PN-ABL-802
ISN 78350

US
ASEAN

ASEAN ENVIRONMENTAL MARKETS:

Opportunities for U.S. Equipment and Service Companies

1991

A U.S.-ASEAN Council for Business & Technology publication

US
ASEAN

ASEAN ENVIRONMENTAL MARKETS:

Opportunities for U.S. Equipment and Service Companies

1991

A U.S.-ASEAN Council for Business & Technology publication

Reported by Tracie E. Monk of Investment & Trade Resources International.

© Copyright 1991, U.S.-ASEAN Council for Business and Technology, Inc.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any electronic or mechanical means, including information or retrieval systems, without prior written consent of the U.S.-ASEAN Council for Business and Technology, Inc. For further information, contact U.S.-ASEAN Council at 1400 L Street, N.W., Suite 650; Washington, D.C. 20005.

ASEAN Environmental Markets: Opportunities for U.S. Equipment and Service Firms has been prepared as an overview report as part of the environmental initiative of the U.S.-ASEAN Council for Business and Technology, Inc. No representation or warranty is made as to the accuracy of its contents.

Acknowledgements

ASEAN Environmental Markets: Opportunities for U.S. Equipment and Service Firms, is an overview report prepared in support of the U.S.-ASEAN Council's current environmental trade and investment program. The project is a joint government-business effort aimed at increasing the role of U.S. companies in developing ASEAN markets for pollution control equipment, services and technology. Organizations playing a key role in the design and financial support of this effort include:

- U.S. Agency for International Development
- U.S. Department of Commerce
- U.S. Environmental Protection Agency

Other U.S. agencies actively supporting the project include: Department of Energy (DOE), Department of State (DOS), Export-Import Bank of the U.S. (EXIM), Overseas Private Investment Corporation (OPIC), Small Business Administration (SBA) and the Trade and Development Program (TDP).

We would also like to thank members of the U.S. Industry Core Group (ICG) and Government Core Group (GCG), representatives of the governments of the ASEAN countries and the Private Investment and Trade Opportunities (PITO) offices in each of the ASEAN countries for their continuing involvement. A special thanks goes to the Council's research contractors in ASEAN and the ASEAN governments, particularly those agencies with environmental portfolios, for their strong support and cooperation.

Direction for the environmental program is being provided by Ernest Z. Bower and Levi Richardson of the U.S.-ASEAN Council. This overview report has been prepared by Tracie E. Monk of Investment & Trade Resources International.

Robert Driscoll
President

Table of Contents

Acknowledgements i

Foreward iv

1.0 Environmental Conditions in ASEAN 1

1.1 Why ASEAN? 1

1.2 Regional Overview 1

1.3 Current Versus Future Markets for Environmental Equipment and Services 3

2.0 Key Considerations for U.S. Traders and Investors 11

3.0 Environmental Sectors 14

3.1 Industrial Waste Water 14

3.2 Solid Waste Management and Municipal Waste 14

3.3 Hazardous and Toxic Wastes Control 15

3.4 Air Pollution 15

3.5 Environmental Services 16

4.0 Emerging Environmental Trade & Investment Markets 18

4.1 Indonesia 18

4.2 Malaysia 22

4.3 Philippines 25

4.4 Singapore 27

4.5 Thailand 29

5.0 Conclusions 36

List of Figures

Figure 1-1. U.S. Environmental Product Exports For Select Products (1989) 4
Figure 1-2. U.S. Environmental Product Exports For Select Products (Jan.-July 1990) 4
Figure 1-3. Capital Expenditures by Majority-Owned Foreign Affiliates of U.S. Companies 5
Figure 1-4. Receipts for U.S. Business, Professional and Technical Services 5
Figure 1-5. Trends in the ASEAN Region 7

Figure 2-1. Key Findings of the Report 13

Figure 4-1. Projected Hazardous Waste Quantities and Treatment Cost 33

Figure 5-1. Environmental Trade/Investment Opportunities in ASEAN 36
Figure 5-2. Trade & Investment Picks 37

List of Tables

Table 1-1. Key Economic Indicators 3
Table 1-2. Indicators of Market Size 3
Table 1-3. Comparative Environmental Investments 10

Table 4-1. Indonesian Waste Generation Projections 21
Table 4-2. Bangkok Waste Water Treatment Systems 30
Table 4-3. Types of Water Treatment Systems by Industrial Sector 32
Table 4-4. Summary of Real and Projected Hazardous Waste Quantities 33

Foreward

The U.S.-ASEAN Council for Business and Technology is working with U.S. and ASEAN government agencies and companies to develop a promotional program to expand ASEAN-U.S. commercial linkages in the environmental products and services sector.* The trade and investment promotion program is intended to heighten U.S. companies' awareness of opportunities (and constraints) in emerging ASEAN environmental product and services markets. The program includes participation of ASEAN and U.S. corporate interests, as well as participation of government agencies from each of the countries.

The Council's environmental market project consists of five elements:

1) *Market Research* in ASEAN to identify the areas for U.S. firms and government agencies to assist and participate in the development of environmental markets in the region.

2) *Informational Seminars* will be held in several venues throughout the United States to disseminate information on ASEAN environmental markets and opportunities, including: Washington, DC; New York City; Chicago, Illinois; Portland, Oregon; Los Angeles, California; and Houston, Texas.

3) *U.S. Environmental Missions* will be conducted to targeted ASEAN countries during 1991 to assess markets opportunities and facilitate necessary government and private sector contacts.

4) *Follow-Up Assistance* will be provided to companies participating in the seminars and/or missions to assist them in developing opportunities for their products/services in the ASEAN region. The Council anticipates an ongoing cooperative relationship between itself, government agencies (U.S. and foreign) and corporations in the environmental sector. The Council is also prepared to assume the role of a "clearinghouse" of information and referrals for the environmental sector.

5) *ASEAN environmental training/education missions* to the United States will be conducted during 1991 and 1992. These missions would be targeted at broadening institutional contacts between top ASEAN business and government leaders and their U.S. counterparts. Particular attention would be paid to U.S. experience in pollution control (state-of-the art management and technical capabilities) and in financing necessary environmental control efforts.

The Council will also work with the U.S. government to evaluate the need for technical experts to assist ASEAN government agencies and companies in formulating sustainable development strategies, environmental financing packages, regulations and other critical environmental assessments. These experts would possess a clear understanding of environmental trade and investment considerations facing U.S. companies in the region, and have a mandate to assist U.S. companies in expanding their operations.

** The U.S. Agency for International Development (AID) is playing a key role in this environmental trade and investment promotion effort through its Private Investment and Trade Opportunities (PITO) project. The trade and investment promotion component of PITO, which is managed by the U.S.-ASEAN Council, is designed to expand ASEAN-U.S. trade and investment. AID, along with the Council's corporate members, is providing funding for this and related U.S.-ASEAN Council projects.*

1.0 Environmental Conditions in ASEAN

1.1 Why ASEAN?

Major shifts -- political, economic and social -- are underway in southeast Asia which promise significant profits for companies who are sufficiently aggressive and far-sighted to capitalize on emerging opportunities in ASEAN's environmental sector. Payoffs should be particularly lucrative for pollution control equipment and service firms who position themselves over the next two to five years to take advantage of opportunities related to environmental management/technical training, hazardous/toxic waste control, and treatment/storage/disposal of municipal and industrial wastes.

Throughout the region, a growing level of environmental awareness and concern is being translated into active environmental movements and, more importantly, *political will* behind increased enforcement and budgetary outlays. ASEAN's severe environmental problems are in large part resulting from its success in attracting investment and sustaining high levels of economic growth. More recently, these governments have begun to emphasize selective industrial growth and sustainability -- economic development minimizing environmental degradation. Sustainable development in ASEAN, as in much of the developed world, is a key component of emerging government policies and practices. Trends toward deregulation (except for the environment sector), privatization and reductions in redtape and central government controls are also occurring in each of these countries, further expanding investment and trade opportunities for foreign firms.

Another important factor affecting southeast Asia's potential as a market for U.S. environmental equipment and service firms is the fact that environmental regulatory structures are already in place. Statutes already exist related to air and water pollution, including legislation requiring the preparation of environmental impact statements (EISs) for all new investments. Pollution control organizations are also present in all national governments. Indonesia, Philippines and Singapore have even established cabinet-level environmental positions in recognition of the growing importance of the environment to their nations' future wellbeing. In addition, ASEAN's governments have publicly announced that enforcement of existing and new environmental regulations is a national priority. Moves are even beginning toward development of region-wide standards and regulations -- especially related to hazardous/toxic waste and vehicle emissions.

Funds for training -- and for key capital improvement projects -- are being provided by international financial institutions (IFIs), national governments and private industry. Training of public and private sector personnel to better monitor, evaluate and manage pollution is a major target of these programs. Major infrastructure development projects -- including significant expansion of the countries' power generation capacities and efforts to retool existing industries -- are also underway with strong emphases on pollution prevention. These projects, as well as the billions of dollars which are being invested annually in new industrial facilities, are indicative of the growing opportunities available to U.S. firms selling pollution control equipment and services.

1.2 Regional Overview

Exceptionally high sustained economic growth rates in its member countries have distinguished ASEAN[1] as one of the fastest-growing regions in the world. These countries continue to be major suppliers to industrialized countries of key raw materials such as rubber, tin, metal and petroleum. However, over the last decade the ASEAN countries have diversified their economies into production of a broad range of manufactured goods, including textiles, electronic components and consumer goods. Today, manufacturing accounts for more than 25 percent of GDP in the five countries covered in this report -- Indonesia, Malaysia, the Philippines, Singapore and Thailand. (See Table 1-1 for a summary of key economic activity.)

Together, these five ASEAN countries have more than 300 million people and a gross domestic product (GDP) of about US$250 billion (see Table 1-2 for 1988 comparisons). Their per capita GDPs range from over US$10,000 in Singapore (1990) to roughly US$500 for Indonesia. ASEAN, including Brunei, is the United States sixth largest trading partner.

Two-way trade between the U.S. and ASEAN totaled US$40 billion in 1989. U.S. exports during the first nine months of 1990 grew by more than 28 percent, and are expected to reach US$20 billion by year-end 1990. Trade in select environmental products (see Figures 1-1 and 1-2) amounted to approximately US$35 million, and is expected to grow at 30 to 40 percent per annum over the next three years.[2]

Since 1986, the United States has overtaken Japan as ASEAN's largest market, accepting more than 20 percent of its exports. Japan, however, remains the dominant supplier of manufactured goods to ASEAN. This is due in part to aggressive marketing, the advantage of proximity and generally cheaper financing than is available to U.S. firms.[3]

During the 1980s, ASEAN was the recipient of 5 percent of total U.S. direct foreign investment which was concentrated in petroleum and electronics. Investments by other foreign countries -- especially Japan, Taiwan and South Korea -- have accelerated in recent years, focusing on chemicals, electronics, textiles and food processing. Indonesia, for example, experienced a three-fold increase in non-oil investments in 1988 alone. (See Figure 1-3 and 1-4 for a breakdown of planned U.S. investment and past receipts from services.)

