportunities in the Indonesian industrial wastewater treatment market will be enhanced by the World Bank's Industrial Efficiency and Pollution Project, which is currently in the pipeline. Through this project, the World Bank will provide a \$80-\$210 million package of credit and services to help Indonesian industries comply with pollution control regulations. The project will also strengthen the capabilities of BAPEDAL staff, local authorities and consultants in environmental analysis and monitoring. The project is scheduled to be reviewed and approved by mid-1993.

The high quality of U.S. equipment is generally recognized in Indonesia, but is not always selected by industries because of its higher costs. This drawback is exacerbated by the overall weak regulatory environment in this nation.

The ideal market for U.S. environmental equipment suppliers exists in outfitting large industrial plants owned or financed by multinationals that maintain worldwide corporate standards. Further markets would be open to U.S. companies willing to lower their short-term profit expectations in exchange for establishing themselves in the long run. This scenario might also include holding product information seminars and free auditing services suited to Indonesian industrial needs and limitations. Joint ventures between local and U.S. firms can also be a valuable strategy for opening markets to U.S. environmental equipment

and service suppliers. One example of such a successful union can be found in the recent joint venture between Bimantara of Indonesia and Waste Management Inc.

While the current capabilities of the local environmental industry to meet demands in the area of industrial wastewater treatment are limited, the list of Indonesian companies supplying wastewater treatment equipment and services is growing. There are over 75 Jakarta-based companies in the water and wastewater treatment business; at least 25 of these claim to have wastewater treatment plant design, construction and operation capabilities. The most successful companies in the Indonesian market are typically joint ventures with foreign companies that offer a range of equipment and services, including wastewater treatment plant design and construction, reverse osmosis and ultrafiltration equipment, clarifiers, media filters, dosifiers, and analytical instruments.

Most basic equipment (e.g., tanks and piping) is fabricated in Indonesia. Most chemicals and filter media used for wastewater treatment are also available locally. There are several private testing laboratories that are expected to conform to the standards and equipment used in the JICA-funded reference laboratory, which is now being developed. More sophisticated equipment, such as instrumentation, is imported. The weakest component of the local industry lies in engineering and design services, including industrial process consulting.

The best near-term and long-term strategies for entering the market for industrial wastewater treatment equipment and services in Indonesia are summarized in the following table.

### ***Municipal Market***

The Directorate General of Human Settlements and the Directorate General of Environmental Sanitation under the Ministry of Public Works are responsible for constructing municipal wastewater treatment systems. Although water pollution control is a high priority for environmental officials, Indonesia's top officials do not stress water supply and wastewater treatment in their plans to develop the country's infrastructure in order to support continued economic growth.

## Indonesia

### Business Strategies for the Industrial Market

Near-term (1992-1995)	<ul style="list-style-type: none"><li>▶ Target private industries on Java where pollution prevention, waste minimization, recycling and material reclamation are most attractive, e.g., metal finishing companies. Offer free or low-cost process consulting as a way of selling wastewater treatment systems.</li><li>▶ Target industries covered in the Prokasih program for which effluent standards exist (e.g., pulp and paper, metal finishing, textiles, palm oil, tapioca, leather tanning).</li><li>▶ Target U.S. and multinational companies investing in Indonesia. Key industries are oil, gas and petrochemicals. The U.S. Foreign Commercial Service publishes an annual petroleum report listing the major firms.</li><li>▶ Work with private developers of industrial estates in selling centralized treatment systems.</li></ul>
Long-term (1996-2000)	<ul style="list-style-type: none"><li>▶ Establish joint ventures with local companies to fabricate and market low-cost, appropriate systems for the Indonesian market.</li><li>▶ Establish joint ventures with local firms to provide environmental services.</li></ul>

Municipal sewerage systems are extremely underdeveloped in Indonesia: less than 1 percent of the 56 million people living in urban areas have access to sewerage systems.<sup>3</sup> It is estimated that 35 to 40 percent of the urban population have access to sanitation facilities equipped with a septic tank and drainage field or a leaching pit. The remainder discharge directly to the surface drainage network, or to septic tanks without drainage fields, or to deep pits. Little treatment capacity exists for sludge pumped from septic tanks. While stabilization ponds have been built in Jakarta and Surabaya, most of the sludge pumped from Indonesian septic tanks is dumped into rivers and drainage canals. This trend is perpetuated

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<sup>3</sup> *Private Participation in Urban Services: Project Paper.* USAID/Jakarta. September 1991.

by the fee that the local governments of Jakarta and Surabaya charge to private pumpers for emptying their trucks into the city stabilization ponds.

The GOI has made the reduction of public and private debt an explicit goal of the national development strategy. Thus, it may be several years before any real opportunities exist for private companies investing in municipal wastewater treatment. It is possible, however, that demand will pick up over the next few years if certain events take place. The Ministry of Public Works, for example, is considering a new requirement that sewer systems be installed in all new residential developments over 200 hectares. If passed, this regulation would create significant opportunities for domestic wastewater treatment systems.

USAID, the World Bank, and the ADB are currently implementing or appraising a number of urban development projects in selected cities and provinces in Indonesia. These projects cover a range of urban infrastructure components, including municipal wastewater treatment, and offer the best near-term business opportunities in the Indonesian municipal market.

Over the longer term, a market may develop for private companies owning and/or operating municipal wastewater treatment systems. Opportunities for U.S. companies in the municipal wastewater treatment market are currently limited by the fact that the legal context in which companies can participate in the construction and operation of municipal facilities is highly ambiguous.

A USAID-funded project was launched in 1992 to assess ways of privatizing solid waste, water, and wastewater treatment services in Indonesia.<sup>4</sup> It concluded that for private investment and operation of wastewater treatment facilities to take place, there are three critical pre-conditions: legal agreements between a private company and a municipal water agency, cost-recovery and profit earning mechanisms, and the recourse available to resolve disputes. The market for private investment in municipal services may benefit from the private development of other infrastructure projects in Indonesia, e.g., power plants and communication.

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<sup>4</sup> *Private Participation in Urban Services: Project Paper.* USAID/Jakarta. September 1991.

## *Indonesia*

### Multilateral Development Bank Projects with Wastewater Treatment Components in the Pipeline, 1992

Project	Funding Source	Cost (\$ million)
Municipal Finance and Shelter Program	USAID	120
Municipal Finance for Environmental Infrastructure Program	USAID	125
Second Jabotek Urban Development Project	World Bank	358
Sulawesi/Irian Jaya Urban Development Project	World Bank	172
Third Jabotek Urban Development Project	World Bank	91
Surabaya Urban Development Project	World Bank	496
Semarang/Surabaya Urban Development Project	World Bank	150
Fourth Jabotek Urban Development Project	World Bank	190
Central Java and Yogyakarta Urban Development Project	Asian Development Bank	250
Water Supply and Sanitation for Low Income Groups	Asian Development Bank	600
Water and Sanitation for Low Income Communities	Asian Development Bank	100
Urban Environmental Sanitation Project	Asian Development Bank	n/a

Source: RCG/Hagler, Bailly, Inc. based on World Bank and Asian Development Bank project announcements, October 1992.

**Business Strategies for the Municipal Market**

<p>Near-term (1992-1995)</p>	<ul style="list-style-type: none"><li>▶ Register with the GOI's List of Companies for Government Contracts. U.S. firms must go through the registration and pre-qualification system for companies working on government projects.</li> <li>▶ Seek Indonesian partner to pursue municipal and multilateral development bank projects. Procurement policies of the national and provincial governments favor local companies. Forming partnerships with a local company is essential in terms of access to government contracts and price competitiveness. Additionally, most MDB projects require some percentage of local participation. BAPEDAL is a good source for locating project opportunities and potential joint venture partners.</li></ul>
<p>Long-term (1996-2000)</p>	<ul style="list-style-type: none"><li>▶ Propose private investment and the operation of wastewater treatment plants for housing projects, resorts and hotels, and municipalities.</li></ul>

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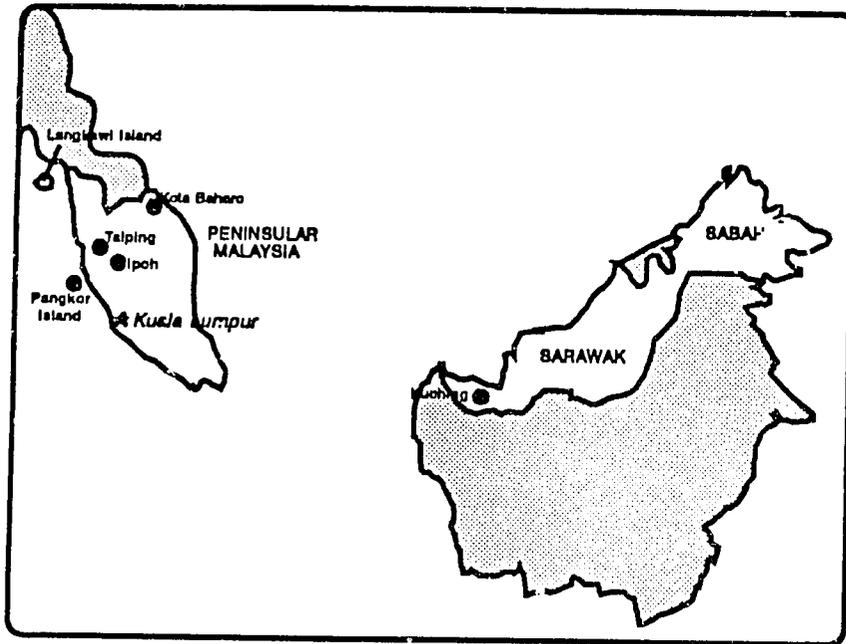
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## Malaysia

### Market Overview

Rapid industrialization and urbanization in the face of increasingly stringent environmental regulation create both near- and longer-term business opportunities in Malaysia for U.S. wastewater treatment equipment and service companies. *Business Asia* estimates that public and private sector demand for water purification and wastewater treatment will reach \$200 million per year during the Sixth Malaysia Plan (1991-1995).<sup>1</sup>

The most important near-term (1992-1995) business opportunities will exist in providing centralized treatment systems for large industrial estates and compact wastewater treatment systems for new housing estates and tourist developments. Marketing pollution prevention and waste minimization services among such high-growth industries as food processing, textiles and metal finishing, and among small and medium-sized companies struggling to meet national effluent standards, will create important longer-term business opportunities for U.S. companies.

### Policy Environment

The Government of Malaysia (GOM) has instituted a fairly comprehensive set of environmental regulations covering air and water pollution and, more recently, hazardous waste. These regulations are embodied in the Environmental Quality Act (EQA) of 1974 and

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<sup>1</sup> "Managing Asia's Environment," *Business Asia*, July 6, 1992.

## Malaysia

its subsequent amendments. The EQA covers the licensing and control of water pollution sources and the preparation of environmental impact assessments. It also contains penalties for any person found guilty of polluting inland waters.

The Department of Environment (DOE) under the Ministry of Science, Technology and Environment is the federal agency responsible for implementing the EQA. The DOE is organized into four central divisions and eight regional offices. The Director General has the authority to require the occupier of any premise to install and operate control equipment in instances where pollutants are being discharged or are likely to be discharged or emitted. Additionally, the director general is empowered to close down factories that violate the EQA, and state directors can take legal action against errant parties.