---

[1] *The Association of Southeast Asian Nations (ASEAN) is an organization for economic, political, social and cultural cooperation among its six member countries: Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore and Thailand. ASEAN was established on August 8, 1967, with the signing of the Bangkok Declaration by five of the countries. Brunei joined in 1984, but due to its relatively small size, the market for environmental services/equipment in Brunei is not covered in this report. Companies seeking information on trading with and investing in Brunei may contact the U.S.-ASEAN Council.*

[2] *Trade could expand considerably under a proposed U.S.-ASEAN Free Trade Agreement (FTA). An FTA between the United States and ASEAN was first suggested by U.S. Trade Representative (USTR) William Brock in a February 1983 speech in Singapore. Concern about the elimination of their own trade barriers between member nations, however, led ASEAN to propose an "umbrella" agreement between ASEAN and the U.S. Such an agreement, which would have an FTA as its ultimate objective, has been under review since 1989.*

[3] *For information on financing available to U.S. firms for environmental projects see ENVIRONMENT MONEY: The International Business Executive's Guide to Government Resources, prepared by Delphos International (Washington, D.C.), December 1990.*

Key Economic Indicators

	1988	1989	1990	1991	1992
Real GDP Growth (%)					
Indonesia	5.7	7.4	9.0	6.7	6.7
Malaysia	8.7	8.5	6.7	7.0	7.0
Philippines	6.2	5.6	1.8	1.8	4.8
Singapore	11.1	9.2	7.9	6.3	6.4
Thailand	13.2	12.4	9.6	8.4	8.2
Inflation (% change CPI)					
Indonesia	8.0	6.5	7.8	8.8	8.5
Malaysia	2.5	2.8	4.0	3.5	3.2
Philippines	8.8	10.6	13.5	18.0	13.0
Singapore	1.5	2.4	3.8	3.5	2.7
Thailand	3.8	5.4	6.6	6.0	5.0
Exchange Rate (vs US$1)					
Indonesia (Rp)	1,686	1,770	1,859	1,949	2,045
Malaysia (M$)	2.6	2.71	2.71	2.73	2.73
Philippines (₱)	21.1	21.7	25.0	30.5	34.6
Singapore (S$)	2.01	1.95	1.85	1.79	1.73
Thailand (฿)	25.3	25.7	25.6	25.5	25.5

Source: Various reports of Business International Asia/Pacific Ltd. and The Economist

Table 1-2.

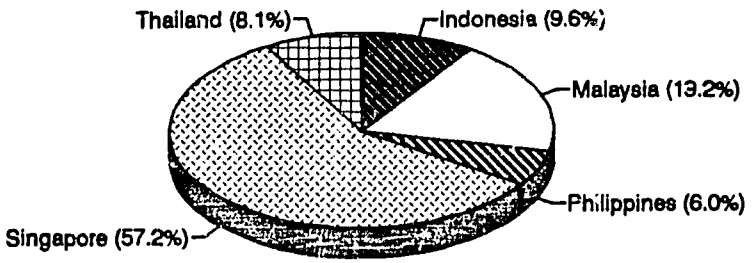
Indicators of Market Size

	Population		Gross Domestic Product		Exports		Imports		1988 Imports From		
	Total 1988 (mill)	Ave % Inc 1983-88	Total 1988 ($ bill)	Ave % Inc 1984-88	1988 fob ($ bill)	Ave % Inc 1983-88	1988 cif ($ bill)	Ave % Inc 1983-88	US	Japan	EC
									(% of Total)		
ASEAN											
Indonesia	175.6	2.1	82.7	5.0	19.4	-0.6	13.5	-2.4	12.9	25.4	19.3
Malaysia	16.9	2.7	34.6	4.5	21.1	9.4	16.6	5.9	17.7	23.0	13.3
Philippines	58.7	2.5	39.1	0.9	7.0	8.2	8.7	4.1	21.0	17.4	12.1
Singapore	2.7	1.2	23.9	5.7	39.3	13.6	43.9	10.6	15.6	22.0	12.0
Thailand	54.5	1.9	57.9	6.6	16.0	21.1	16.3	11.3	16.8	11.7	18.6
ASIA	2,789.2	1.4	3,941.4	—	626.3	14.2	547.4	11.6	15.9	14.3	13.9
Japan	122.6	0.6	2,678.4	4.5	265.0	12.6	187.5	8.7	22.5	—	12.9
EC	324.8	0.2	4,765.6	—	1,064.7	12.5	1,084.3	11.8	7.3	4.6	57.7
EASTERN EUROPE	420.0	0.7	1,530.1	—	98.6	4.4	107.8	5.1	3.8	4.0	24.1
US & CANADA	272.3	1.0	5,333.8	—	436.6	9.9	571.5	11.5	—	17.6	17.9

Source: Business International (1990); Investment & Trade Resources International
Note: Declines in Indonesian imports/exports are largely attributable to the drop in oil prices.

Figure 1-2.

U.S. Environmental Product Exports
For Select Products - 1989

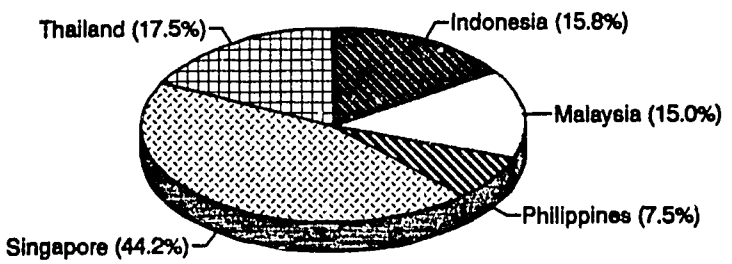


Total Sales Globally = $890.1 million
Total Sales ASEAN = $33.4 million

Includes water/liquid/gas filters, related parts, gas separation equipment, industrial gas cleaning equip., & air purification equipment.
Source: US Commerce Department; Investment & Trade Resources International

Figure 1-3.

U.S. Environmental Product Exports
For Select Products - Jan.-July 1990

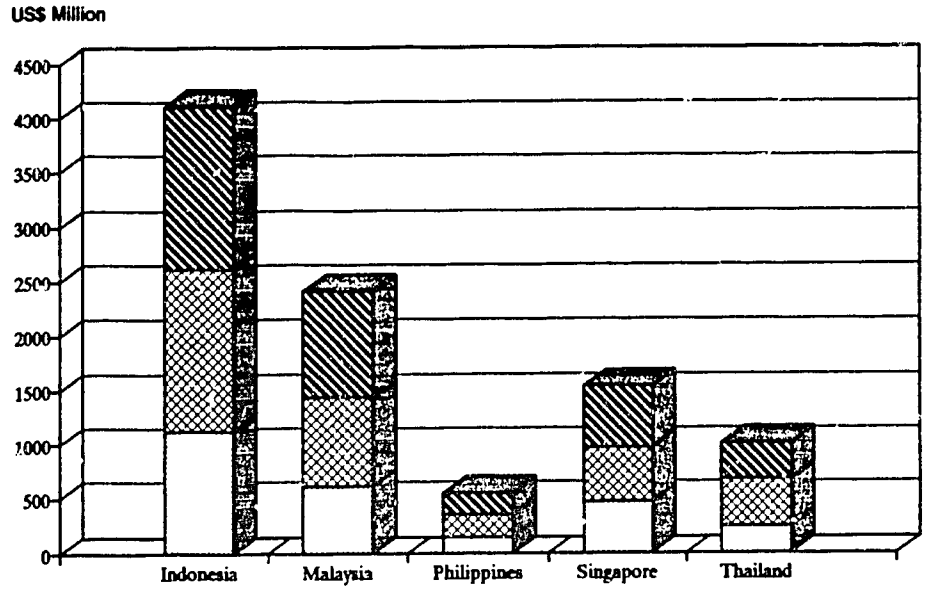


Total Sales Globally (thru July) = $707.2 million
Total Sales ASEAN (thru July) = $24 million

Includes water/liquid/gas filters, related parts, gas separation equipment, industrial gas cleaning equip., & air purification equipment.
Source: US Commerce Department; Investment & Trade Resources International

Figure 1-4.

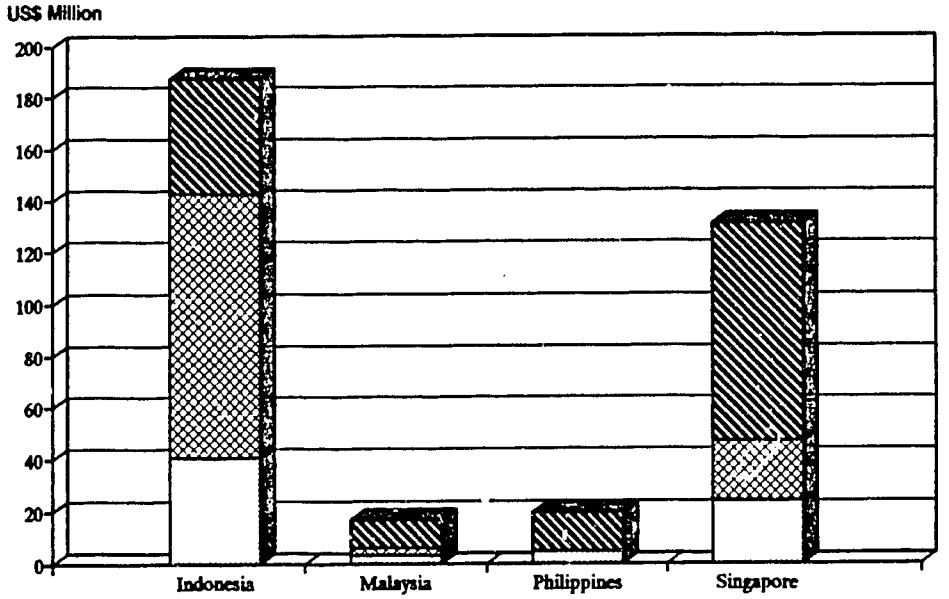
Capital Expenditures by Majority-Owned Foreign Affiliates of U.S. Companies



Note: 1990 & 1991 estimates are reported by US companies.
Source: Survey of Current Business, 9/90

Figure 1-5.

Receipts for U.S. Business, Professional and Technical Services



Note: Information for Thailand is not available.
Source: Survey of Current Business, 9/90

Recent investments have also indicated a maturing of the industrial bases in ASEAN countries, shifting away from the natural resource sectors toward value-added manufacturing. Of particular note are increases in industries known for their production of hazardous wastes, including plastics, petroleum refining, pesticides, leather tanning, metals, chemicals, electronics and cement.

1.2 Current Versus Future Markets for Environmental Equipment and Services

The degradation of the environment in ASEAN countries is, in part, a result of three related factors:

1) the countries' comparatively favorable investment climates (low wage rates, abundant natural resources, open policies, etc.) which are resulting in the rapid growth of pollution-intensive manufacturing industries -- in part, through the relocation of these industries away from sites in developed and newly industrialized countries.

2) rapid urbanization, far surpassing the capacity of local infrastructures: and

3) historically low levels of environmental regulation, standards and enforcement.

Development planning in these economies (with the exception of Singapore), has historically strongly favored economic growth at the expense of quality-of-life. This situation has only recently begun to change. (See Figure 1-5 for a summary of region-wide trends.) In late 1989, for example, the **Philippines** began phased implementation of their strategic plan for *Sustainable Development* which emphasizes a balanced approach to economic development and environmental protection.