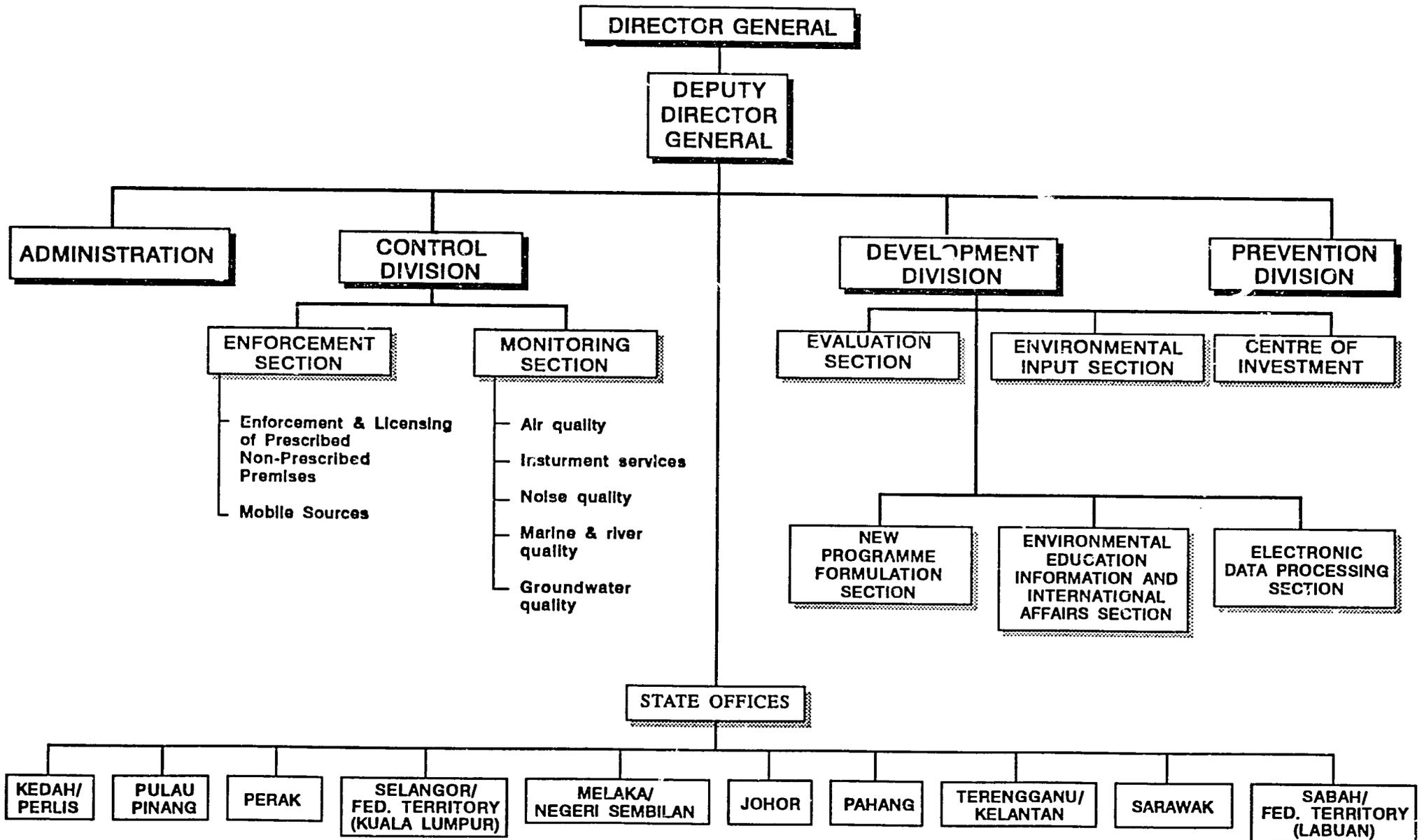
Under the Sixth Malaysia Plan (1991-1995), the GOM is planning to strengthen the Sewage and Industrial Effluent Regulations in order to comply with water quality standards developed in 1988. The Sixth Plan also promotes investments in pollution control technologies and effluent monitoring. In addition, the 1993 federal budget, approved in November 1992, allocates \$58 million for pollution control and conservation to the following ministries: Science, Technology and Environment, Primary Industries, Agriculture, and Housing and Local Government.

In recent years, DOE has created tax incentives and other initiatives for industrial environmental investments. DOE is currently collaborating with other government agencies, including the Ministry of Finance, to review monetary strategies for promoting pollution control, such as preferential interest rates for industries using "environmentally friendly" technologies.

### EQA Amendments Related to Water Pollution Control

- ▶ Licensing Regulations of 1977
- ▶ Environmental Quality (Sewage and Industrial Effluent) Regulations, 1979
- ▶ Environmental Quality (Crude Palm Oil) Regulations, 1977
- ▶ Environmental Quality (Raw Natural Rubber) Regulations, 1978
- ▶ Environmental Quality (Environmental Impact Assessment) Order, 1987

# Organizational Structure: Department of Environment



## *Malaysia*

The Regional Offices and the Enforcement Section of the Control Division are the primary central authorities responsible for enforcing national effluent standards, issuing licenses and contravention permits, and dealing with appeal cases. Local governments, on the other hand, are responsible for wastewater collection and treatment.<sup>2</sup> Two important laws that empower local authorities are:

- ▶ **The Town and Country Planning Act (1976)** stipulates that no person shall use any land or building in any way not according to the development plan of the local authority, and that any development requires approval from the local authority.
- ▶ **The Local Government Act (1976)** provides the local authority with control over any activities that affect the health, property or safety of the community, including the discharge of domestic wastes into rivers.

State governments are also involved in wastewater treatment through the State Economic Development Corporations (SEDC). SEDCs implement state commercial and industrial development plans and plans for new townships. These corporations are responsible for constructing drains, sewers and other utilities for these new developments. After construction, the management of the new sites and infrastructure is turned over to the local government.

## *Industrial Market*

The industrial market for wastewater treatment is a function of the DOE's capacity to enforce the national effluent standards at the roughly 2,300 industrial pollution sources in Malaysia. Through its pollution source inventory, DOE estimated the following breakdown of major industrial sources of water pollution in 1991: 40 percent food and beverage, 14 percent rubber products, 12 percent crude palm oil, 12 percent chemicals, 9 percent textile and leather, 9 percent raw natural rubber, and 4 percent pulp and paper.

The major industrial sources of water pollution are concentrated on the west coast of Peninsular Malaysia, with only 7 percent found in Sabah and Sarawak. Nearly 50 percent of the major sources are found in the states of Selangor, Johor and Pulau Penang.

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<sup>2</sup> The Malaysian Federal Constitution separates the legislative and executive powers between the Federal and the State Governments.

Geographic Distribution of Major Industrial Sources  
of Water Pollution in Malaysia, 1991

State	Number of Factories							Total
	Palm Oil	Raw Natural Rubber	Rubber Product	Food & Beverage	Textile & Leather	Paper	Chemical	
Selangor	29	13	132	94	22	15	109	414
Johor	67	41	36	136	59	11	34	384
Pulau Penang	5	9	35	164	58	14	43	328
Perak	36	26	28	133	13	5	12	253
Kedah	3	29	22	98	9	2	8	171
Terengganu	11	3	6	84	16	-	-	120
Pahang	58	20	3	33	-	1	1	112
Wilayah Persekutuan	-	4	26	21	10	13	31	105
Sabah	27	4	3	49	5	11	5	104
Negri Sembilan	12	22	13	15	2	22	9	95
Melaka	3	12	17	21	7	3	11	74
Sarawak	6	4	1	38	-	3	4	56
Kelantan	8	11	1	28	4	1	3	56
Perlis	-	-	1	14	1	-	-	16
<b>Total</b>	<b>265</b>	<b>198</b>	<b>324</b>	<b>928</b>	<b>206</b>	<b>101</b>	<b>270</b>	<b>2292</b>

Source: *Environmental Quality Report - 1991*. Department of the Environment, Ministry of Science, Technology and Environment, April 1992.

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The DOE has been particularly successful at controlling water pollution from the crude palm oil and natural rubber processing industries. DOE targeted these industries as early as the mid-1970s because they were a visible source of high biological oxygen demand (BOD) loading into the country's inland waterways.

Today, separate water pollution control regulations are on the books for each of these industries, and nearly all of the 500 palm oil and natural rubber processing factories have installed some type of wastewater treatment system. The DOE asserts that BOD loading from these two industries has been cut by more than half since the palm oil and rubber water pollution regulations were passed in 1977-78.

Through the environmental impact Assessment (EIA) process, the DOE has also been relatively successful at enforcing water pollution control standards on industrial estates. There are currently over 100 industrial estates in Malaysia. Most of the larger factories located on these estates have installed wastewater treatment systems to meet the minimum effluent standards required by DOE. In 1991, DOE was involved in the permitting process for several major proposed developments, including the Mukim Industrial Estate in Petaling, Selangor, the Kota Kinabalu Industrial Park in the state of Sabah, and the Malaysia Technology Park.

The DOE has not been as successful at enforcing effluent standards at some of the newer industries. This is due, in large part, to a lack of information on proper treatment technologies for these industries and to the limited resources that DOE has to enforce the Sewage and Industrial Effluent Regulations of 1979. The current wastewater treatment practices of several key industries include:

### **Status of Water Pollution Control in the Palm Oil and Natural Rubber Industries**

- ▶ In 1991, 265 crude palm oil mills were licensed to comply with the discharge standards specified under the Environmental Quality (Crude Palm Oil) Regulations 1977. About 85 percent of the mills monitored were found to be in compliance with BOD discharge standards.
  
- ▶ In 1991, 207 licenses were issued to raw natural rubber factories under the Environmental Quality (Raw Natural Rubber) Regulations 1978. About 81 percent of the factories monitored were in compliance with the licensing conditions.

- ▶ **Food processing plants** are the major source of industrial water pollution according to DOE. Non-compliance in this industry primarily results from the lack of appropriate treatment technology, under-utilized capacity, and poor maintenance practices in existing wastewater treatment systems. Nearly 40 percent of the 81 contravention licenses issued by DOE for water pollution in 1991 went to food processing companies.<sup>3</sup>
- ▶ Many **textile industries**, especially in the states of Perak, Johor, Selangor, Kelantan and Terengganu, are operating without proper effluent treatment systems. For industries that do have wastewater treatment systems, meeting the national discharge standards remains a problem.
- ▶ Only 22 percent of the **metal finishing industry** has installed some form of wastewater treatment equipment. It also appears that most metal finishing factories in the Federal Territory of Kuala Lumpur have contravention permits from DOE pending extension of the municipal sewerage system.

Despite these low compliance rates, the overall number of permit applications submitted to DOE for the construction of industrial wastewater treatment facilities is rising steadily. The majority of these applications came from electronics, furniture, metals, and food processing industries. Over three-quarters of all applications were filed in 1990 for installations in the State of Johor.

Number of Applications for New Industrial Wastewater Treatment Facilities

	1988	1989	1990	1991
No. of Applications	90	171	282	505

Source: RCG/Hagler, Bailly, Inc., November 1992, based on Department of the Environment data.

<sup>3</sup> DOE issues contravention licenses under the following conditions: no known practicable treatment technology exists, the estimated cost of compliance is prohibitive relative to the size of the facility, installation of control equipment would take longer than compliance regulations allow, or a municipal sewerage system is planned for the area in which the facility is located. DOE issued 81 water pollution contravention licenses in 1991, most under the condition that no treatment technology existed for meeting COD discharge standards.

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The industrial wastewater treatment market is estimated at \$75 million in 1992 and should grow steadily through 1995. The majority of business opportunities for industrial wastewater treatment will exist in servicing larger factories in high-growth manufacturing sectors. By 1995, the three industries with the greatest contribution to GDP will be food processing, electronics, and chemicals and petrochemicals.

The textile and metal finishing industries are moving toward compliance with national effluent regulations. The Malaysian textile industry comprises over 300 licensed factories with over 60,000 employees. Growth rates of around 10 percent or higher are expected to continue into the 1990s. The Textile Manufacturers Association recently formed a pollution control technical committee to advise companies on how to comply with the national environmental quality regulations.

The Metal Finishing Society of Malaysia is holding meetings with the DOE to discuss a proposed plan to relocate a large number of Malaysian metal finishing factories to a special industrial estate with centralized wastewater treatment facilities. The International Finance Corporation (IFC) estimates that the metal finishing industry relocation project will probably take around five years to get underway, but could represent a \$5 million opportunity for constructing a centralized treatment facility for the estate.<sup>4</sup> The market for centralized wastewater treatment systems will grow as the number of industrial estates for all types of manufacturing enterprises increases.

With the passage of the EQA for the palm oil and natural rubber processing industries in 1977-78, the local wastewater treatment industry has had almost twenty years to develop. Today, local wastewater treatment capabilities surpass those in the air pollution control and hazardous waste treatment and disposal markets. Nevertheless, the capability of the local industry is limited to basic primary treatment, and the most common treatment technology used by both industrial and municipal sources remains anaerobic ponds. Basic civil works and products, such as screens, pressure vessels and tanks, account for most of the domestic value added in industrial wastewater treatment projects.

U.S. companies with wastewater treatment technology will find significant business opportunities in the food processing, electronics, textiles, metal finishing, and rubber products industries as DOE continues to crack down on these sectors. Aerated lagoons and activated sludge systems are becoming increasingly popular, while land constraints are

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<sup>4</sup> *Identifying Market Opportunities in Environmental Goods and Services: Malaysia*. International Finance Corporation. March 1991.

increasingly an issue. U.S. companies specializing in more compact biological treatment systems and aeration equipment will benefit from this trend.

#### **Industrial Development in the States of Johor and Melaka**

The State of Johor is planning a \$2.4 billion investment in infrastructure to become Malaysia's largest industrial center. Currently, 120 new factories are established each year in Johor. Over the next few years, the State Economic Development Corporation of Johor will spend \$360 million to develop 13 new industrial parks spread over 2,700 hectares to house these new factories, including a high-tech park in Skudai and a heavy industrial zone in Tanjung Langsat. Between 1992 and 2005, Johor predicts that over 1,600 new manufacturing projects will be carried out, for a total investment of \$11 billion.

The State of Melaka has ambitious plans to attract petrochemical, textile, food and electronics industries. The number of industrial estates in Melaka increased from five in 1987 to eleven in 1992. The State of Melaka alone accounted for 20 percent of Malaysia's \$10 billion fixed capital investment in 1991. Because of several incidents of contamination of municipal water supplies, both the State Economic Development Corporation and the local governments in Melaka will be particularly sensitive to building environmental safeguards into new industrial projects. Last year, there were three separate incidents of contamination of the municipal water supply from a latex processing plant and a fertilizer plant.

In general, U.S. wastewater treatment equipment is well-received by Malaysian industrial buyers. Local manufacturers present the major competition for U.S. companies in the production of lower-value equipment such as screens and tanks. In the high-tech segments, however, Japanese and British firms are the primary competitors.

Supplying advanced chemicals for industrial wastewater treatment also presents significant opportunities for U.S. chemical producers.<sup>5</sup> Local producers are currently able to service

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<sup>5</sup> In 1990, Malaysia imported over 90 percent of its water treatment chemical needs. The U.S. market share was about 10 percent.

## *Malaysia*

the demand for basic chemicals, such as pH adjusters, but polyelectrolyte flocculents and other advanced chemicals must be imported. Local packaging/manufacture of these treatment chemicals could supply not only Malaysia, but the entire ASEAN region. The IFC reports that the main supplier of water treatment chemicals, CSC Kemico (a subsidiary of Kumpulan Emas Bhd) is looking for a joint venture partner to undertake such an operation.

The market for industrial wastewater treatment technical services is dominated by small and medium-sized consultants specializing in environmental impact assessments. In 1990, there were over 60 such companies (foreign and local) registered with the Department of Environment. Local consultants can easily undercut the prices charged by foreign companies for EIAs.

Multi-nationals, however, often use firms from the country in which they are headquartered. For example, U.S. electronics companies operating in Malaysia typically use U.S. environmental consulting companies. Because the Malaysian manufacturing sector has traditionally been dominated by U.S. and Japanese companies and their subsidiaries, U.S. and Japanese environmental companies are well established in the Malaysian environmental services market. In the area of wastewater monitoring, there is a considerable number of independent water laboratories competing on the basis of price over quality. DOE's monthly inspections of industrial facilities has substantially increased the demand for both EIA and laboratory services in recent years.

Business Strategies for the Industrial Market

<p>Short-term (1992-1995)</p>	<ul style="list-style-type: none"> <li>▶ Market low-cost treatment technologies capable of meeting DOE standards (especially COD limits).</li> <li>▶ Offer free wastewater treatment technology consultations to the Textile Manufacturers Association, Metal Finishing Society of Malaysia, and other industry associations that are moving ahead on compliance with national effluent standards.</li> </ul>
<p>Long-term (1996-2000)</p>	<ul style="list-style-type: none"> <li>▶ Market integrated environmental services including pollution prevention, advanced process technologies, materials recovery, and safe disposal of solid wastes.</li> </ul>

**Municipal Market**

The Ministry of Housing and Local Government is responsible for programming water and sewerage projects for cities and resort areas. Specifically, the Technical Unit within the Local Government Division is responsible for all urban engineering projects including sewerage, wastewater treatment, urban drainage, and solid waste management. The Ministry publishes a 20-year plan identifying the projects it expects to fund.

Few Malaysian cities operate centralized municipal wastewater treatment systems. The largest city, Kuala Lumpur, is only partially served by a centralized collection system with treatment in stabilization ponds. Due to the capital and human resource constraints faced by most local authorities, only nine of a total of 19 planned feasibility studies on centralized sewerage systems for state capitals and major towns were completed during the Fifth Malaysia Plan (1986-1990). Under the Sixth Malaysia Plan, the GOM plans to increase the urban population's access to municipal sewerage systems from 5 percent to 8.5 percent with an investment of \$220 million.

Under the Sixth Plan, centralized sewerage systems are slated for the towns of Desaru, Langkawi and Pangkor, in conjunction with the GOM's efforts to promote these areas as tourist destinations. The GOM also plans to initiate feasibility studies for sewerage schemes for the cities of Kangar, Kuching and Taiping. The Ministry of Housing and Local Government has proposed a 50-50 cost sharing arrangement where the Ministry pays half. The local government will add a fee onto household water bills to cover its share of building

## *Malaysia*

a new wastewater treatment system. Kuala Lumpur already charges for sewerage, while Penang is in the process of instituting the charge.

The Ministry of Housing and Local Government is also studying the potential for privatizing municipal wastewater treatment systems. As this privatization initiative moves ahead and the legal mechanisms are worked out, substantial opportunities will exist for build-own-transfer and build-operate-transfer (BOT) schemes to provide municipal wastewater treatment.

The State of Melaka, for example, drew up a master sewerage plan several years ago, but has not secured the financial resources necessary to implement it. The plan includes the construction of pumping stations and several centralized sewage treatment systems. A large partner willing to enter a BOT arrangement with the State of Melaka could take advantage of this sizable opportunity. Several large civil engineering firms, including United Engineers and IJM Corporation Bhd, are already moving into this area.

Business opportunities will also exist in providing wastewater treatment equipment and services for private developers of housing estates. In 1990, there were 101 applications for the construction of wastewater treatment systems by building owners. It is mandatory for all new housing estates to construct sewage treatment plants. The IFC estimates that \$20 million will be invested in turn-key sewage treatment plants for housing estates over the next few years.<sup>6</sup> Because of land constraints, the current trend is towards compact treatment systems using more advanced technology.

### **Malaysian Housing Estate Developers Turn to Advanced Wastewater Treatment Technology**

In 1987, the Ministry of Housing approved Water Engineering Ltd's (UK) fine bubble activated sludge system, which was later installed on a housing estate by Cessna Engineering Bhd (Malaysia). To date, Cessna has installed four of these systems, with another four in the pipeline. Housing estate developers are currently reviewing a proposal by Cessna to construct an additional eight systems.

State Economic Development Corporations are responsible for developing new housing estates, townships, and industrial estates, and for providing all the basic infrastructure facilities (to be financed by an assessment from each connected unit). The Ministry of

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<sup>6</sup> *Identifying Market Opportunities in Environmental Goods and Services: Malaysia*. International Finance Corporation. March 1991.

Housing and local governments, on the other hand, are responsible for approving wastewater treatment systems considered for new housing estates.

The major players in the municipal wastewater treatment market tend to be established consortia, comprising large local civil engineering firms and foreign water supply/treatment companies. These consortia generally work in the BOT/privatization field on water supply and sewage treatment projects. A good example is Kumpulan Emas Bhd (with its subsidiary Salcon Engineering Sdn Bhd), which is partnered with the British firms North West Water and Bovis International for the Ipoh Water Supply project. In addition, the partnership of Innovest Group and Lyonnaise des Eaux (France) currently operates the water supply system in Taiping. Although they operate mainly on water supply projects, these consortia are well-positioned to bid on large wastewater treatment projects.

Other important players in the municipal market are small to medium-sized joint ventures. Cessna Engineering Sdn Bhd is a small Malaysian firm licensing turn-key activated sludge plants for housing estates from the British company Water Engineering Ltd. Another joint-venture between Sam McCoy Manufacturing Sdn Bhd and Flygt AB is manufacturing submersible pumps for local and regional markets. Finally, the Malaysian industrial solid waste collection company, City Waste, recently began offering maintenance services for small sewage treatment plants for city councils and private housing estates.

#### Business Strategies for the Municipal Market

<p>Short-term (1992-1995)</p>	<ul style="list-style-type: none"> <li>▶ Team with a local company to license and market compact treatment systems for resorts and new housing estates to private developers and SEDCs.</li> </ul>
<p>Long-term (1996-2000)</p>	<ul style="list-style-type: none"> <li>▶ Team with local civil engineering firms and larger consortia to propose BOT municipal wastewater projects to local governments.</li> </ul>

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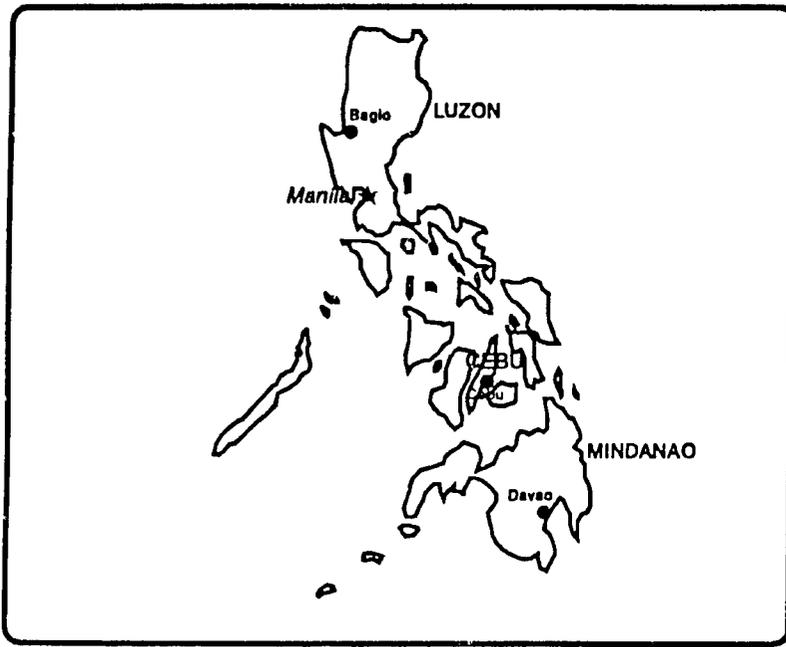
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## *Philippines*

### ***Market Overview***

The U.S. Department of Commerce (DOC) estimated the Philippine market for wastewater treatment equipment and services to be \$15.8 million in 1990. This market is expected to grow by 15 to 25 percent per year through 1995.<sup>1</sup>

The most promising business opportunities in the Philippine industrial sector will be found in providing low-cost wastewater treatment systems for food and beverage, textiles, and chemicals manufacturers. In the municipal sector, projects funded by international donor agencies offer the best near-term market opportunities.

### ***Policy Environment***

Although Philippine environmental policies date back to the early 1960s, the framework for these policies was set in 1977 with the passage of Presidential Decree (PD) No. 1151 (the Philippines Environmental Policy) and PD No. 1152 (the Philippines Environmental Code). The two agencies created by the decrees -- the National Pollution Control Commission and the National Environmental Protection Council -- were later reorganized into the Department of Environment and Natural Resources (DENR).