Indonesia now requires that environmental impact statements be prepared for proposed (and certain existing) investments. In addition, Indonesia is (for the first time) effectively cracking-down on polluters -- particularly those contributing to the nation's severe water pollution problems.

Thailand envisions the environment as a cornerstone of its Sixth National Plan, begining in 1992. Supplemented by multinational and bilateral donor monies, officials plan to make massive infrastructure investments throughout the country to beef-up its capacity to meet growing waste treatment and disposal needs. Planned government investments in waste water treatment alone amount to over US$230 million with larger outlays expected in the near-term.

Singapore prides itself as being the "cleanest" of the ASEAN region and is now concentrating on becoming Southeast Asia's *center-of-excellence* in the environmental sector. Both Singapore's public and private sectors are actively seeking foreign partners to join forces with local firms to meet the region's needs for pollution control products and services.

Malaysia, though slower than its neighbors in responding to environmental problems, now acknowledges that their lack of infrastructure to handle the growing volumes of hazardous/toxic waste, municipal waste and industrial effluent is reaching critical proportions. Decision-makers accept that policy changes and investments must be forthcoming in the near-term. The issue for Malaysia -- like most nations -- remains one of financing the needed developments.

Figure 1-5.

Trends in the ASEAN Region

Corporate Environment:

- ASEAN corporations are increasingly sophisticated, due to highly educated managers, active participation in international markets and to the emergence of fledgling capital markets providing new sources of financing for growth.

- Singapore is a favored sight for corporate regional headquarters -- managing MNCs' Southeast Asian business -- and for financial interests. It will also be the regional headquarters for many environmental products/service firms operating in southeast Asia.

- Thailand still claims the favor of most international executives, but urban congestion and mounting infrastructure problems are leading many investors to look elsewhere -- particularly to Indonesia and Malaysia.

- Significant deregulation in Indonesia has opened here-to-fore closed or "monopolized" markets for investors. Attempts to reduce bureaucratic redtape are also showing signs of easing operating conditions in several ASEAN countries.

Investment:

- The key investors in ASEAN in recent years tend to be Taiwan, South Korea and Hong Kong (replacing the U.S. and Japan). Companies from these newly industrialized countries (NIC) have relocated pollution intensive industries to the region, partly in response to increasing environmental controls in their own countries.

- Overall investment levels are increasing along with a general shift away from investments in natural resources in favor of those involving industries which are significant generators of wastes, including chemicals, electronics, textiles, food processing, cement and metals.

- Lack of treatment facilities is resulting in unlawful dumping of industrial effluent, including hazardous and toxic wastes, in many areas and/or unsafe storage of these wastes.

- Environmental impact statements (EISs) have only recently begun to be used in regulating pollution-intensive investments. Lack of resources within key agencies and weak support from top levels of government continue to undermine effectiveness and enforcement of EISs. However, improvements are underway. Conditions should be significantly better by the mid-1990s.

Enforcement:

- Waste reduction or treatment involves additional expenditures which pro-growth advocates feel increase production costs and reduce competitiveness, thereby discouraging investment. These growth advocates continue to dominant national decision making in the region. However, demands of environmental organizations and certain government factions are gaining ground, supported by international organizations and IFIs.

- Support for the "polluter pays principle" is increasing as a result of growing grassroots environmental movements in the countries coupled with crisis conditions, i.e., water pollution in Java's rivers and Manila Bay waters, hazardous waste in Northern Malaysia, municipal wastes in Thailand, etc.

Figure 1-5 Con't

- Near-term enforcement will concentrate on the pollution intensive industries -- especially chemicals, textiles, refineries, electronics, utilities, etc. While foreign investments are generally more visible, they also tend to be more environmentally responsible than their domestic counterparts.

- All ASEAN countries now require environmental impact statements for investments in sectors known to be significant polluters. While enforcement remains a problem in parts of Southeast Asia, the foundation for pollution control now exists and should rapidly develop as public understanding of the costs and risks of environmental degradation improves. Discussions have also begun concerning the development of ASEAN-wide regulations, particularly related to hazardous/toxic wastes and vehicle emissions.

Urban Growth:

- Imbalances in regional growth and income structures are exacerbating the trend toward urban migration, which -- without associated improvements in public works -- is placing severe strains on already weak urban infrastructures.

- High density development without adequate drainage and sewerage is leading to flooding, water pollution and associated health problems. High water demand without adequate municipal water supply is leading to excessive groundwater pumping and consequent land subsidence, especially in Bangkok, Jakarta and Manila. Financial constraints at the local level continue to hindered cities' abilities to upgrade poor infrastructures.

Industrial Growth:

- Industrial development without adequate pollution control investment and enforcement is leading to increased air, water and solid waste pollution, encroaching on quality-of-life in and near some urban areas.

- Dumping of partially (or un) treated effluent into waterways is a common practice among businesses and is unlikely to change without a significant enforcement effort by local/regional/national officials beyond current practices.

- Environmental expenditures by domestic companies are increasing slowly. Pollution control expenditures and practices of Western firms tend to be relatively high since their tendency is to follow the standards of their home countries which are generally more stringent than local standards. NIC companies, however, tend to follow the lead of their domestic counterparts, minimizing upfront outlays for environmental equipment.

- Deficiencies in infrastructure -- including electricity, water, telecommunications and waste disposal -- have been major constraints to industrial development in many ASEAN countries. The current trend toward industrial estates -- especially in Indonesia, Thailand and Malaysia -- has reduced this hurdle and opened new opportunities related to the development and operation of centralized waste treatment facilities.

- Major investments -- financed through government funds or through private investment -- are planned or underway to solve key infrastructure bottlenecks in ASEAN, especially in electricity, telecommunications and transportation. Investments in central treatment facilities are also planned.

In the developed world, the *"polluter pays principle"* which calls for waste-management costs to be borne by the waste-producing companies and indirectly by the consumers of their products now is accepted as the favored means of financing environmental protection. (See Table 1-3 for a summary of comparative environmental investment levels.) Similarly, upgrades in municipal infrastructures are financed through increased taxes or fees on residential and commercial customers. In the ASEAN countries, while the polluter pays principle is receiving considerable attention and is even being applied in certain situations, political and economic considerations dictate that the majority of the financial burden rests with the national, regional and local governments -- requiring trade-offs between environmental infrastructure and other development needs.

In most of these countries, privatization of existing and some new facilities and incentives for build-own-operate or build-own-transfer are under consideration. This includes private investment in solid waste disposal, municipal waste treatment and central treatment facilities for industrial and hazardous wastes. It is likely that within the next 2-5 years this trend will accelerate, leading to greater private sector participation in the hazardous/toxic waste management and treatment sector.

International financing institutions are taking an increasingly active role in this sector. According to World Bank officials, more than one-third of all Bank projects contain environmental components. In November 1990, the World Bank announced plans to administer a new Global Environmental Facility (GEF). This Fund involves 25 developed and developing countries and three international agencies: The World Bank, the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP). Commitments are initially estimated at US$1-1.5 billion, with US$100 million designated for an ozone layer protection program. The GEF will concentrate on bio-diversity and protection and/or rehabilitation of natural resources.

The U.S. Overseas Private Investment Corporation (OPIC) has announced plans to establish an Environmental Growth Fund and an ASEAN Growth Fund. The Environmental Fund is to be capitalized at US$100 million (US$40 million to be provided by OPIC and the rest from venture capital), and managed by Kidder Peabody. Monies will be available for equity and quasi-equity investments in 116 developing and Eastern European countries. OPIC estimates funding approximately 25 investments over the next three years, including investments in sustainable agriculture, forest management and pollution prevention technologies. The ASEAN Fund is still under development, but is expected to be capitalized at approximately US$200 million.

A private sector, Pre-Investment Support Fund (PIF) has also been set up to fund studies supporting new private business projects in the Philippines. The PIF is funded by the U.S. Agency for International Development (AID) and is capitalized at US$5 million. It will accept proposals until August 1991 for reimbursements of up to 50 percent of investment-related study expenses. In addition, U.S. AID has committed US$17 million for pre-feasibility and feasibility studies for public sector projects in the Philippines as part of the U.S.'s participation in the US$3.5 billion per year multilateral assistance initiative.

Table 1-3.

Comparative Environmental Investments

	Total Annual Expenditures Construction + O&M as a % of GDP	Total Annual Expenditures Construction + O&M on a Per Capita Basis (US$)
Average for OECD Countries[1]	1.28	84.83
China[2]	0.70	2.03
Indonesia[3]	0.38	1.71
Korea[4]	0.40	10.76
Singapore[5]	1.09	106.86
Thailand[4]	0.24	2.04

Note: [1]OECD (1984), [2]UNDP (1990), [3]World Bank (1985), [4]Business Times (1990), [5]National Institute of Development Administration (1987); data for Malaysia and the Philippines were not available.
Source: Thailand Development Research Institute (TDRI) 1990.

2.0 Key Considerations for U.S. Traders and Investors

ASEAN nations are rapidly industrializing. As a result, traditional attitudes toward quality of life and economic growth are all in a state of flux. Definitions of acceptable practices in industry and the role of government -- both as a promoter of trade/investment and a protector of the nations' environments -- are being defined and redefined. While the pace and magnitude of these shifts are uncertain, **the ultimate result -- increased environmental controls and expenditures for improvements in environmental quality -- is a certainty.**

Figure 2-1 summarizes the findings of this study with respect to potential environmental trade and investment in ASEAN. This list is based on an analysis of environmental conditions in the region; the current operating climates for trade and investment; and trends related to investment, regulation and government priorities.

Of the eight key findings, the most important is the emerging nature of ASEAN environmental markets. With a few exceptions, ASEAN is presently not a significant market for international environmental goods and services. Conditions are rapidly changing though, and within the next five years, ASEAN will develop into a major consumer of environmental products. Specific opportunities and constraints in ASEAN markets is discussed in the following section.

Figure 2-1.

Key Findings

1. **ASEAN environmental markets are viewed as "emerging".** Growth in foreign and domestic investments in pollution-intensive industries, which are fueling ASEAN's booming economies, will continue into the next century. Pressure from domestic and international public interest groups, international organizations and citizens directly affected by water pollution, deforestation and other forms of environmental degradation will require shifts in policies and budget priorities in coming years in favor of environmental upgrades.

   Increases in education and per capita incomes will also bring concomitant demands for improvements in quality of life. Rising expectations will pressure governments toward public works infrastructure development and also engender support for the current global trend in favor of **"the polluter pays principal"**, placing the burden for environmental quality on the polluter rather than the general public.

2. **Enforcement efforts are increasing. These trends are both a general sign of "political will" behind environmental improvements and an indication of near-term opportunities.** Indonesia's crackdown on industrial effluent, for example, is indicative of a growing and potentially very large market for monitoring and testing equipment as well as pollution abatement equipment for targeted industries, i.e., textiles and chemicals.

   Increases in enforcement also require commitments for developing institutional resources, namely staff training and decision support capabilities. For service firms, environmental training and seminars will be "in vogue" over the next five years and are one means of acquainting oneself with the markets and potential partners/clients. Demand for sophisticated modeling and decision support (computer) systems are likely to be relatively low for the near-term due to cost. However, assistance related to sampling, testing and related analysis will be critical for government agencies and for new domestic environmental firms and laboratories.

3. **Of primary importance throughout the entire region is training.** This includes management training of personnel responsible for leading government and industry environmental efforts and technical training of environmental analysts, technicians and scientists. To date, lack of competently trained personnel in areas of environmental management, monitoring, evaluation, etc. has been a major hinderance to effective design and implementation of environmental regulations. On-the-job training, seminars and teaming between domestic environmental firms and foreign companies -- emphasizing technology transfer -- will be crucial over coming years.

4. **Demand for environmental products and services in the 1990s will be predominantly from ASEAN governments and select polluting industries.** As education and income levels improve, demand for consumer-oriented environmental products will pick up -- especially in Singapore and certain urban areas -- but ASEAN will not experience high levels of consumer demand for these products (similar to those in the West) until the late 1990s.

Figure 2-1 Con't

5. **Financing constraints will ease at the national-level as environmental priorities gain against competing demands for limited development monies.** Increased burden on the private sector to control pollution at-the-source will open-up new opportunities involving industrial pollution abatement equipment. While increased financing for these upgrades should be forthcoming from government and IFIs, U.S. companies must be prepared to develop their own financing packages -- especially for big ticket items.

6. **Personal relationships are the key to success. U.S. firms partnering in the initial stages of the ASEAN markets will receive greater payback as the markets mature.** The pace with which these environmental markets are developing requires that relationships be cultivated now to address opportunities in the near-term.

7. While ASEAN environmental markets are still in their infancies, **positioning your firm today will be key to receiving contracts and orders two to five years from now.** Western products are still associated with quality and value. However, name recognition is very important in ASEAN. Companies will find selling directly in ASEAN, without adequate in-country or regional representatives, is difficult at best.

   Potential investors and traders must consider setting up representational offices to learn the market and product requirements prior to investing large sums. In some urban sites, especially Singapore, there are professionals who routinely represent multiple firms. While such relationships are unlikely to result in big payoffs for your firm, they are viewed by many companies as an inexpensive first-step toward positioning companies/products in the region or in a particular country.

8. **For firms specializing in "pollution prevention", trends in enforcement and in investment indicate new opportunities for modernizing industrial processes and practices.** ASEAN governments are emphasizing prevention as the favored means of controlling pollution from new industrial investments. Projects financed through IFI grants or loans must have environmental assessments and generally have requirements for the designs to incorporate best available technology and environmentally benign processes to reduce pollution. (Note these requirements are present for planned power generation projects throughout the region.)

3.0 Environmental Sectors

3.1 Industrial Waste Water

Water quality in ASEAN is regulated through stream standards and/or effluent standards. Under the former, various agencies, ascertain the best uses of a stream and assign certain quality standards to each use. Any polluter found adding contaminants in such quantities as to contravene these stream standards is cited as a violator and must then abate the pollution. The second method involves establishing the desired receiving waste quality and attempting to maintain this quality by controlling each waste discharge to the minimum contaminant units per unit of production or per capita.

In Indonesia, Malaysia, Philippines and Thailand, stream standards is still the preferred method of controlling water quality. Use of this method reflects the involvement of multiple authorities in setting and enforcing environmental effluent regulations. Lack of nation-wide, industry-specific effluent standards, coupled with the involvement of pro-growth agencies as regulators, are no doubt significant contributors to the historic lack of political will behind pollution control.

Recently however, Thailand and, to an even greater extent, Indonesia have moved toward development of industry-specific effluent standards. For the coming years, it is likely that they will join Singapore in significantly cracking down on industrial waste water polluters. The role of a central authority in setting, monitoring and enforcing standards will be critical, as will the development of domestic capabilities related to sampling, monitoring and other aspects of effluent management.

Waterways between adjacent ASEAN countries are receiving particular attention. The executive-level Johor-Singapore Environmental Control Committee, for example, was set up late last year to address the critical water pollution problems of the Straits of Johor. Industrial and livestock wastes in the region have resulted in very high concentrations of heavy metals and other contaminants, devastating local marine resources.

3.2 Solid Waste Management and Municipal Waste

Solid waste disposal standards or resulting land use standards are extremely variable from one country to the next, depending mostly upon the availability of sufficient land, density of the populations and concern of the citizens for protection of environmental quality. Singapore's laws involving disposal of trash, for example, are among the world's harshest and are stringently enforced. However, solid wastes regulations in the other ASEAN countries tend to be minimal at best. National codes and requirements are almost nonexistent, with performance standards dictated largely by municipal laws. Municipal laws, in turn, are often confusing, unenforceable and conflicting.

While solid waste management is still viewed by most in ASEAN as the responsibility of local governments, conditions are worsening and are requiring increased involvement of central government agencies. Changes in patterns of living, population shifts and industrialization have substantially altered the production and composition of solid wastes. Where once solid wastes were mostly domestic, they are now produced in substantial quantities by industry as well. Solid wastes from industry pose special problems such as nondegradability (plastics) and toxicity (chemical residues). Hospital waste (especially in Thailand and Singapore) are increasing exponentially as are their associated toxic wastes.

Urban migration is also placing a disproportionate burden on certain ASEAN cities, increasing the number of poor residents without sewer connections or adequate trash disposal. These infrastructure shortages are leading to myriad health problems and aggravating issues of social inequities.

For most ASEAN governments, addressing these pressing infrastructure needs is of utmost importance. While development financing remains an issue, the question for these government is *when* rather than *if* significant public and private investments are required in these sectors. Indeed, significant steps are underway in Thailand and Malaysia to deal with municipal wastes, including a US$700 million waste water treatment program in Bangkok.

3.3 Hazardous and Toxic Wastes Control

The alarming feature concerning the region's industrial hazardous waste is the projected rapid growth of such waste, both in quantity and hazard as the ASEAN countries become further industrialized. Since most industrialized countries require and enforce proper treatment and disposal of such waste, the industries tend to have a comparative advantage in, and gravitate toward, countries with less stringent environmental regulations. As export-oriented, rapidly industrializing countries, ASEAN nations are likely to continue attracting pollution-intensive industries through the decade, despite improvements in enforcement.

As industry in Southeast Asia continues to grow and evolve, the current industrial mix, and its hazardous waste problems, will undoubtedly involve new control and remedial technologies to deal with the more exotic waste streams. Few treatment/disposal facilities presently exist in Thailand, Singapore or Indonesia. None exist in Malaysia or the Philippines. Storage of waste in anticipation of future facilities is reaching critical proportions, with illicite dumping a pervasive problem throughout the region. Key issues which the governments are currently attempting to resolve center around financing and the degree/nature of private sector participation in this sector.

There are also moves underway to establish regional guidelines in this sector. In November 1990, a four-day, closed-door workshop was held in Singapore focusing on risk assessments and management of chemical hazards in the ASEAN region. The meeting, sponsored by the United Nations Environmental Program and the U.S. National Center for Toxicological Research, is another indication of efforts in the area to strengthen procedures and regulations related to hazardous and toxic substances and to promote a regional approach to environmental problems.

3.4 Air Pollution

Industrial activities, along with combustion of fuels for heating, energy production and transportation, are the major sources of air pollutants in ASEAN. It is rare that an analysis of local factors, including weather conditions, stack heights, location, control equipment, feedstocks and type of process and their effect on stationary (or point sources) of pollutants is adequately completed prior to construction of industrial plants. Industry-specific emission standards, providing allowable levels for specified contaminants, tend to be vague or non-existent (with the notable exception of Singapore)[4] and are generally unenforced. In addition to sulfur dioxide (SO_2), suspended particulate

---

[4] *Singapore's emission regulations are continuing to be strengthened. New automobile vehicle standards will prevent many vehicles from entering Singapore via Johor. The Republic is also reducing emission levels for diesel vehicles from the present 55 Hartridge smoke units to 50, effective January 1991. About 3,500 Malaysian diesel-powered vehicles are estimated to enter Singapore by the Causeway each month. Of these, about 20 percent do not comply with current standards. As of October 1, 1991, all motorcycles and scooters will be expected to comply with hydrocarbon and carbon monoxide emission standards under simulated*

matter and oxides of nitrogen (NO_x), ASEAN's air pollutants include lead, cadmium, mercury, beryllium, the mercaptans and hydrogen sulfide, fluorides, chlorine, asbestos and many other wastes and by-products of technological processes.

Certain industrial operations such as power plants, cement production and incinerators are large contributors to air contamination throughout the region, yet these industries have rarely been monitored or controlled due to the costs associated with both actions. Despite these historic practices, environmental standards are likely to be of prime importance to new facilities -- especially power generating plants -- since many of ASEAN's planned capital projects are being financed by IFI grants/loans which dictate strict controls on pollution.

It is normally desirable, from a cost standpoint, to remove contaminants by changing a process or by heightening the stack where emission is occurring. In the case of existing facilities in ASEAN, however, the extent to which the process changes can be accomplished is limited because of prior commitments of plant capacity, equipment and labor.[5] Changes in stack height are also rarely required since these facilities tend to be grandfathered under new standards or regulations.

In new plants, some improvements in operation can usually be made to minimize or eliminate completely the final treatment of emissions. However, lack of trained environmental engineers and consultants in these countries, has limited the use of options emphasizing pollution prevention.[6] Consideration -- especially among foreign investors -- is increasingly being given to making industrial processes more environmentally sound before installing costly contaminant removal systems. This is being accomplished by changing raw materials or processes of manufacturing or by reusing materials formerly wasted to the stack emissions.[7]

3.5 Environmental Services

Throughout the ASEAN region, basic information on the source, nature, levels and concentrations of pollution is not widely kept or available. In addition, the institutional resources supporting the generation of needed data and analysis are weak. With the establishment of environmental enforcement agencies, and with financial/technical support from several international and domestic groups, the ASEAN countries are initiating studies to improve both available data and institutional capabilities.

While in the past, demand for environmental services -- domestic and foreign -- has been minimal, conditions are changing. Both the public and private sector are now complaining of the deficit in skilled personnel and firms capable of conducting required environmental impact assessments, environmental engineering, sampling and laboratory analyses, modeling, etc. The cost/benefits of

---

urban traffic conditions (versus idling as is current practice).

[5] *There are certain traditional sectors, e.g. textiles in Indonesia, which are undergoing a complete restructuring backed by IFI monies. In these cases, pollution prevention is a key criteria included in the choice of new process technologies.*

[6] *Malaysia's government has announced that the preferred means of addressing future pollution problems is through prevention rather than abatement. This policy has yet to be supported by strengthened government scrutiny of environmental impact statements for proposed projects, but moves in this direction are expected in the near-term.*

[7] *The substitution of oil or natural gas for coal as a fuel for boilers for industrial steam production or for power production would serve to lessen, if not eliminate entirely, the need for sulfur dioxide removal systems on the waste gas stream. In Indonesia and Thailand -- major users of high sulfur coal for power production -- such a change could make a significant difference in ambient air quality.*

various pollution prevention/abatement alternatives are of increasing importance to new investors. Institutional upgrades (such as a recent US$100 million Japanese grant to Indonesia for an environmental laboratory and related training) are increasing throughout Southeast Asia. Singapore has even targeted environmental services as a primary growth area for the 1990s, and plans to have its firms provide the entre for foreign technical service companies interested in other ASEAN markets.