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<sup>1</sup> *Industry Sector Analysis - The Profile of the Market for Water and Wastewater Pollution Control Systems*. U.S. and Foreign Commercial Service, Manila, Philippines. November 1990.

## *Philippines*

DENR is the principal agency responsible for environmental management in the Philippines. Executive Order 131 created the DENR to oversee conservation, management, development, and the proper use of the country's environmental and natural resources. Executive Order 192 reorganized the environmental functions of the government and established the Environmental Management Bureau (EMB) to focus on environmental policies and their implementation, as well as to review all environmental impact assessments. A Pollution Adjudication Board is attached to DENR and is responsible for prosecuting violations of pollution laws.

### **The Philippine Strategy for Sustainable Development**

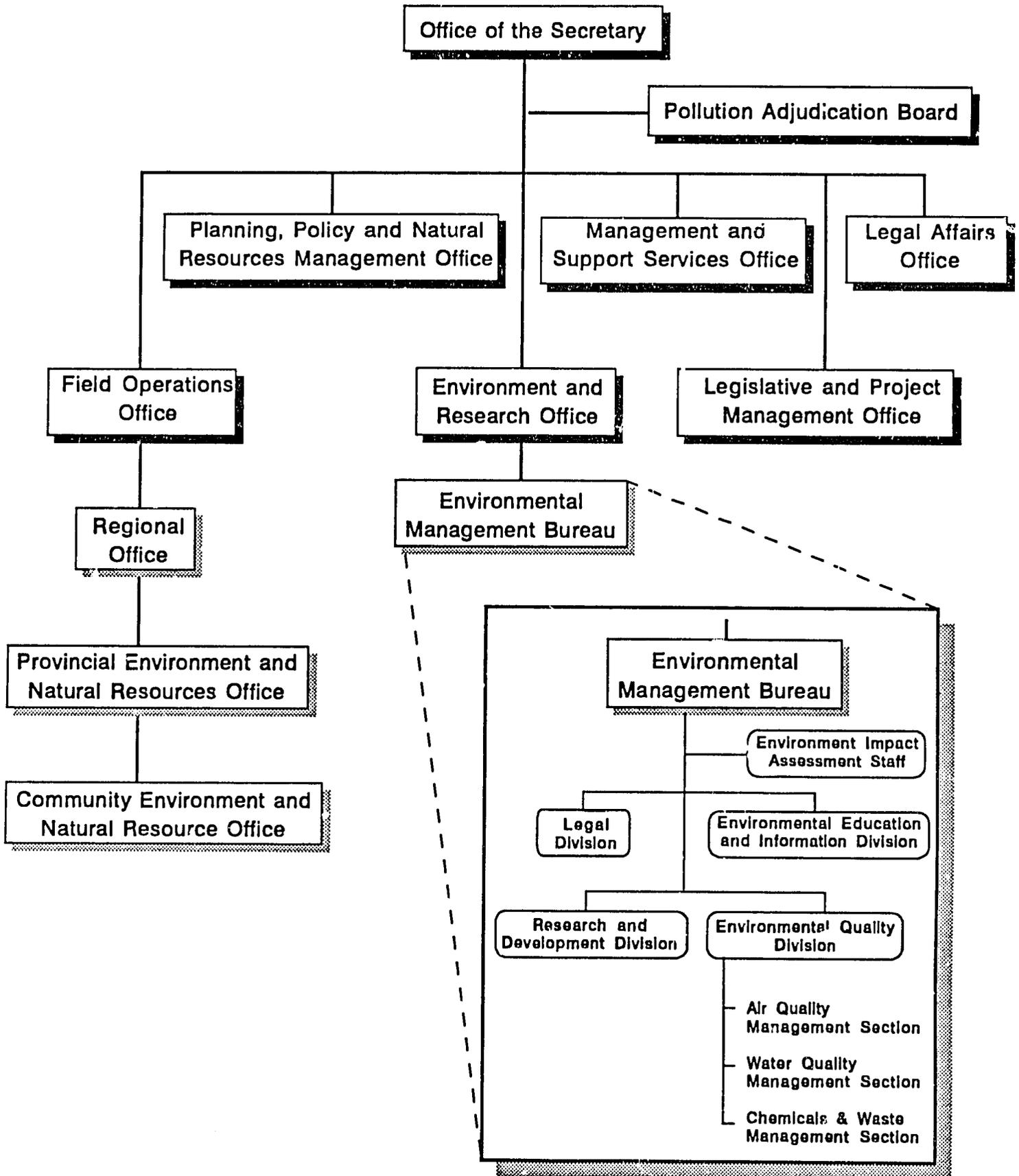
In 1989, the Government of the Philippines (GOP) launched the **Philippine Strategy for Sustainable Development**, which consists of 11 strategies and priority projects. While the cost of all 127 projects in the "Mid-Term Investment Program - 1990-1995" comes to nearly US \$3.4 billion, only eight of the projects target industrial pollution at a total cost of \$12.3 million. The distribution of projects and proposed funds is indicative of the GOP environmental orientation toward "green" or natural resource issues in the country. The industrial pollution control strategy focuses on low-cost treatment technologies, pollution prevention, and the strengthening of pollution control laws.

In recent years, the DENR has taken a number of initiatives to crack down on industrial polluters. It launched the "Dirty Dozen" campaign in 1990, which disclosed the names of the 12 largest polluters in each region of the country.<sup>2</sup> Those listed were subjected to close monitoring and enforcement. In addition, DENR has expanded the powers of the Pollution Adjudication Board to shut down plants by issuing cease and desist orders to polluting firms that are in violation of air and water quality standards. Such cases, however, are the exception and not the rule. Some random sampling is done by the DENR, but monitoring equipment, laboratory and trained personnel are all lacking.

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<sup>2</sup> The industries most frequently targeted in the "dirty dozen" were sugar milling and refining, cement, lime and plasters, mining industry, piggeries and poultry farms, food products, beverages, and pulp and paper plants.

# Organizational Structure: Department of Environment and Natural Resources/ Environmental Management Bureau



## *Philippines*

### *Industrial Market*

Agro-based industries (e.g., sugar, coconut mills) and resource-extraction industries (e.g., mining and mineral processing, cement plants) comprise the bulk of the Philippines industrial sector. Light manufacturing industries (e.g., textile mills, garments factories, consumer products manufacturing plants), chemical plants, and a few heavy industries (e.g., steel mills, copper smelters, phosphatic fertilizer plants) are also important components of the industrial sector.

Over two-thirds of the country's industrial facilities are located in the Metro Manila area. The GOP has thus pursued a policy of industry dispersion. It has complemented this policy by encouraging foreign investment in export processing zones (EPZ) and industrial estates, which are being set up at selected sites throughout the country (e.g., Regional Industrial Centers). Over 50 of these sites are either functioning or in various stages of planning and development.

As of the end of 1991, there were four government-owned industrial estates and EPZs: Mariveles, Bataan; Bagio City EPZ; Cavite EPZ; and Mactan, Cebu EPZ. Private developers are currently building seven large industrial estates. Six of these are located south of Manila in the CALABARZON (Cavite, Laguna, Batangas, Rizal, Quezon) region. The seven estates are: Camelray Industrial Park, Canlubang, Laguna; First Cavite Industrial Estate, Dasmarinas, Cavite; Gateway Business Park, General Trias, Cavite; Laguna International Industrial Park, Santa Rosa, Laguna; Laguna Technopark, Santa Rosa, Laguna; Light Industry and Science Park of the Philippines, Cabuyao, Laguna; and Luisita Industrial Park, Tarlac.

Most industrial effluent in the Philippines is untreated or only partially treated and discharged into inland and marine waterways. Coconut and vegetable oil, sugar milling, distilleries, textiles, iron and steel, mining, and cement are the largest polluting industries by volume of effluent discharge.<sup>3</sup> The most toxic pollutants are smelters, petroleum refineries, petrochemicals, pesticides/wood preservatives, gold amalgam processors, industrial chemicals, and fertilizer plants.

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<sup>3</sup> *Sustainable Urban and Industrial Environmental Management Review*. Prepared by Tropical Research and Development, Inc. in cooperation with Dames and Moore International for USAID/Philippines, May 21, 1991.

## Annual Pollution Discharges by Industry in Metro Manila

Industry	No. of Plants	Biological Oxygen Demand (tons/year)	Suspended Solids (tons/year)
Food Processing	35	1,849	2,035
Textile	29	313	1,307
Piggery	8	298	895
Pulp and Paper	3	56	178
Chemical	9	43	57
Metallic Products	14	32	237
Slaughterhouse	1	34	36
Non-metallic	1	3	164
Tannery	1	3	2
Other	9	34	50
<b>TOTAL</b>	<b>110</b>	<b>2,664</b>	<b>4,969</b>

Source: *Industry Sector Analysis - The Profile of the Market for Water and Wastewater Pollution Control Systems*. U.S. and Foreign Commercial Service, Manila, Philippines, November 1990.

Recent government pressure through spot monitoring has led some factories to install wastewater treatment systems and has increased sales of treatment equipment. The existing penalty for non-compliance (Peso 5,000, or US \$208 per day maximum), however, has not been adjusted since it was set in 1976, despite numerous devaluations of the peso. The fine for discharging untreated effluent has thus not been an effective deterrent to industrial polluters. EMB is considering increasing the penalty to better reflect the marginal cost of compliance by industry.

In 1990, only 31 percent of all firms had treatment equipment and a permit to operate. Modern wastewater treatment facilities can be found within some of the larger industrial plants, but they are often not properly operated or maintained. The majority of those industries that do employ some kind of wastewater treatment facilities are located in the Metro Manila area. In Cebu, the second-largest industrial area, very few plants are equipped

## *Philippines*

with wastewater treatment equipment.<sup>4</sup> Some examples of current wastewater treatment practices and technologies used in the Philippines include:

- ▶ Some **pulp and paper mills** are equipped with instrumentation devices for water pollution which include water samplers, analyzers, flow, volume and level measuring equipment. Settling tanks, flotation systems, mechanical aerators, air diffusers and lagoons are also commonly used.
- ▶ The treatment systems currently employed in **textile mills** include filtering, screening, chemical treatment, flocculation, sedimentation and aeration. None of the mills removes color from the waste.
- ▶ **Oil refineries** tend to control effluent pollution to international standards and are among the largest purchasers of water and wastewater control systems. An abbreviated list of equipment used by oil refineries would include instrumentation, air flotation units, pumps, oil/water separators, and incinerators.
- ▶ The **food and beverage industry** produces mostly organic waste, which is best treated by biological treatment methods. The methods currently employed include lagooning, activated sludge, and anaerobic digestion. Aerators, clarifiers, and oil/water separators are the most commonly used equipment.
- ▶ None of the **sugar mills** has any effective treatment plants. Their liquid effluent is generally discharged into adjacent surface water.
- ▶ **Distilleries** tend to be located near sugar mills and nearly all of them have some form of on-site wastewater treatment. The activated sludge systems typically used, however, are ineffective to meet discharge standards.
- ▶ **Semiconductor** manufacturers typically employ flow equalization, neutralization, chemical addition, clarification, and sludge dewatering.

For industry as a whole, sedimentation tanks are the most commonly employed physical treatment technology where systems are employed at all. According to DENR, 36 percent of

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<sup>4</sup> Approximately 85 percent of the known pollution sources that exceed effluent limitations are located in Cebu. *Sustainable Urban and Industrial Environmental Management Review*. Prepared by Tropical Research and Development, Inc. in cooperation with Dames and Moore International for USAID/Philippines, May 21, 1991.

all the physical separation systems used by the 50 industrial plants along the Pasig River are sedimentation tanks, followed by oil/water separators (14 percent) and filters (12 percent).<sup>5</sup> Aeration and activated sludge are the most common biological processes used, primarily in large installations, while chemical treatment is not commonly used.

Simple, manually operated technologies are best suited for the current conditions in the Philippines and are encouraged by EMB. More sophisticated treatment plants run at low efficiencies due to operational problems. Environmental consulting firms typically use simple instrumentation because sophisticated controls are usually not implemented by the companies themselves.

A World Bank-funded assessment in 1992 concluded that most Filipino industries can afford to invest in wastewater treatment.<sup>6</sup> However, some smaller food processing, piggery, and textile industries encounter difficulties in accommodating the increased costs of water pollution control. The beverage, chemicals, pharmaceuticals, electronics, metals, and automotive sectors are in a better position to afford such investments. The major polluters from the large food processing, beverage, piggeries, textiles and chemicals industries are among the country's top 500 corporations. The World Bank, Asian Development Bank, and other funding sources are currently helping to set up financing windows for industrial environmental improvements, primarily through the Development Bank of the Philippines.

The DOC estimates that the total market for wastewater treatment equipment and services increased from \$9.5 million in 1988 to \$13.81 million in 1989.<sup>7</sup> In 1990, it was estimated at \$15.8 million and was forecast to grow by 15 to 25 percent over the next five years. The bulk of this market was accounted for by filtering machinery, aerators, flocculators, pumps, mixers, and laboratory instruments.

The local manufacture of water pollution control equipment is limited to low-technology components. Aerators, clarifiers and flocculators are locally manufactured, except for their motors and reduction gears, which are imported. Small pumps, piping and valves, and all

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<sup>5</sup> *Private Investment and Trade Opportunities in Air and Water Pollution Control*. Economic Brief No. 11, prepared by the East West Center for USAID/ASEAN, August 1992.

<sup>6</sup> *Industrial Environmental Pollution Control*. Prepared by James M. Montgomery, Inc. and Dames and Moore International for the World Bank, 1992.

<sup>7</sup> *Industry Sector Analysis - The Profile of the Market for Water and Wastewater Pollution Control Systems*. U.S. and Foreign Commercial Service, Manila, Philippines, November 1990.

## *Philippines*

metal and structural supports with specifications for most proposed plants can be sourced in the Philippines. Fiberglass floats, shafting and propellers for surface aeration up to 10 hp are also locally made. The local production of wastewater treatment equipment amounted to \$2.64 million in 1990, or 17 percent of the total market. This level is not expected to change much in the near future.

Filipino companies generally rely on environmental engineering consultants to draft specifications and select pollution control equipment. Smaller companies without technical consultants typically seek help from EMB. As a standard practice, consulting engineering firms that have no distributorship arrangements with foreign suppliers do not recommend particular brands of equipment, although some firms act as both consulting firms and distributors of equipment.

The greatest market opportunities for U.S. companies are in surface and paddle wheel aerators, differential flow systems, rotary biological contactors, filter presses, mechanical screens, pumps, special cleaning equipment, complete wastewater treatment plants, and instrumentation such as pH meters and analyzers.

According to the U.S. Department of Commerce, the United States held 21 percent of the import market for wastewater equipment and instrumentation in 1990, compared with 23 percent for Japan and 19 percent for Germany.<sup>8</sup> U.S. equipment has a reputation for good quality among end users, but at a higher cost than European and Japanese competitors. The reputation of U.S. equipment could be improved by shortening delivery schedules and increasing the availability of spare parts.

### **USAID Helps Filipino Industries Improve Pollution Control**

The U.S. Agency for International Development is currently supporting the **Industrial Environmental Management Project (IEMP)**. This five-year project began in 1992 and has three components: pollution prevention, capability building, and policy studies and public/private dialogue. The objective of IEMP is to demonstrate the benefits of voluntary industrial environmental management. Approximately 150 industrial plants from throughout the country will receive pollution management appraisals under IEMP.

For more information on the IEMP, contact PRC-EMI, 23-A Maalindog Street, U.P. Village, Oilman, Quezon City, Metro Manila, Philippines, tel. (63-2) 921-8973, fax (63-2) 922-6913.

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<sup>8</sup> *Industry Sector Analysis - The Profile of the Market for Water and Wastewater Pollution Control Systems*. U.S. and Foreign Commercial Service, Manila, Philippines, November 1990.

**Business Strategies for the Industrial Market**

<p>Short-term (1992-1995)</p>	<ul style="list-style-type: none"> <li>▶ Work with a local company to develop and market low-cost treatment technologies capable of meeting standards for large food processing, beverage, piggery, textile, and chemical industries.</li> <li>▶ Market U.S. multinationals to supply their wastewater treatment needs in the Philippines.</li> <li>▶ Work with private developers of industrial estates and export processing zones to install packaged wastewater treatment systems. A list of estate developers can be obtained from the Ministry of Trade and Industry's Regional Industrial Center Program.</li> </ul>
<p>Long-term (1996-2000)</p>	<ul style="list-style-type: none"> <li>▶ Market integrated environmental services including pollution prevention, treatment and safe disposal, together with equipment.</li> </ul>

***Municipal Market***

Several other agencies are involved in the Filipino municipal wastewater treatment market in addition to the DENR. The Department of Public Works and Highways (DPWH) is responsible for the maintenance of drainage systems; the Local Waterworks and Utilities Administration (LWUA) is responsible for the provision of water and wastewater to urban and rural areas through the creation of autonomous water districts; and the Department of Trade and Industry (DTI) is responsible for the licensing of firms that could have wastewater discharges and the promotion/development of industrial estates. The Metropolitan Waterworks and Sewerage System (MWSS) is responsible for construction and operation of municipal wastewater treatment systems in Metro Manila.

EMB survey results indicate that only 20 percent of Metro Manila's 8 million resident population discharges sewage to a MWSS collection system, while 26 percent of the population discharges to septic tanks, which empty into storm drains. The remaining untreated sewerage is discharged directly into various water bodies.

## Philippines

### Donor-Assisted Projects with Wastewater Treatment Components

Project	Donor	Status	Cost (\$ millions)
Pasig River Rehabilitation	DANIDA	1990-1994	1.9
ANGAT Water, Sewage, and Industry Optimization Projects	ADB	Approved 1/90	150.0
Second Provincial Towns Water Supply	ADB	Planned	99.5
Manila Northeast Water Supply	ADB	Approved 5/91	35.2
Water/Wastewater in Cebu	JICA/OECF	Planned	not available
Metro Cebu Water Supply	ADB	Approved 1990	56.0
Industrial Environmental Management	USAID	1992-1996	11.0
Environmental Management	CIDA	On-going	3.0
Environment Sector Loan	ADB	Approved 1990	0.3
Regional Municipal Development Project	ADB	Planned	63.0
First Water Sanitation and Sewage Project	WB	1989-1995	85.0
Second Water Sanitation and Sewage Project	WB	Planned	40.0
Industrial Environmental Pollution Control Project	WB	Planned	100.0
Western Visayas Development Master Plan	ADB	Approved 3/91	1.3

Note: DANIDA - Department of International Development Cooperation (Denmark); ADB - Asian Development Bank, JICA/OECF - Japan International Cooperation Agency/Overseas Economic Cooperation Fund; USAID - U.S. Agency for International Development; CIDA - Canadian International Development Agency; WB - World Bank.

Source: RCG/Hagler, Bailly, Inc. based on *Sustainable Urban and Industrial Environmental Management Review*. Prepared by Tropical Research and Development, Inc. in cooperation with Dames and Moore International for the USAID/Philippines, May 21, 1991. *Asian Development Bank Business Opportunities*, March 1993, and other sources.

Most public collectors, gravity mains, and municipal wastewater treatment facilities are dated (some are ninety years old) and most are not in working order. The LWUA has drafted the Philippine Wastewater Master Plan for 1991 to 2010, which includes an assessment of the country's current wastewater systems in addition to feasibility studies for selected areas. In addition, the MWSS is conducting the Metro Manila Sewage and Sanitation (METROSS) Master Plan, which consists of five construction phases extending to the year 2007.

In the near term, the best business opportunities for U.S. companies in the municipal market are associated with international donor-funded projects. Over the longer term, however, opportunities may arise for the private financing and operation of sewerage projects. The Philippines was one of the first countries to allow foreign companies to develop infrastructure projects (i.e., power plants) on a build-own-operate (BOO) or build-operate-transfer (BOT) basis. With greater authority being delegated to local government units and their ability to collect fees for services, this market may develop in the second half of the decade.

#### Business Strategies for the Municipal Market

Short-term (1992-1995)	<ul style="list-style-type: none"><li>▶ Track large municipal projects through the Local Water Utilities and Utilities Administration and Metropolitan Waterworks and Sewerage System.</li><li>▶ Track multilateral development bank (i.e., Asian Development Bank and World Bank) and untied bilateral funded projects.</li></ul>
Long-term (1996-2000)	<ul style="list-style-type: none"><li>▶ Propose private financing and operation of wastewater treatment facilities under a BOO or BOT basis.</li></ul>

## *Philippines*

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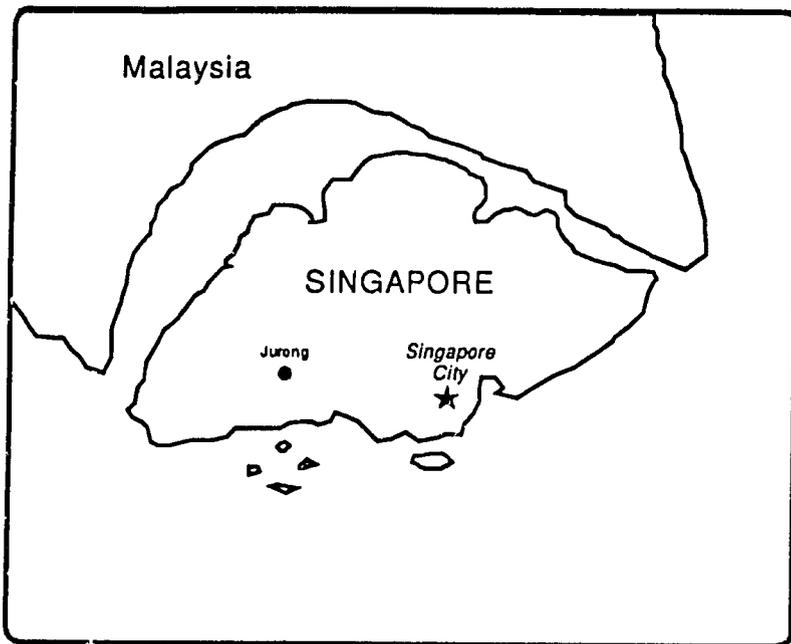
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*Singapore*

### ***Market Overview***

The total market for wastewater treatment equipment and services in Singapore will probably reach around \$200 million in 1992, according to *Business Asia* and U.S. Department of Commerce estimates.<sup>1</sup> Annual growth in the Singapore market will not be as high as in the other ASEAN countries.

The best opportunities for U.S. business will be found in municipal wastewater treatment plant rehabilitation under the "Singapore Green Plan" and in wastewater treatment for new petroleum refining, chemicals and petrochemicals manufacturing, and electronics industries. Singapore's greatest potential as an environmental market lies not in projects for local clients, but as a center for the distribution of environmental equipment and services to other countries in the region.

### ***Policy Environment***

The Singapore Ministry of the Environment (ENV), the principal environmental agency in Singapore, was created in 1972. In Singapore, there is no distinction between national and local levels of government, making the national government responsible for all levels of environmental regulation and pollution control. The Environmental Engineering Division of ENV has primary responsibility in the area of water pollution.

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<sup>1</sup> "Managing Asia's Environment," *Business Asia*, July 6, 1992.

## *Singapore*

The major administrative body on environmental affairs is the Pollution Control Department (PCD) of the ENV. The PCD was established in 1986 with a mandate for the control of air pollution, water pollution, and hazardous waste, and monitoring of air and water quality. In 1990, the PCD spent \$3.36 million on air and water pollution control, hazardous substances and toxic wastes control, and environmental planning.

PCD is the primary agency responsible for enforcing Singapore's three main regulations relating to water quality and water pollution control. All of these come under Chapter 348 of the Water Pollution Control and Drainage Act. The Act and its implementing regulations control the discharge of wastewater from domestic, industrial, agricultural and other premises; they also stipulate the standards for the discharge of industrial ("trade") effluent into the public sewers and watercourses. The trade effluent regulations cover heavy metals and other toxics.