4.0 Emerging Environmental Trade & Investment Markets

4.1 Indonesia

Indonesia's environmental minister, Emil Salim, is garnering increasing international attention in his crusade towards sustainable economic development for the world's largest archipelago and fifth most populous nation. Under his guidance, environmental laws have been passed requiring the preparation of environmental impact statements for all new development projects and establishing new environmental standards and institutions.

Public opinion is strengthening behind Minister Salim, supported by the development of several grassroots environmental organizations, including the Environmental Forum (WALHI), Skephi (forest preservation) and Skrepp (an antipollution network linked with the Legal Aid Institute). President Suharto, both in public and in his 1988 biography, has championed environmental quality as an important objective for the nation. As a result of these changes in attitude and mounting environmental problems -- especially in groundwater -- the transition from rhetoric to action has started.

The most pressing environmental problem currently facing Indonesia is that of water availability[8] and quality. Rapid population growth and urban migration has placed severe strain upon water sources, while at the same time, prolonged dumping of untreated municipal and industrial wastes into estuaries has taken its toll on water quality. On the island of Java, where more that 60 percent of Indonesia's 180 million people live, over half of the rivers are considered highly polluted.

The Indonesian government's next priority, after water pollution control, is improvements to public and private institutions supporting environmental impact assessments (EISs). EISs are required for all new projects and for those existing facilities which produce toxic or hazardous wastes. Improvements to law enforcement and hazardous waste programs are next in priority, with the remaining priorities for Indonesian environmental officials (in order of importance) being air pollution control, reversal of environmental degradation, sewage regulation and the environmental effects of small-scale activities.

A centralized authority coordinating environmental regulations (BAPEDAL) was announced in late 1990, pursuant to Presidential Decree No. 23/1990. This environmental protection agency will have central authority in Jakarta, but actual monitoring and enforcement will be implemented at the provincial level through regional BAPEDAL offices. Provincial offices will report to the respective governors, with central coordination and training provided by the national BAPEDAL.

Water Pollution: The Clean River Program, *Prokasih,* established in June 1989, is expected to be the foundation for enforcement actions by local and regional governments related to industrial effluent. The target of the *Prokasih* program is to decrease the volume of pollution material entering 20 key Indonesian rivers, by focusing on major contaminants and reduction of industrial

---

[8] *During the current five-year planning period (1989 through 1994), the Indonesian government estimates that the industrial sector will grow at a rate of 8.5 percent per annum. The demand of industry for water by the year 2000 is projected be 70.1 percent greater than 1980 levels of 143.7 x 10^6 m^3/year -- demand in Java alone is expected to increase 51.9 percent over 1980 levels of 137.2 x 10^6 m^3/year. This demand, coupled with domestic and agricultural water requirements, indicates that demand for surface water will reach 153 percent of availability by the year 2000.*

wastes.[9] The initial emphasis of the program is on hazardous and industrial wastes, rather than municipal waste. Most existing industries are expected to be grandfathered (with treatment of waste streams remaining minimal to nonexistent); new facilities, however, will have to comply with the new regulations.

Results of initial monitoring efforts[10] indicate a continuing decline in water quality in Indonesia, particularly for rivers near densely populated urban centers and industrial areas. For example pH values have decreased at the rate of 0.16/year in the Musi river in Palembang, 0.13/year for the Ciliwung river in Jakarta, 0.02/year for the Surabaya river in Surabaya. BOD values have increased in the Banjir Kanal by 1.06 mg/ltr/yr (9.94 percent); COD values have increased by 3.24 mg/ltr/yr for the Banjir Kanal and by 2.7 mg/ltr/yr (15.8 percent) for the Citarum river in Nanjung. Rivers targeted as heavily polluted include: the downstream portion of the Bekasi Cileungsi River, the Pengubuan River and the Seputih River in the industrial zone, the downstream portion of Kali Burabaya and the downstream portion of the Ciliwung River. Only Kali Surabaya has shown an increase in its water quality due to the waste processing activities undertaken by manufacturing plants located along the Surabaya River.

Key components of the *Prokasih* program which offer opportunities for U.S. firms include:

- Provision of processing, storage and disposal facilities for hazardous waste.
- Consulting services related to waste water treatment design (consultants must be registered).
- Agents for waste processing equipment (joint ventures with Indonesian firms are critical, with procurements likely to be through sole agents).
- Monitoring and enforcement of new regulations supporting the program, such as those on waste water standard quality, water regulation, etc.

Each of the eight participating provinces is free to choose one of two potential approaches to regulation/enforcement of the *Prokasih* program.[11] It is expected that small industries (especially

---

[9] *The industries which have been identified by the government as the primary contributors to water pollution include factories producing palm-oil, tapioca, pulp, sugar, textiles (especially from bleaching and dyeing activities) and leather tanning. Furthermore, there are industries such as electroplating, chemical (pesticides, caustic soda, ammonia), and petrochemical industries whose waste products contain dangerous toxic materials.*

[10] *Laboratories used for the Prokasih program include the Industry Institute (Balai Industri), the Regional Health Laboratory, the Institute for Environmental Health Technique (Balai Kesehatan Tehnik Lingkungan), the Directorate for Water Studies, various universities' environmental laboratories, as well as laboratories of various state-owned enterprises, such as PT Pusri and Pertamina. The quality of data from these laboratories is highly variable and is dependent on the capabilities of the respective personnel and equipment.*

[11] ***First Pattern:*** *1) First-priority industries along Prokasih rivers will, by June 1990, already have decreased their pollution by 50 percent. 2) First-priority industries along Prokasih rivers will, by December 1990, already have the quality of their waste conform to the standard acceptable waste quality. 3) All second-priority industries along Prokasih rivers will, by June 1991, have complied with the standards for acceptable waste quality. 4) All priority industries along all rivers will, by March 1993, have complied with the standard for acceptable waste quality. At this stage, other priority industries will be determined.*

Second Pattern: *1) By June 1990, the amount of pollution originating from medium and large industries will have decreased by 50 percent. 2) By June 1991, medium and large industries along Prokasih rivers will have complied to the standard acceptable waste quality. 3) By March 1993, priority industries along all rivers will have complied with the standards of acceptable waste quality. At*

printing, electroplating, textiles and leather tanning), located in Jakarta, West Java (Tangerang, Bandung), Central Java (Semarang, Solo) and East Java (Surabaya) will be in a position to conduct central waste processing by March 1993. Current Federal funding for the program varies by region, ranging from Rp20 million (US$10,760) for East Kalimantan to Rp125 million (US$67,000) for Jakarta. Supplemental funding is expected in the near-term to support planned program and infrastructure development efforts.

Within *Prokasih*, standards for waste quality are being developed based on:

- Type of industry;
- Best practicable intermediate technology, except for special cases at sensitive/vulnerable locations.

These standards are being issued in the form of formal regulations and laws. As of early 1990, standards for waste quality had been issued for 14 types of industries. Industrial estates which already possess integrated waste processing facilities are required to comply with the standards for waste quality determined by *Prokasih* for each type of industry located within the estate. In order to encourage local authorities, as well as industries, to implement *Prokasih*, awards are being given to those who achieve particular success. Certain incentives are also being provided to industry, including exemption of import taxes on waste processing equipment.

During 1990, the following laws and regulations were passed implementing *Prokasih* and other environmental efforts:

- Act No. 5/1990, Natural Resources Conservation and Its Ecosystems
- Government Regulation No. 20/1990, Water Pollution Control
- Presidential Decree No. 23/1990, Environmental Protection Agency
- Presidential Decree No. 32/1990, Management of Protected Areas
- Public Works Ministerial Decree No. 45/1990, Water Effluent Control in Water Sources
- Forestry Ministerial Decree No. 5/1990, Forestry Protection and Nature Conservation

Hazardous/Toxic Wastes: Widespread installation of industrial waste water treatment equipment is expected to result in a large increase in the quantities of sludge produced in Indonesia -- much of which will contain toxic and/or hazardous wastes. Currently the Industrial Estate Rungkut in Surabaya is the only location of an operational treatment plant of industrial wastes in Indonesia. Plans for a model treatment plant in the Citarum River basin of West Java were curtailed due to budgetary constraints. The ten priority locations identified[12] for the development of treatment, storage and disposal (TSD) facilities are:

---

this stage, other priority industries will be determined.

[12] *This list was developed during a 1989/90 study by Dames & Moore (U.S.) and P.T. Environment Nusa Geotechnica (Indonesia) entitled Hazardous Waste Management Plan: The Republic of Indonesia. The study was a feasibility assessment for a hazardous waste management center for the JABOTABEK region surrounding metropolitan Jakarta.*

1. JABOTABEK
2. Surabaya, East Java
3. Lhokseumawe Industrial Zone, Aceh, North Sumatera
4. Medan, North Sumatera
5. Batam Island Authority, Riau
6. Palembang, South Sumatera
7. Bandung, West Java
8. Semarang, Central Java
9. Balikpapan, East Kalimantan
10. Samarinda, East Kalimantan

International assistance is being sought by the government to assist in development of these hazardous waste treatment facilities. The first project is the final design and construction of the Jakarta (JABOTABEK) and Surabaya (GKS) facilities. The JABOTABEK region is the largest population center in Indonesia as well as the nation's largest industrial area. JABOTABEK contains the capital (Jakarta), the city of Bogor, and the districts of Bogor, Bekasi and Tangerang, covering a total of 6,418 square kilometers and containing a population of 12.8 million persons.

The JABOTABEK TSD facility, as conceived by the 1990 Dames & Moore study, would have a capacity to receive 50,000 tons of wastes per year. The capital cost of the facility (including incinerator) is estimated at US$33 million, with operating and maintenance costs amounting to approximately US$3.5 million per annum.

Total volumes of wastes in the JABOTABEK regions are projected by waste management group below.

Table 4-1.

Indonesian Waste Generation Projections
(Solids & sludge in tons; liquids in m^3)

Waste/Management Group	1995	2000	2005
Incineration Solids	925	1,021	1,127
Stabilization Solids	3,537	3,905	4,311
Landfilled Solids	188,559	206,708	226,663
Incineration Sludge	76,898	84,902	93,739
Stabilization Sludge	1,858,958	2,052,440	2,267,033
Landfilled Sludge	0	0	0
Acid Liquids	8,921	9,849	10,874
Incineration Liquids	93,696	103,448	114,215
Toxic Organic Liquids	0.015	0.016	0.018

Source: Dames & Moore/PT Environment Nusa Geotechnica (1990) based on analyses and projections of PT Mirazh (1987)

Short-term Focus:

- Significant increases in enforcement and infrastructure upgrades pertaining to industrial effluent, especially those containing hazardous/toxic substances -- strong participation of provincial governments in regulation, enforcement and financing of waste control efforts;

- Minor emphasis on air pollution from the transportation sector. Cement and pulp/paper industries have been targeted for enforcement with respect to air pollution.

- Anticipated increases in use of high sulfur coal for power generation will result in increased demand for clean coal technologies.

4.2 Malaysia

While recent moves to privatized aspects of hazardous/toxic waste handling and disposal (discussed below) indicate a growing awareness by Malaysia's government of its environmental problems, budgetary constraints and decentralized environmental authority, leading to weak regulatory enforcement, are expected to hinder attempts to address pollution problems in the near-term. However, growing volumes of untreated toxic and hazardous wastes, especially at electronics and certain other manufacturing facilities, will require action by the central government in the near-term. Municipal waste disposal and air quality are becoming major considerations for all levels of government.