### **National Water Pollution Control Law and Implementing Regulations**

Water Pollution Control and Drainage Act, Chapter 348

- The Sewage Treatment Plants Regulations, 1976
- Trade Effluent Regulations, 1976
- The Sanitary Plumbing and Drainage System Regulation, 1976

From 1977-1987, the Government of Singapore (GOS) spent \$200 million on the ambitious Clean Rivers Program to clean up the country's major waterways: the Singapore River and the Kallang Basin, which drain the Rochor, Whampoa, Kallang, and Gaylang Rivers and the Pelton Canal. The Clean Rivers Program was implemented by an inter-ministerial committee headed by the Minister of the Environment. Major activities completed under the program include urban redevelopment, relocation of river-based activities such as boat repair, relocating street vendors to sewered areas, resettling squatters and backyard industries, phasing out pig and duck farms, and extending sewerage networks.

In addition, the Clean Rivers Committee undertook a massive public education program to discourage Singaporeans from polluting the waterways. In 1987, the government held a series of public events celebrating the conclusion and success of this ten-year program.

As a result of the Clean Rivers Program and subsequent efforts to promote clean water on the part of the government, water quality in Singapore's rivers and streams is generally good today. In 1990, 47 streams in water catchment areas were monitored and found to be of good quality in terms of biological oxygen demand (BOD) and total suspended particles. In addition, the 17 rivers and streams in non-catchment areas, the country's reservoirs, and coastal waters were monitored at 19 sampling points. They were also found to be of good quality.

Singapore's ENV has enjoyed substantially more political support than environmental agencies in the other ASEAN countries. ENV has been particularly successful at enforcing and collecting water and sanitation fees. In 1989, ENV's total revenues reached \$130 million (up 6 percent from 1988), with water and sanitation fees reaching \$65 million.

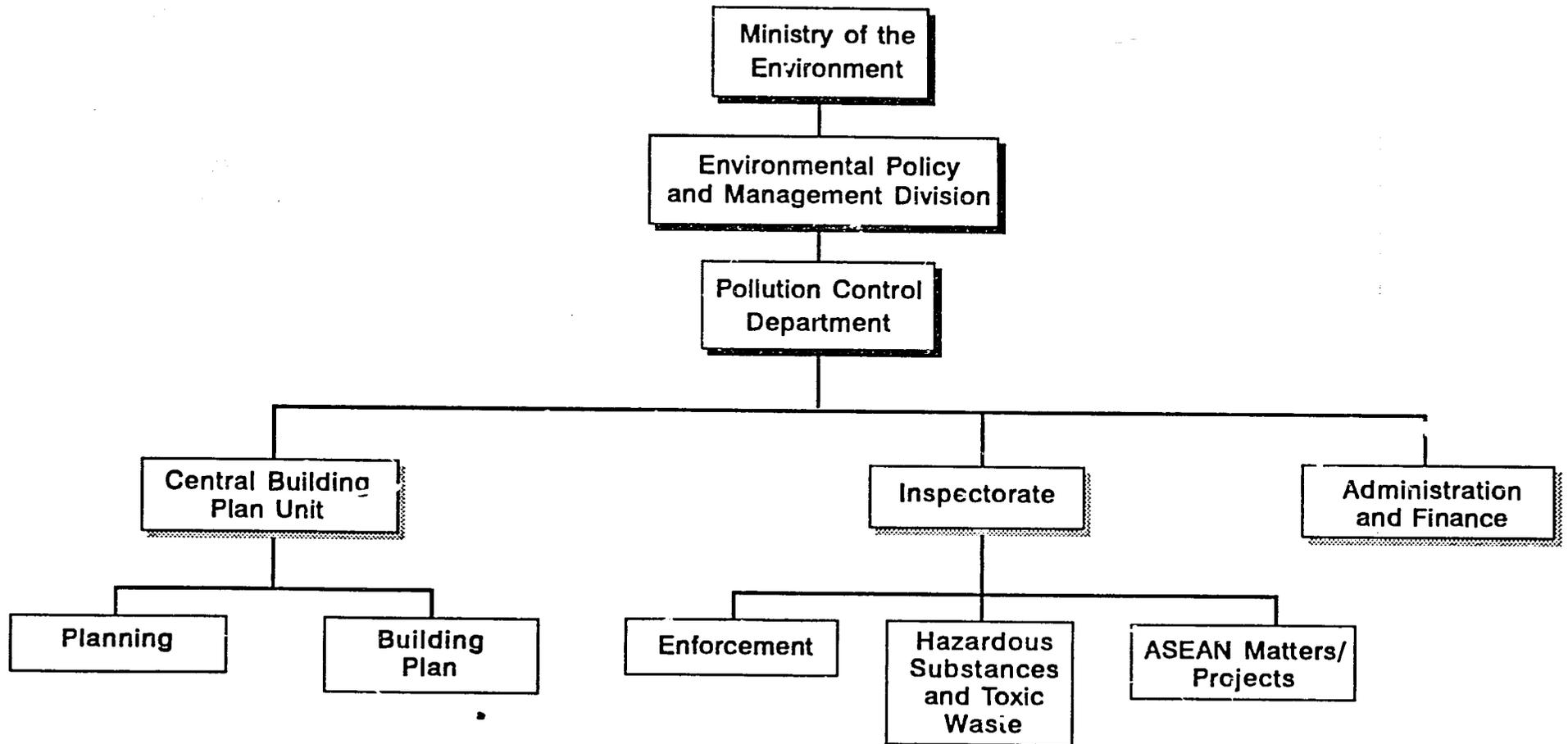
In January 1991, an administrative change took place within ENV. A new Environmental Policy and Management Division was formed to design and implement the country's environmental strategy. The new division comprises three departments: Strategic Planning and Research (SPRD), International Environment and Policy (which deals with regional and global environmental issues, and promotes Singapore as a base for environmental technology), and Pollution Control. The Pollution Control Department (PCD) remains the primary department responsible for enforcement and compliance, while SPRD took over water quality monitoring duties. In addition to this administrative restructuring, the Ministry formed a company, Singapore Environmental Management and Engineering Services Corporation (SEMES), to provide engineering, architectural and technical services with an authorized capital budget of \$6.3 million.

In November 1991, the Ministry of the Environment launched the "Singapore Green Plan." The objective of the Green Plan is to achieve a model green city by the year 2000 through higher health and environmental standards, a more environmentally proactive business sector, and the establishment of Singapore as the Asia/Pacific hub for environmental technology transfer and marketing.

For the past few years, the Singapore Ministry of the Environment has been actively promoting Singapore as a center of environmental technology because of its strategic location and its experience in environmental management. The Ministry is also encouraging environmental companies and international development assistance agencies to use Singapore as a base to market their technologies and expertise to developing countries.

In order to implement another national plan -- the new National Science and Technology Plan -- the GOS has committed \$1.2 billion over five years in grants and fiscal incentives for private companies, especially multinationals, to conduct R&D in several areas, including energy and environment. The first installment, \$139 million, has been obligated in the 1992 central budget.

# Organizational Structure: Pollution Control Department



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The Minister of the Environment estimates that the Green Plan will require a \$1.9 billion investment in infrastructural works such as upgrading sewage treatment facilities, solid waste management systems, and creating recreational waterways. A steering committee of industry representatives has been formed to work on the implementation plan, the details of which will be revealed by mid-1993.

To complement the Green Plan, ENV is designing a new environmental law that will merge the national regulations on water, soil and air pollution, and public health into a comprehensive Environmental Policy and Management Act. It is expected that the new act will contain provisions requiring that all oil, petrochemical and chemical companies include safety and audit systems in factories and warehouses.

The ENV is also developing an environmental audit plan to help industries identify ways to conserve resources and minimize wastes. To complement these new regulations, ENV plans to publish a one-stop guide to the existing national environmental regulations. ENV is now obtaining feedback from industry on this new act, which is expected to go before the Parliament in 1993.

### ***Industrial Market***

Growth in Singapore's manufacturing sector has dropped dramatically over the past few years, primarily as a result of recession in Singapore's largest export market, the United States. The annual growth in manufacturing output dropped from 9.5 percent in 1990 to 5.3

#### **Key Objectives of the "Singapore Green Plan"**

- ▶ To encourage domestic and industrial waste minimization and recycling
- ▶ To reduce the acreage of land required for sewage treatment and switch to anaerobic systems to reduce odor
- ▶ To encourage multinationals in environmental fields to set up business in Singapore
- ▶ To establish a National Council on the Environment comprising representatives from business and government to organize educational campaigns and advise the Environment Minister on policy matters
- ▶ To establish an Institute of Environmental Technology in 1994
- ▶ To automate and update PCD's environmental monitoring equipment.

## *Singapore*

percent in 1991. Furthermore, growth in the electronics industry, which accounts for a third of manufacturing output, decreased by 5.6 percent during 1990-91.<sup>2</sup>

Despite the slowdown in manufacturing sector, the number of new industrial developments is rising steadily. Because most existing industrial facilities have already installed wastewater treatment systems, these new facilities offer the best business opportunities for U.S. wastewater treatment equipment and services suppliers.

In 1991, the Central Building Plan Unit (CBPU) of PCD processed 226 proposals for new industrial facilities, up from 143 in 1990.<sup>3</sup> In addition, CBPU held 2,227 consultations on permitting standard industrial premises in 1991. The majority of these focused on civil engineering works and manufacturing facilities for the electronics, wood products, food processing, and plastics industries. In addition, a new aromatics plant proposed by an existing refinery and two new pharmaceutical plants were approved.

The principal sources of industrial waste in Singapore are petroleum refineries, power plants, chemical factories, cement works, and steel mills. Most medium to large-scale facilities have already taken steps to install wastewater treatment systems. In 1991, PCD approved 85 new industrial wastewater treatment systems. The majority of new installations involved chemical treatment, oil-water separation, and neutralization equipment.

Local capabilities in industrial wastewater treatment are limited. The Singapore environmental market is dominated by foreign companies working through joint ventures or local distributors. The U.S. Embassy reports that Singaporean distributors have good technical knowledge of the product lines they represent and provide reputable after-sales service and support.<sup>4</sup> Both the public and private sectors are actively seeking foreign partners to set up regional operations in Singapore.

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<sup>2</sup> The production of disk drives, integrated circuits, printers, and computer parts for export are the major components of the electronics industry. Singapore currently produces half the world's supply of disk drives.

<sup>3</sup> The CBPU advises the Urban Redevelopment Authority (URA), the land-use planning authority of Singapore, on environmental aspects of new developments. CBPU ensures that pollution control systems are included before all new industrial developments are commissioned. The Housing and Development Board (HDB) and the Jurong Town Corporation (JTC) also consult CBPU before granting permission for new industrial facilities.

<sup>4</sup> *Singapore Economic Trends Report*, U.S. Embassy Singapore, July 1992.

**Industrial Wastewater Treatment Facilities Approved by Singapore  
Pollution Control Department**

Treatment Facility Type	No. Approved in 1991	Cumulative Total
Chemical	32	315
Oil Separator	26	613
Neutralization	14	127
Dilution/Balancing Tank	7	186
Biological Filtration	3	11
Sedimentation	1	132
Activated Carbon Adsorption	1	6
Activated Sludge Oxidation	1	3
Ion Exchange/Reverse Osmosis	0	1
<b>Total</b>	<b>85</b>	<b>1,394</b>

Source: Ministry of the Environment Singapore, Pollution Control Department, 1991.

The U.S. Department of Commerce reports that the U.S. and Japan are the predominant suppliers in Singapore's industrial wastewater treatment market. German and Australian companies have also been successful. Last year, the Australian company Miltox entered into a joint venture with Bonvests Holdings (Singapore) to build a sludge and petroleum-based wastewater treatment plant in Singapore, using Miltox's patented technology. Now called Miltox Singapore Pte Ltd., the joint venture has exclusive license to use the technology in the ASEAN region. It is expected that the new plant will be tested and approved by ENV in the next few years. Another company, BOND Instrumentation (Singapore) Pte Ltd., distributes the French SERES water pollution monitoring systems for marine- and land-based applications. BOND has been in the business of distributing environmental monitoring equipment and providing the after-sales service since 1981.

The U.S. Department of Commerce suggests that U.S. firms seeking to enter the industrial wastewater treatment market contact the Singapore Institute of Standards and Industrial Research (SISIR), which provides consulting services to small and medium-sized Singaporean industries on the appropriate pollution control technologies to install in their factories.

## *Singapore*

### Business Strategies for the Industrial Market

Short-term (1992-1995)	<ul style="list-style-type: none"><li>▶ Seek local partner for distributor/licensing arrangement to market wastewater treatment systems to new industrial facilities</li><li>▶ Market new manufacturing facilities in the electronics, wood products, food processing, and plastics industries.</li></ul>
Long-term (1996-2000)	<ul style="list-style-type: none"><li>▶ Tailor pollution prevention services to meet environmental audit requirements under the proposed Green Plan.</li></ul>

### *Municipal Market*

Over 96 percent of the Singaporean population is served by the country's \$2 billion sewerage system, which comprises 2,250 km of sewers, 123 fully automated pumping stations, and six municipal wastewater treatment plants that provide secondary treatment. The Bedok, Jurong, Kim Chuan, Kranji, Selatar and Ulu Pandan Sewage Treatment Works treat over 776,000 m<sup>3</sup> of municipal wastewater daily. All six facilities are fully modernized, with anaerobic digestion systems, process control and monitoring stations, fully-automatic high-pressure filter presses, and a \$1.6 million computer-aided-design (CAD) system. In addition, air emissions from the digesters and oxidation ponds are treated by scrubbers and activated carbon beds to remove acidic, alkali and organic gases. The Kim Chuan plant, a \$3.3 million computer information system, enables the remote control of operations. Methane recovery systems at all six facilities generated 43 million kWh of electricity for in-house use in 1987.

Treated effluent from the municipal sewage works is discharged to the sea or rivers, and meets the "20/30" standards for discharge to inland waters (20 mg/l of BOD and 30 mg/l of suspended solids). Some effluent is further treated for industrial use and stabilized sludge is used as a soil conditioner for tree planting programs and turfing. Around 19,500 m<sup>3</sup> per day of effluent from the Ulu Pandan Works are treated for industrial use at the Jurong facility. The treated water is supplied to 36 industrial establishments in the Jurong and Tuas industrial estates and around 6,600 residences in Taman Jurong, Teban and Pandan Gardens for toilet flushing.

Opportunities in Singapore's municipal wastewater treatment sector are limited because an extensive system already exists to serve most of the population. The most promising opportunities will be found in the expansions and upgrades projected under the Green Plan.

Under this Plan, the GOS plans to upgrade the six municipal treatment works with compact and covered designs over a 40-year period beginning in 1993. Land constraints are a major motivating force behind this policy. Four of the works will be upgraded by the year 2000 and the government will encourage the industrial use of treated effluent to conserve potable water.

Beyond the Green Plan, the government also plans to boost growth in the construction sector by increasing public spending on upgrading public housing, and later on major infrastructure projects. The CBPU processed 758 proposals for new housing developments in 1991, up from 324 in 1990. These trends of increased spending on municipal infrastructure and the increasing numbers of proposals for new housing developments open up opportunities for U.S. companies in the municipal wastewater treatment market.

**Business Strategies for the Municipal Market**

Short-term (1992-1995)	▶ Market compact, packaged treatment systems for housing developments.
Long-term (1996-2000)	▶ Track ENV's plans to upgrade municipal wastewater treatment plants under Green Plan.

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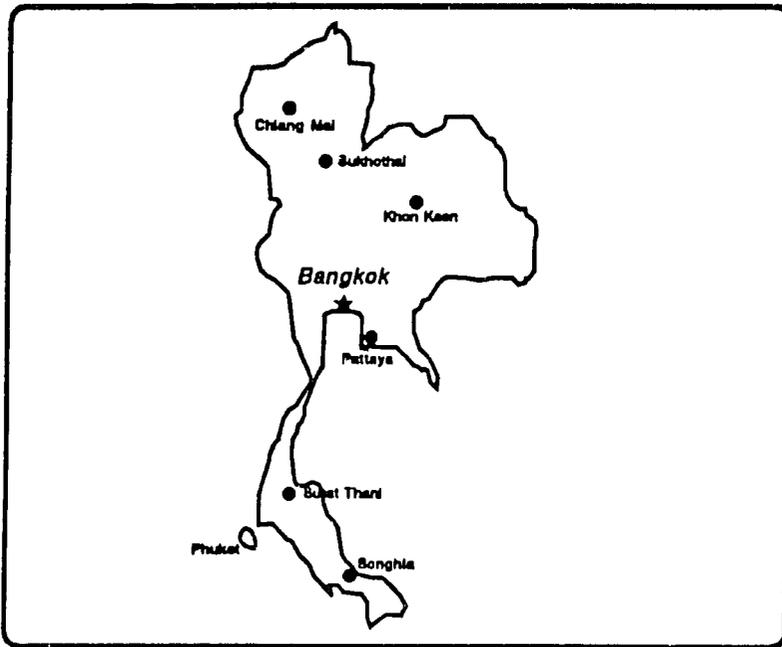
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## *Thailand*

### ***Market Overview***

Increasing wealth from industrialization and greater political will on the part of the government are fueling the growing demand for wastewater treatment equipment and services in Thailand. Current estimates place the market for municipal and industrial wastewater treatment equipment and services at over \$100 million, with predicted growth in the next decade ranging from 10 percent to 25 percent annually.<sup>1</sup> According to *Business Asia*, the total pollution control equipment and services market is estimated to reach \$1.5 billion by the year 2000, with water pollution control equipment accounting for a significant share.<sup>2</sup>

An Environmental Fund in Thailand's 1991-1996 Five-Year Plan allocates over \$20 million, plus an additional \$80 million annually from the recently abolished Oil Fund, to natural resource management and pollution control over the five-year period. Water quality and forestry projects are top priorities for spending. Water pollution control clearly ranks as one of the most, if not the most, important issue of the Plan, with \$230 million allocated for government-funded wastewater treatment projects.

The best business opportunities for U.S. companies exist in industrial waste minimization and materials recycling systems, turnkey wastewater treatment systems for municipalities, and water testing and analysis equipment.

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<sup>1</sup> *The Greening of Thai Industry: Producing More and Polluting Less*. Research Report No. 5, Thailand Development Research Institute, 1991.

<sup>2</sup> "Special Issue: Managing Asia's Environment," *Business Asia*, July 6, 1992.

## *Thailand*

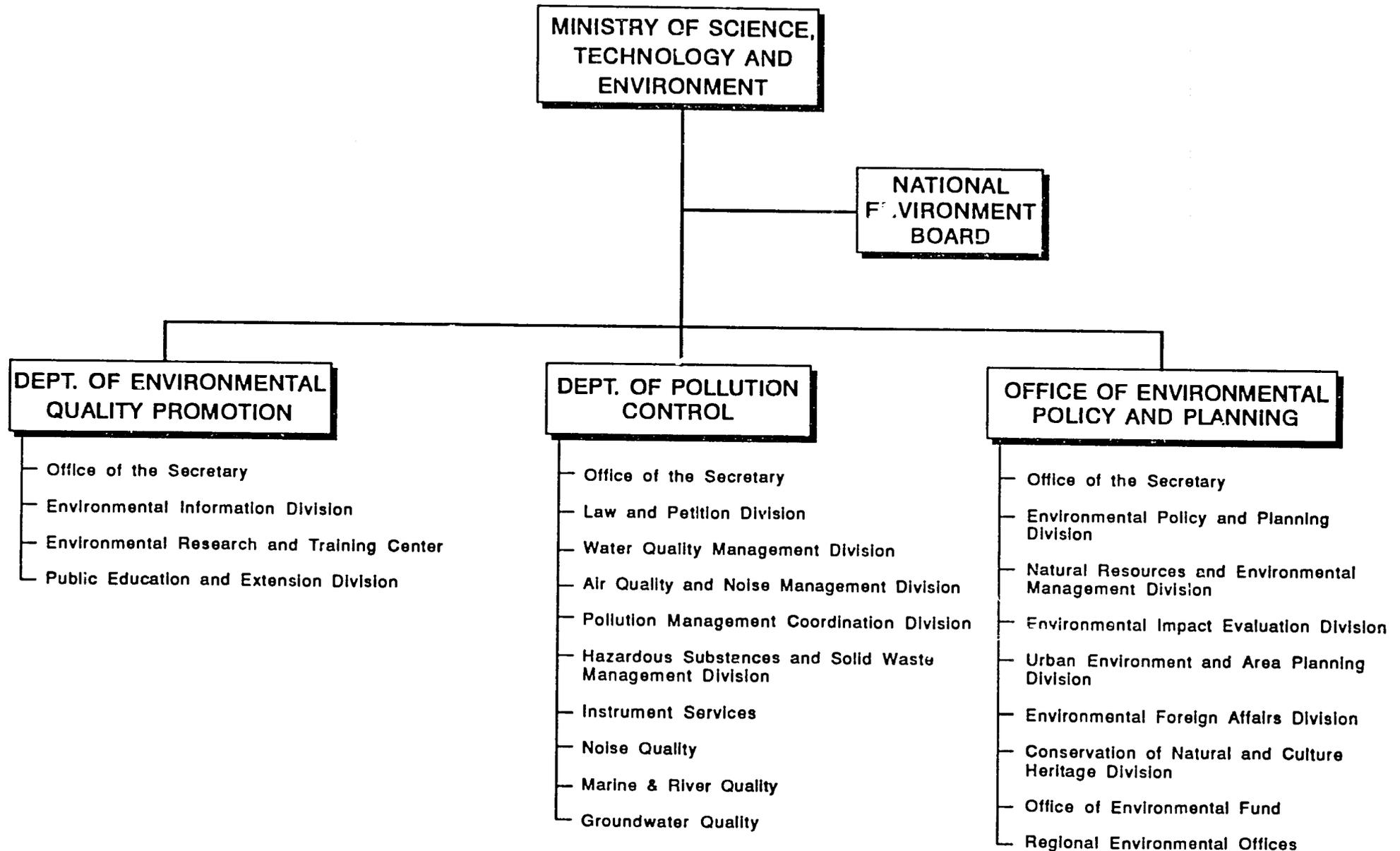
### *Policy Environment*

Sections 65 and 69 of the 1978 Constitution and the provisions of the Improvement and Conservation of the National Environmental Quality Act of 1975 provide the original framework of Thai environmental law. The Act established the National Environment Board together with its executing arm, the Office of the National Environmental Board (ONEB).

In May 1992, the Government of Thailand (GOT) passed the Environment Protection and Conservation Act, replacing the 1975 law. The new law renamed the Ministry of Science, Technology and Environment (formerly the Ministry of Science, Technology and Energy) and maintained ONEB as the principal environmental agency. The National Environment Board (NEB) was elevated to a sub cabinet-level committee reporting directly to the Prime Minister and was given responsibility for overseeing environmental activities among all government entities. The NEB is granted the legal power to enforce laws when other Ministries fail to do so, and it can close down factories in violation of environmental laws. Thai monitoring and enforcement efforts are expected to become more comprehensive as a result of the new law.

Another important law -- the Factory Act of 1969 -- was replaced by the New Factory Act in July 1992. The New Factory Act tightens the government's control over pollution sources by granting the Ministry of Industry power to levy civil and criminal penalties on polluting factories. Factories are now divided into one of three categories: factories that can be opened without supervision or control, factories that must report to the Ministry of Industry before beginning operation, and factories that require a permit to build and operate the facilities (five years with renewals). In certain cases, the Ministry of Industry may actually assume the management of a non-complying factory in order to ensure pollution control.

# Organizational Structure: Ministry of Science, Technology and Environment



## *Thailand*

### **Wastewater in the Headlines**

In early 1992, the Ministry of Industry threatened to close down the Phoenix Pulp and Paper Company plant if it did not bring its wastewater treatment plants into effective operation. The Ministry also suspended trading of the company's stock until it complied, and filed a suit against the company for downstream damages to the Nam Pong River.