In terms of new investments, Malaysia announced late last year that environmental considerations (along with value-added manufacturing and full-employment) would be a key consideration in evaluating proposed projects. This new policy position is consistent with Malaysia's commitment as a signatory of the Langkawi Declaration[13] to ensure cleaner industries.

Waste Water: Approximately 90 to 95 percent of the total volume of waste water discharge from Malaysian industries originates from three categories of manufacturing facilities: food processors, industrial chemical and other chemical products and textiles. Most of the factories which are located in industrial estates, especially the larger ones, have some form of waste water treatment facilities and attempt to conform to SIE Standard B pollutant discharge limits. The exceptions to the rule are industries located in municipalities which have announced planned expansions of sewage facilities. In this instance, the Department of Environment permits effluent discharges which do not conform to the SIE requirements on the pretext that the industry shall soon be connected to the sewerage facility. In reality, however, municipal sewage expansion programs have been slow to materialize. As a result, many Malaysian industries are indiscriminately discharging untreated waste into urban waterways.[14]

---

[13] *The Langkawi Declaration was drawn-up during the last Commonwealth Heads of Government meeting in Malaysia and is aimed at protection of the environment.*

[14] *Small industrial related enterprises, mainly electroplating shops, metal workshops, printing, dyeing and paper product establishments, car repair garages and petrol stations do not have the sufficient space or financial resources to install in-situ waste water treatment facilities. As a consequence, they discharge significant quantities of waste waters containing high levels of pollutants, including trace metals. In the latter case, insufficient storage space dictates indiscriminate releases of toxic waste material into the environment.*

A recent study on waste discharges from the Klang Valley area indicates that the total industrial pollution load of the Klang River system amounts to 38.760 m^3/day containing a BOD, COD and total nitrogen waste load of 28,410 kg/day, 176,090 kg/day and 1,896.3

As in many developing countries, staff shortages in the municipalities and local governments are the principal reason that enforcement of antipollution legislation and other pollution controls are not instituted on a dedicated basis. In other cases, political pressure and other considerations often lead to the establishment of deficient or ineffective waste treatment plants in urban centers. Lack of awareness by local authorities of key environmental regulations relating to enforcement also limits effective controls.

The funds allocated for urban sewerage during the Fifth Malaysian Plan (1986 - 1990) was M$116.14 million (US$43 million). Under the Sixth Plan, this should be raised to upwards M$500 million (US$185 million). These figures include funds for development of select urban sewerage systems and do not reflect the expenditures by local authorities on public works, or by the private sector on treatment facilities for industrial or large residential developers. Expenditures in these sectors could amount to four to five times national government expenditures.

It has been proposed in the Sixth Malaysia Plan that previous sewerage master plans be reappraised and restructured in order that they can become more affordable to the government and be within the users' ability to pay. In this respect decentralization of waste water treatment plants to serve smaller areas is being considered. Existing plants, under this plan, would be upgraded to sub-regional units serving several adjoining housing estates which are already fitted with comprehensive reticulation (collection) sewers. In addition, privatization of local facilities is being considered. However, current laws only provides for private participation under contracts or under a build-operate-transfer (BOT) modus operandi and would have to be modified to permit direct private sector involvement.

Solid Waste: The average per capita generation rate in urban areas is approximately 0.5 to 0.8 kg/per capita/day. Malaysian solid wastes contain very high concentrations of organic wastes, and have a high moisture content and a bulk density of approximately 200 kg/m^3. Solid waste management in urban areas accounts for 30 to 50 percent of local authority expenditures and uses 40 to 50 percent of local staff resources.[15] Local funds spent on solid waste management amounted to M$122 million (US$45 million) in Peninsular Malaysia in 1988 and should double by 1995 -- primarily due to the planned development of incinerators throughout the country.

Currently, laws and regulations relating to solid waste are almost non-existent. Constitutionally, solid waste management is the responsibility of local governments with services typically provided by the local Health Department, with assistance from the Engineering Department. Since no clear delineation of responsibilities or procedures exists, inter-agency disputes are common and services are, on the whole, poor. Very few local authorities engage in sanitary landfilling, instead, open dumping has been the norm. Complaints of nearby residents and increasing scarcity of new sites are leading local officials to rethink these practices. However, continued monetary constraints at the local level, personnel limitations, and lack of guidance and assistance from the national level, are hindering improvements. Increasingly, local officials are favoring the construction of incinerators,[16] despite the high capital costs and lack of skilled technicians. This tendency is in part driven by the aggressive marketing underway by various domestic contractors.

---

kg/day respectively. This is in comparison to urban BOD, COD and total nitrogen loadings of 90,600 kg/day, 226,020 kg/day and 18,100 kg/day respectively. Discharges of toxic metals amounts to approximately 5,000 kg/day currently, versus 3,600 kg/day in 1975.

[15] *The per capita expenditure for public health cleaning services – sewerage, solid waste, street cleaning, etc. – is approximately M$18-28/year.*

[16] *Note that energy recovery is not economically feasible from most incinerators due to the high moisture content of solid wastes.*

Collection and disposal of industrial solid wastes have, in the larger municipalities, been privatized. Two foreign firms are currently active in this area and others are anticipated.

Hazardous/Toxic Wastes: In March 1989, Malaysia issued regulations to control the generation, storage, treatment, transportation and disposal of toxic and hazardous wastes.[17] These regulations make the generators of these wastes responsible for their management and require that the generators notify the Director General, Department of Environment (DOE) of the quantity and type of wastes generated and dispose of said wastes only at prescribed locations.[18] The regulations also control the operation and licensing procedures of facilities used for the recovery, treatment, storage and disposal of scheduled waste.

A total of 107 categories of scheduled wastes are included covering wastes generated by the electronics, petroleum, paint, pharmaceutical, rubber, chemical, metal finishing/workshop industries. Wastes from these industries are currently either being stored on-site at facilities or dumped into surface drains or unsecured refuse sites.

To meet this growing problem, the government is seeking private investment in a central hazardous waste treatment facility. Initial steps are underway by two consortiums -- headed by Chem-Security Ltd. (Canada) and Krugers (Denmark). These organizations are negotiating arrangements for minimum volumes at treatment sites, backed up by strict enforcement of regulations. They have also requested government assistance in the form of grants or subsidies for the development of planned sites. While current proposals are being prepared by these two groups, the government's commitment to privatize this sector and encourage the development of related industries, e.g. waste recovery, should lead to new opportunities for U.S. firms.

Air Pollution: During recent years the problem of air pollution has received increasing public and political attention.[19] According to one official, Kuala Lumpur ranks as the 14th most polluted among the world's 41 largest cities. Local smog is attributed to a combination of factors, including the burning of wood, grass and wastes; industrial emissions; and vehicle exhaust fumes combined with unfavorable climate conditions.

---

[17] Malaysia introduced two incentives in 1990 promoting proper storage, treatment and disposal of toxic and hazardous waste: (1) Industries directly handling toxic wastes will be accorded a "pioneer" status for five years, and classified as a promoted activity (under the 1986 Promotion of Industries Act), receiving special consideration and tax breaks. (2) Companies establishing facilities to store, treat or dispose of their own wastes will receive a special allowance for capital expenditures (40 percent year 1; 20 percent years 2-5).

Import duty exemptions were also extended for machinery and equipment, raw materials and components directly involved in the management of hazardous wastes.

[18] According to a 1987 study by Dames and Moore (USA), 380,000 m^3 of scheduled industrial wastes were generated that year in West Malaysia. About 44 percent of these wastes were produced by the metal finishing industry and 16 percent by asbestos firms. Other contributors included the packaging and printing industries, metalworks/foundries, film processing and oil refineries (3 to 4 percent each); and motor assembly plants, paint industry, electronics/semiconductor plants and pharmaceutical manufacturers (1 to 2 percent each).

According to various studies in the mid-1980s, acid waste constitutes approximately one-third of total toxic/hazardous waste. Almost half of all hazardous wastes are produced in the state of Selangor, with the Federal Territory second (generating about 17.5 percent), and Johor third at just over 8 percent of the total. Recent investment trends, especially related to the electronics sector, have shifted Johor into second place as a major generator of toxic/hazardous wastes.

[19] On a national scale, air quality monitoring is limited to measurements of total suspended particulate (TSP), atmospheric lead (Pb) and dust fallout.

In 1988, the Malaysian government commissioned a study to develop criteria and standards for ambient air quality and a quality assurance program for air quality monitoring. The study proposed a set of air quality guidelines for the following pollutants: total suspended particulate matter (TSP), particulate less than 10 micrometers (PM10), dustfall, lead, sulphur dioxide, nitrogen dioxide, carbon dioxide, carbon monoxide and ozone. It was recommended that uniform guidelines be adopted for the entire country. As of this report, these standards are still under consideration by the government.

The major sources of air pollution can be classified into three major groups: mobile sources, industrial stationary sources and solid waste disposal sites. Petroleum powered vehicles account for 93 percent of the mobil sources of pollution; power stations, boilers, furnaces and incinerators account for 32 percent of the statutory sources of pollution; open burning at solid waste disposal sites are routinely carried out at almost all of the 102 sites in the country.

Increased enforcement has reduced particulate emissions from cement factories and quarries, major contributors to TSP. Current trends toward use of natural gas by power stations, versus coal or oil, have had a positive effect on ambient air quality. The DOE is considering requirements for motor vehicles to have periodic inspections, and is working on emission control standards for autos and trucks, including a shift to unleaded gasoline and adoption of catalytic converters for autos. Petronas, Malaysia's national oil company, took the lead here in July by introducing unleaded petrol in local markets. Shell, the second largest petrol producer in Malaysia, followed suit a month later. Moves are also underway to develop ASEAN-wide vehicle emission standards.

Environmental Services: The level of environmental analyses capabilities in Malaysia (public and private sectors) is still low. Required environmental impact assessments[20] are typically performed by local firms in cooperation with foreign associates. A few foreign firms (primarily associated with the oil and gas industry) have established offices in Malaysia to perform these studies. Risk analyses, a new requirement for EIAs associated with the petroleum and chemical industries, are being prepared by foreign firms due to scarcity of skilled in-country personnel.

Focus in the Short-term:

- Immediate opportunities exist for private sector participation related to hazardous/toxic waste treatment, storage and disposal;
- Infrastructure investments aimed at improving industrial and municipal waste disposal are increasing. However, funding will remain a constraint at the local level for the short-term. Opportunities are emerging at all levels for private sector participation in urban sewerage systems and solid waste handling and disposal.

4.3 Philippines

The Philippines Department of Energy and Natural Resources (DENR) was created in June 1987 and given a mandate to formulate a strategy for sustainable development. The Philippine Strategy for Sustainable Development (PSSD) was formally launched in the fall of 1989.[21] The DENR is

---

[20] *In accordance with the Environmental Quality Act, 1974 and related regulations, approval in the form of written permission from the Director General of DOE must be obtained prior to the construction of any facility that is likely to result in the discharge or emission of pollutants into the environment. This is to ensure that adequate pollution control measures are incorporated to meet the emission and effluent discharge standards stipulated under the Environmental Quality (Prescribed Premises - Crude Palm Oil) Regulations, 1977; Environmental Quality (Prescribed Premises - Raw Natural Rubber) Regulations, 1978; Environmental Quality (Clean Air) Regulations, 1978; and the Environmental Quality (Sewage and Industrial Effluent) Regulations, 1979.*

[21] *The primary goal of the PSSD is to achieve and maintain economic growth in the Philippines without depleting the stock of natural resources and degrading environmental quality. Key objectives include:*

- *Ensuring sustainable utilization of the country's natural resources such as forests, croplands, mineral and marine and freshwater ecosystems;*
- *Achieving and maintaining an acceptable quality of common resources such as air and water;*
- *Maintaining the country's species and genetic diversity;*

headed by a team of well-respected environmentalists who work closely with activist non-government organizations and university specialists. It is divided into six bureaus, covering forest management, land management, mines and geosciences, environmental management, ecosystems research and development and protected areas and wildlife. Ultimately, Regional Environment and Natural Resource Offices are to be created as part of the overall effort to decentralize and streamline the functions of the DENR.

DENR leaders, including Secretary Fulgencio Factoran Jr., are working hard to improve the image of organization from one of corrupt regulator to that of an effective development agency. While they are increasingly confronting big business, attempts at beefing-up enforcement are frequently undermined by unsupportive, powerful political factions.

Solid and Municipal Waste: The 1990 *Manila Metropolitan Region Environmental Improvement Study* reported that the four cities and 13 municipalities of Metro Manila generate about 4,000 tons per day (tpd) of solid wastes. About half of this solid waste comes from domestic wastes of its more than 8-million residents. These residential wastes contain a high percentage of wet garbage or putrid food wastes.

About 3,400 tpd of solid waste are collected and transported to dumpsites. The remaining 600 tpd is either left on the streets; recycled by scavengers; burned; or dumped into storm drains, canals or other waterways. Most of Metro Manila's rivers are highly polluted. The most severe is the Navotas-Malabon-Tullahan-Tenejeros rivers, where 1,000 industrial firms and 11,000 squatting families contribute to the current BOD levels of upwards 500 mg/l.

Manila Bay also shows signs of stress, with the waters near shore unfit for swimming and unable to sustain commercial shell fisheries. The *Manila Bay Monitoring Program* recently found that the total coliform and fecal coliform counts in the Bay have multiplied more than 10-fold in the last five years; dissolved oxygen concentrations range from 3 to 8.5 mg/l.

The need for sewerage systems in Metro Manila is reaching crisis proportions. Less than 2 percent of the residential households are currently served by sewerage facilities; the rest are connected to drains, estuaries and canals leading directly to rivers. At least 31 municipalities and 10 cities discharged their sewage, industrial effluent and domestic wastes into strategic coastal areas, including Manila Bay, Iligan Bay, Lingayen Gulf, Calacan Bay and Tanon Strait.

Industrial Waste: Approximately 70 percent of Metro Manila's water pollution is due to domestic sources and 30 percent comes from industry. Metro Manila, for example, dumps at least 1,000 tpd of wastes into the Pasig river. Meanwhile, some 313 industrial firms along its banks dump an estimated 11 million gallons per year of untreated/partially treated industrial effluent.

Outside of Metro Manila, mining firms discharge at least 140,000 tpd of mine tailings into rivers and other water ecosystems. The mining industry generated 82.8 million dry metric tons of mine tailings in 1985, 60 million DMT in 1986 and 63.2 million DMT in 1987.

- *Ensuring the integrity of essential ecological processes and life-support systems;*
- *Achieving a level of population growth that can be optimally supported by and will not cause undue stress on the country's resources.*

The PSSD identifies a number of strategies to meet these objectives and goals, including incorporation of environmental concerns into all areas of decision making; environmental education; citizen mobilization; introduction of pricing mechanisms for natural resources; pollution control; and population control. Ideally, the PSSD will be fully implemented and in the monitoring stages by 1995. In reality, many of its goals may be not be achievable in the short-term due to monetary constraints, corruption and other factors. The PSSD does, however, indicate a growing public and political awareness of environmental concerns and the necessity of acting responsibly in areas affecting the environment.

Air Pollution: Air quality in the Philippines has not been monitored since 1983. Therefore, it is difficult to adequately gauge current conditions. One study, however, reports that in Metro Manila, particulate matter go up to 1,000 u/cum. Another study estimates that 60 percent of the air pollution comes from motor vehicles, e.g., diesel and gasoline vehicles. Critics claim that significant transportation-related air pollution is to blame for the 471,100 cases of upper respiratory tract infections and 79,400 cases of bronchitis reported in Manila in 1988.

Other sources of air pollution include: food industries (aerosolized fat); metallurgy and cement industries (mineral matter); combustion fired industries (soot, flash, carbon monoxide and nitrogen oxides); utilities (nitrogen oxides, sulfur oxides and carbon monoxides); and various odor-causing agents (human feces, food preparations, sewage handling and animal slaughter).

Hazardous Waste: Surveys indicate that a broad range of toxic and hazardous substances are routinely discharged in the Metro Manila area. Waste sources include: chloroalkali and pulp and paper industries (mercury and arsenic compounds), electroplating and industrial waste water sludge (heavy metals), refineries (oil substances) and hospitals and laboratories. But while many industrial firms have treatment facilities for toxic wastes, they do not have provisions for the safe and secure disposal of concentrated wastes and sludge.

In 1987, some 11,514 million tons of pesticides were imported by the Philippines. Pesticide poisoning incidents are increasing despite efforts of a major Food and Agriculture Organization (FAO) program dedicated to integrated pest management. From 1980 to 1988, and average of 503 cases of pesticide poisoning were reported annually of which 15 percent were fatal.

Focus in the Short-term:

- Municipal and industrial waste disposal -- although financing will remain constrained in near-term.

- Hazardous/toxic waste treatment, storage and disposal -- particularly in the Manila Bay region. Again, financing will remain a constraint.

4.4 Singapore

Singapore has maintained almost uninterrupted economic growth since its independence in 1965, resulting in the second highest per capita income in Asia. In January 1990, an inter-ministerial committee including officials from the Community Development, National Development and Environmental ministries was formed to increase public awareness of environmental issues. Singapore has a 22-year old *Keep Singapore Clean* campaign, and a decade-old "greening" program aimed at increasing the tree population.

While residents are still relatively unconcerned regarding global environmental conditions, *green* champions such as biodegradable bags are taking hold. Solid waste disposal is also a major consideration of the Singapore government, driven in large measure by the nation's limited space. Camp Dresser and McKee (U.S.), in cooperation with Singapore Engineers and Consultant Services, was recently awarded a S$13 million (US$7 million) contract in 1990 to develop a 350-hectare offshore dumping site for the country's 5,400 metric tons per day of garbage. An additional incineration plant is planned for completion in 1992.

Existing environmental laws include the Environmental Public Health Act, 1971 (which includes amendments regarding toxic industrial wastes, 1987); the Water Pollution Control and Drainage Act, 1975 and Clean Air Act, 1971; and the Poisons (Hazardous Substances) Rules, which list 73 chemicals to be controlled as hazardous substances. Singapore's Pollution Control Department (PCD) is responsible for reviewing new factory plans and proposals, ensuring that operations are compatible with the surrounding area and ensure that suitable technology is installed in new industries. The PCD also conducts periodic checks to ensure that the industrial effluent meet ambient standards.

During the 1960s and 1970s, Singapore developed a significant level of expertise regarding the control and treatment of urban pollution. A key objective of the Pollution Control Department is to parlay Singapore's environmental experience into regional environment service contracts. During the 1990s, the PCD plans to develop a Technology Showcase -- aimed at providing expertise regarding application of specific pollution control products to the region, as well as related training and technical support services -- and develop Singapore's role as a springboard to Asia/Pacific markets.

The PCD recognizes that demand in Singapore for environmental products and services is limited. However, it believes that with Singaporean firms as partners, other ASEAN markets may be more accessible to U.S. and other foreign firms. Sectors being emphasized by the PCD include:

- Monitoring of air and water quality;
- Laboratory services and certification services, e.g., for vessels to transport hazardous and toxic wastes;
- Consultancy services, e.g., hazard assessments, environmental impact statements;
- Manufacturing support services, e.g., equipment and technology intensive industries, including process controls and instrumentation;
- Solid waste management, e.g. Singapore is looking for new technologies in collection, compaction, transfer and transport, with special emphasis on equipment that will work in tropical climates;
- Hazardous and industrial waste, e.g. methods of disposal;
- Software and information technologies, e.g., dispersion modeling, automation, telemetry and monitoring, automated control monitoring;
- Training, specifically technical on-the-job training and intensive workshops.

As a signatory of the Montreal Protocol, Singapore is cracking down on use of CFCs. As of January 1990, users must bid for warrants to buy CFCs, with prices reaching upwards US$2,000 per warrant by mid-year. These restrictions are leading electronics manufacturers, such as Seagate technologies, to invest millions of dollars in abatement equipment. Other firms, such as AT&T, have already eliminated use of CFCs in their Singapore manufacturing facilities.

The European Community (EC) has recently indicated interest in cooperating with Singapore in the environmental sector. In December 1990, the European Commission announced that it was reviewing a proposal for an industrial joint venture between the EC and the Singapore Institute of

Standards and Industrial Research. The focus of this effort would be on expanding Singapore's capabilities related to soil sampling and analysis and on applying this expertise to commercial projects.

As part of its environmental initiative, Singapore will host the *Enviro Asia '91: International Conference & Exhibition on Environment*, November 7-10, 1991 at its World Trade Center. The conference will bring together distinguished speakers from international environmental agencies and companies to discuss aspects of air pollution control, waste disposal, energy/land management, deforestation, etc. In addition, there will be a forum on problems in selected countries and an exhibition of environmental products and services.

Focus in the Short-term:

- Alternatives to CFCs, especially for Singapore's electronics industry, as well as equipment for handling and disposing of CFCs.
- Treatment and disposal of hazardous and toxic wastes, particularly those related to the operations of the port.
- Development of domestic environmental management and consulting services, including those which may be required for private sector and government initiatives in other ASEAN countries.

4.5 Thailand

The Thai government has allocated *B*33.3 billion (US$1.3 billion) of its 1991 budget to "quality of life" spending, including upgrading the environment (a 36 percent increase over 1990 levels). Water quality and forestry, will receive the most attention including a plan to install several waste water treatment plants in and around Bangkok by 1994 at a cost of *B*3 billion[22], with similar projects currently underway in Pattaya.

Zones to be covered by planned treatment facilities are still being defined, but preliminary budget projections are for five facilities as shown in Table 4-2. The current pollution load generated in Bangkok (1990) is approximately 215,000 kg BOD/day, and projected to rise to 415,000 kg BOD/day by the year 2000.