Thai authorities recently moved to shut down two Stock Exchange of Thailand-listed textile companies for their bad environmental record. In another case, MDF Board Co., a manufacturer of particle board, was closed down and subjected to substantial legal action.

A major brokerage firm in Bangkok is now employing a system of de-rating stocks based on a company's environmental record, and hence its liability risk. Investors will be paying more attention to companies that risk being fined for pollution violations or are required to invest heavily in pollution control equipment.

## *Industrial Market*

Over the last two decades, Thailand has experienced phenomenal growth in the number of manufacturing industries. In 1969, there were only 600 factories in the entire kingdom. By 1979, that number had increased 33 fold, to 20,000 factories registered with the Department of Industrial Works (DIW), and by 1990 there were over 51,000 registered factories.<sup>3</sup>

More than half of registered factories are located in the Bangkok Metropolitan region, while another 17 percent are found in the Central region surrounding greater Bangkok. The industries that realized the largest growth in the 1980s include chemicals, paper and paper products, and transport equipment. The greatest number of factories were found in the food and beverage industry (over 10,000).

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<sup>3</sup> This does not include rice milling operations, which number about 50,000 in Thailand.

## Number of Registered Factories in Thailand by Type, 1989

Sector	Number of Factories	Share of Total (%)
Food, Beverages and Tobacco	10,439	20.3
Transport Equipment	6,553	12.7
Machinery	6,141	12.0
Fabricated Metal Products	6,107	11.9
Wood and Wood Products	4,939	9.6
Textile, Wearing Apparel and Leather Goods	4,553	8.8
Non-Metallic Mineral Products	2,798	5.4
Rubber Products and Plastics	2,643	5.1
Other	2,370	4.6
Paper Products and Printing	2,211	4.3
Electrical and Electronic Products	1,121	2.2
Chemical Products	1,093	2.1
Iron and Steel Basic Industries	530	1.0
Total	51,498	100

Source: *The Greening of Thai Industry: Producing More and Polluting Less*. Research Report No. 5, Thailand Development Research Institute, 1991.

The organic load from major industrial sources is expected to grow from 472,900 tons of biological oxygen demand (BOD) in 1990 to 1,907,300 in the year 2010, a four-fold increase. In 1990, the sugar industry accounted for 30 percent of the total, followed by pulp and paper (20 percent), rubber (19 percent), and beverages (18 percent). The profile of industrial wastewater now includes complex pollutants beyond traditional organic loads, such as heavy metals, toxic hydrocarbons, and other hazardous substances. Industrial sources of toxic discharges include electroplating, textiles, dyeing, metal-smelting, chemicals,

## Thailand

petrochemicals, electronics, electrical utilities, hospitals and laboratories. Metal sludge and solid oil wastes comprise nearly three-quarters of all hazardous waste generated in 1991.<sup>4</sup>

Projection of BOD Discharges from Major Polluting Industries  
(thousands tons/year)

Industry	1990	1995	2000	2005	2010
Sugar	140.7	215.6	302.2	409.9	565.8
Pulp and Paper	93.2	149.0	217.9	308.3	444.0
Rubber	89.7	129.2	169.6	214.5	276.0
Beverages	84.0	122.8	163.0	209.4	237.7
Tapioca	36.7	57.1	81.3	112.0	157.0
Slaughter	14.9	17.8	19.4	25.0	22.0
Canned Fish and Crustaceans	10.1	14.6	19.4	25.0	32.6
Tannery	9.6	18.2	35.4	68.4	136.3
<b>Total</b>	<b>472.9</b>	<b>724.3</b>	<b>108.2</b>	<b>1,367.9</b>	<b>1,907.3</b>

Source: *The Greening of Thai Industry: Producing More and Polluting Less*. Research Report No. 5, Thailand Development Research Institute, 1991.

Currently, the major industrial buyers of wastewater treatment equipment are large-scale industrial plants, both publicly and privately owned. Thai regulations do not yet target small private sector manufacturers, and they are not expected to make up a substantial market share in the near term. Most small factories in Thailand do not employ wastewater treatment processes for a variety of reasons, including lack of information, financing, and even space. In Bangkok alone, there are tens of thousands of small manufacturing and repair shops that

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<sup>4</sup> *The Greening of Thai Industry: Producing More and Polluting Less*. Research Report No. 5, Thailand Development Research Institute, 1991.

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account for a major proportion of the untreated industrial effluent that is discharged to canals and rivers.

An Environmental Fund was incorporated into the Seventh Five-Year Plan (1991-1996) to subsidize investment in pollution control technology and to provide low-interest loans to local governments for environmental infrastructure. The Fund was allotted a one-time budget of \$20 million in 1992, plus another \$80 million each additional year from the abolished Oil Fund. The Fund will be used to support investments in pollution control technology among small and medium-scale industries.

All 23 industrial estates in Thailand already have some level of wastewater treatment. For example, a government-operated facility at Bang Khuntien treats waste from approximately 150 factories stemming mainly from electroplating and textile plants. Activated sludge and aerated lagoons are the two most common systems employed by industrial estates. The Industrial Estate Authority of Thailand, which currently manages utilities on 18 industrial estates throughout the country, has requested proposals from private companies for the eventual turnover of the operation and maintenance of its water supply, industrial wastewater, and solid waste systems on these estates.

The Department of Industrial Works (DIW), which is responsible for regulating industrial discharges, plans to construct collective wastewater treatment facilities for existing and future industries located outside of industrial estates. The World Bank is providing technical assistance to the DIW to develop two centralized treatment plants that will serve factories at Rungsit in Pathumthani Province and Suksawad in Samut Prakan Province. The total capital investment for each of the plants is estimated at \$16 million.

The DIW has five additional central treatment plants planned around the greater Bangkok metropolitan area: Poochaosamingprai Project and Theparak Project in Samut Prakan; Sampran Project in Nakhon Pathom; Katumban Project in Samut Sakhon; and Bangpakong Project in Chachoengsao. The GOT will finance and manage the construction of these central treatment projects. The private sector will then be invited to operate the facilities. Industries discharging into the systems will be required to pay a fee.

## *Thailand*

### Industrial Wastewater Treatment Technologies Employed in Bangkok and Samut Prakarn Province

Industry	Type of Treatment System
Food Processing	aerated lagoon, oxidation ditch
Pulp and Paper	chemical treatment, aeration
Textile	activated sludge, aerated lagoon, chemical treatment
Plastics	chemical treatment
Glass	activated sludge, chemical treatment, oxidation pond
Dairy	activated sludge

Source: *Synthesis of Markets Survey for Environmental Equipment and Services in Thailand*. Business Information Center, Joint Standing Committee on Commerce, Industry and Banking, 1990.

To date, primarily basic and some moderately-complex pollution control equipment is being manufactured in Thailand, notably: softeners, filters, ion exchange equipment, aerators, tanks, and parts for clarifiers. Increasingly sophisticated Thai manufacturing and assembly capabilities will lead to greater competition for high-tech foreign pollution control equipment. Of a total of 72 local companies listed in a recent report, 37 were active in consulting work, 41 in design, and 5 in laboratory work; 24 conduct EIAs, 7 work in pollution control, 6 are suppliers, 5 are contractors, and 35 manufacture equipment. (A number of companies were listed as providing multiple services.)<sup>5</sup>

Foreign companies are heavily represented in the Thai wastewater treatment equipment market, accounting for an estimated 85 percent of the value of pollution control equipment delivered in Thailand. Most foreign companies operate through Thai agents or by forming partnerships with local companies.

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<sup>5</sup> *Industrial Pollution and Investment Opportunities in Improving the Environment*. Prepared by Dararatt Anantanasuwong, NIDA East West Center, PITO Business Environment in ASEAN - Thailand Workshop, August 1992.

**Business Strategy for the Industrial Market**

<p>Short-term (1992-1995)</p>	<ul style="list-style-type: none"> <li>▶ Market packaged wastewater treatment and recycling systems to plastics, glass, and pulp and paper manufacturers.</li> <li>▶ Track the seven priority DIW centralized projects for the greater Bangkok metropolitan region for construction and operation and maintenance contracts.</li> <li>▶ Offer pollution prevention services with treatment systems through the Federation of Thai Industries.</li> </ul>
<p>Long-term (1996-2000)</p>	<ul style="list-style-type: none"> <li>▶ Propose operation and maintenance contracts for treatment systems on industrial estates.</li> <li>▶ Form joint ventures or license the manufacture of more complex chemical treatment systems with local firms.</li> </ul>

***Municipal Market***

Thailand's population reached 57.0 million in 1991, and is projected to grow to 65.1 million by the year 2000. In terms of BOD, municipal sources of wastewater pollution are responsible for the majority of the organic pollution load in Thai waterways. In the final 60 miles of the Chaophraya River, for example, 40 percent of the organic pollution load is the result of direct discharging and dumping from residents along the river. Restaurants, markets and hotels contribute 35 percent, while industry is responsible for the remaining 25 percent.<sup>6</sup> Most industrial and economic activity is concentrated in Bangkok, which contains over half of all registered factories and over 11 percent of the country's total population.

In June 1991, the GOT announced a \$2 billion plan for sewage treatment plants in major cities. These cities include Bangkok, Chiang Mai, Phuket, Pattaya and Sakon Nakhon. The Bangkok Metropolitan Authority (BMA) is proceeding with a two-staged, \$800 million wastewater treatment program intended to meet the needs of the most densely populated areas in Bangkok. The project will be 75 percent funded by the central government, and the remainder privately financed. Total treatment capacity will be around 350,000 m<sup>3</sup>/day, the equivalent of one quarter of Bangkok's wastewater.

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<sup>6</sup> "Thailand - Victims of Success," *Far Eastern Economic Review*. September 19, 1991.

## *Thailand*

The BMA is also planning a capital investment of \$188 million on sewage and wastewater treatment projects covering the Bangkok metropolitan region. Five additional sewage treatment projects, serving Ratanakosin, Siphraya, Yanawa, Nongkhame-Pasicharem and Ratburana, are already in various stages of construction. It is estimated that 75 percent of greater Bangkok's municipal wastewater will be treated once these central and outlying area projects are completed. The BMA is planning a transition towards privatizing the operation of its wastewater treatment plants.

### **Bangkok Wastewater Treatment Systems**

Location	Capacity (m <sup>3</sup> /day)	Budget (US\$ million)	Year
Sipraya	N/A	8.5	1992
Rattanakosin Banglumpoo	25,000	19.2	1993
Ratburana	30,000	16.0	1993
Thonburi Nongkham Pasichareon	50,000	41.7	1993
Yannawa	120,000	60.0	1994

Source: Thailand Office of Policy and Planning, Bangkok, 1990.

Also driving the market for wastewater treatment equipment is an NEB regulation requiring high-rise buildings to install their own sewage treatment plants. In 1989 building developers invested over \$12 million in sewage treatment plants. In addition, hotels and other facilities are quickly moving to install wastewater treatment systems because of the GOT's crackdown on pollution in tourist areas.

The new Environmental Protection and Conservation Law defines areas as Environmental Conservation Areas and Pollution Control Areas. Areas so classified that do not have central treatment facilities are obligated to connect to public treatment systems or install their own treatment systems to meet standards. Phuket and Pattaya are the first two tourist areas where this law is being enforced. Not only will hotels at current tourist areas need to be retrofitted with wastewater treatment equipment, but new tourist developments will also need to comply with the new law.

**Business Strategy for the Municipal Market**

Near-term (1992-1995)	<ul style="list-style-type: none"><li>▶ Track Bangkok Metropolitan Authority (BMA) sewage treatment projects.</li><li>▶ Market prepackaged wastewater treatment systems for hotels and resorts in Bangkok, Chiang Mai, and islands and coastal areas (e.g., Pattaya, Phuket).</li></ul>
Long-term (1996-2000)	<ul style="list-style-type: none"><li>▶ Pursue BMA projects on a build, own and operate basis once a revenue collection mechanism is established.</li></ul>

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