Waste disposal and air pollution control (especially in the Bangkok region) are expected to be major priorities for the Thai government over the next five years. Bangkok is seeking bids for a private waste water treatment program for the central city,[23] and several regional cities (in particular,

---

[22] *The US Agency for International Development has ear-marked US$44 million for environmental and natural resource projects in Thailand over a seven year period (1988-1994). The project emphasizes improved policy formulation and implementation; management of human and natural resources; and support for environmental projects related to urban, industrial and tourist sectors. The project also including funds for feasibility studies for proposed waste-water facilities.*

[23] *The Bangkok Metropolitan Authority (BMA) has recently decided to proceed with a privately financed and operated waste water treatment program for central Bangkok. The facility has an estimated at US$700 million to US$1 billion, will include both collection and treatment of household and commercial building waste water in a 217 sq km area. BMA hosted a first meeting with the private sector on January 15, 1991 to reveal its plans and to obtain input from firms on how it should proceed. Two additional such meetings are planned on February 15th and March 14th. Bid documents should be prepared shortly after the final meeting, and BMA is aiming for approval of the project by the end of the year.*

Table 4-2.

Bangkok Waste Water Treatment Systems

Location	Capacity (m^3/day)	Budget (*B* million)	Year
Rattanakosin Banglumpoo	25,000	480	1993
Yannawa	120,000	1,500	1994
Sipraya	N/A	212	1992
Thonburi Nongkham Pasichareon	50,000	500	1993
Ratburana	30,000	400	1993

Source: Thailand Office of Policy and Plan, Bangkok 1990

Chiang Mai and Phuket) and are planning significant upgrades in their solid waste disposal systems. Planned government investments waste water treatment facilities and systems are estimated at over *B*6 trillion (approximately US$235 million), not including private sector investments.

Enforcement of pollution regulations is being upgraded, driving increased private sector purchases of abatement equipment. In 1989, Thai purchases of US environmental products amounted to US$2.7 million (see Figures 1-1 and 1-2). However, 1990 purchases are expected to be over triple this amount, indicating Thailand's importance as a target environmental product/service market in the 1990s.[24]

The main findings of the Thailand Research Development Institute (TDRI) Foundation's 1990 year-end report on Industrializing Thailand and Its Impact on the Environment are summarized as follows:

- Industrial pollution will quadruple within the next 15 to 20 years and have an increasing impact on human health, property and the quality of life in Thailand.
- Industrial pollution is currently concentrated in the Bangkok Metropolitan Region (BMR) and will continue to be in the foreseeable future. There are indications, however, that some of the worse polluters are moving outside Bangkok and into the satellite provinces of the BMR.

[24] *Companies interested in the Thai market should obtain copies of the multi-volume research report on Industrializing Thailand Its Impact on the Environment, prepared for the 1990 Thailand Development Research Institute (TDRI) Foundation's Year-End Conference. These outstanding reports provide both detailed historic information and projections of industrial development in Thailand and concomitant pollution levels, trends in government intervention, tradeoffs between continued urbanization, energy consumption, etc. and environmental quality. For information, contact TDRI at Rajapark Building, 163 Asoke, Sukhumvit Road, Bangkok 10110 Thailand; telephone 258-9012-7; fax 258-9046.*

- The 1980s were characterized by an increase in output from key export industries, including textiles, leather, chemicals, basic metals and petrochemicals. The economic forecast for these industries in the 1990s shows continued high growth.

- The structural changes in the industry and in production materials are leading to the emergence of new types of pollution problems in Thailand. A shift is occurring from traditional pollutants such as waste water pollution in the form of biochemical oxygen demand (BOD) to more complex toxic pollutants, including heavy metals, toxic air and water pollutants and hazardous wastes. With pollutants accumulating at an exponential rate and becoming increasingly hazardous, no piecemeal patching up of existing regulations will reverse the trend, and a total revamping of Thailand's approach to its environment is required.

- Industrial promotion policies have accelerated the introduction of new technology-based industries into Thailand. The Board of Investment has provided investors with privileges and incentive packages in order to attract foreign investment, but has not used environmental impact assessments (EIAs) or pollution intensity per unit of the GDP among its selection criteria for these target industries. By neglecting this, it has accelerated the production of hazardous industrial waste. An analysis of promoted industries indicates that the proportion of approved investment in hazardous waste generating industries increased from 25 percent in 1987 to 55 percent in 1989.

- Industrial estates have an unrealized potential in industrial pollution control. While all 23 industrial estates have waste water treatment facilities, none operate a hazardous waste treatment facility.

New industries generate major quantities of air, water and solid waste pollutants with practically no enforcement. There are currently 51,441 registered industrial plants in Thailand (23,703 in the BMR), and only 356 government employees responsible for monitoring and enforcing government environmental regulations. When all government expenditures related to the environment are included, Thailand spends less than 0.24 percent of GNP on environmental protection; however, this amount is expected to increase substantially in the next budget cycle, beginning in 1992.

Three laws cover the environment in Thailand: the 1967 Poisonous Substance Act and 1969 Factory Act, the enforcement of which is the responsibility of the Industrial Works Department (IWD) of the Ministry of Industry, and the 1975 Improvement and Conservation of National Environment Quality Act. The latter act set up the National Environmental Board and set requirements for preparation of environmental impact assessments[25] and standards for environmental quality.

Under the Factory Act, the IWS is responsible for industrial safety and pollution; factory licensing (three years, with renewals); development of standards and monitoring procedures for waste water effluent and hazardous waste; and enforcement of applicable regulations. The IWS is also responsible for the establishment of central treatment facilities for waste water and hazardous waste.

The IWD has three operating units: the Industrial Environment Division, the Office of Industrial Solid Waste Management and the Office of Toxic Substances. The latter has control and enforcement responsibilities for toxic substances (under the Poisonous Substances Act), and is responsible for monitoring of compliance and establishing standards in line with the Montreal Protocol on CFCs.

---

[25] *Only registered environmental experts are permitted to prepare EIAs. As of 1990, only 22 companies, seven universities and one research institute were listed as registered experts.*

Water Waste: As in the majority of developing countries, industrial development in Thailand is most prevalent in and around its capital city. More than 50 percent of registered factories are located in the Bangkok Metropolitan Region; and another 17 percent are located in the Central Region surrounding the BMR (1989 figures). Bangkok's rapid growth and the industrialization of outlying areas are producing many signs of stress in terms of water quality, even well out into the Gulf of Thailand. Two-thirds of the wastes that effect water quality in the Gulf of Thailand come from municipal wastes, and the rest come from industrial effluent. Approximately 75 percent of the pollution in Bangkok's Chao Phya river is from domestic sources.

Generally, the proportion of industrial waste water is about 25 percent of total waste water. The Thongchai Pansawad Study (1987) reported that the industrial waste water from factories in Bangkok and Samut Prakarn have the volume and water treatment technologies as in Table 4-3. Typically, Thai factories use the activated sludge system and aerated lagoon for treatment.

Table 4-3.

Type of Water Treatment System by Industrial Sector

Industry Type	Flow Rate (m^3/day)	BOD Load (kg/day)	Type of Water Treatment System
Food Processing	370.53	1466.73	Aerated Lagoon, Oxidation Ditch
Pulp and Paper	1,988.75	710.03	Chemical Treatment, Aerated Lagoon
Textile	300.83	108.79	Activated Sludge, Aerated Lagoon, Chemical Treat.
Plastics	20.33	4.80	Chemical Treatment
Glasses	62.67	17.81	Activated Sludge, Chemical Treat., Oxidation Pond
Dairy	150,425.00	755.63	Activated Sludge
TOTAL	366.67	1,433.47	--

Source: Business Information Center; Adapted from Thongchai Pansawad, 1987

Hazardous/Toxic Waste: Approximately 20,000 of the factories registered with the Thai government are classified as water-polluting. Of this group, 1.4 percent generate highly hazardous waste water, 52 percent generate medium-level hazardous waste water, and the remaining 46.6 percent contribute minimally hazardous waste water and nonhazardous waste water. Hazardous waste water is generated by several industries including the electroplating, dyeing, metal-smelting, chemical and electronic industries. (See Table 4-4 and Figure 4-1 for projections of hazardous waste quantities and costs.)

In terms of volume, 90 percent of all hazardous waste is generated by manufacturing, 4 percent is generated by hospitals and laboratories, and 1 percent is generated by municipalities. According to projections of industrial output, it is clear that the hazardous waste producing industries such as steel, textiles, electronics and chemicals and petrochemicals will be the primary threats to environmental quality (versus traditional polluting industries that produce biochemical oxygen demand (BOD) load). Metal sludge and solid and oil wastes account for the bulk of hazardous waste generated by manufacturing, municipalities, electrical utilities, hospitals and laboratories and the coal- and lignite-based industries. The trend in hazardous waste generation will almost double from 1986 to 1991 and will increase almost six times by the year 2001. A U.S. Trade and

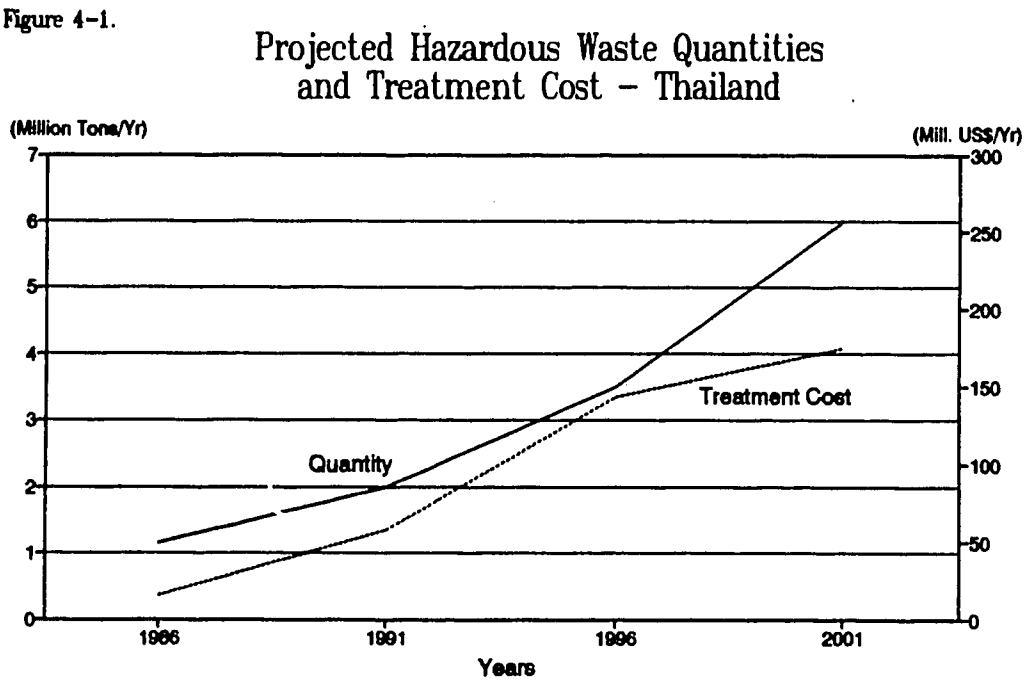
Table 4-4.

Summary of Real and Projected Hazardous Waste Quantities
(by Waste Type and Year)

Waste Type	Hazardous Waste Quantity (Tons/Yr) 1986	1991	1996	2001
Oils	124,194	219,467	387,893	686,358
Liquid organic residues	187	311	522	876
Organic sludge & solids	3,737	6,674	11,951	24,533
Inorganic sludge & solids	11,698	19,254	32,043	54,080
Heavy metal sludge & solids	823,869	1,447,590	2,536,030	4,418,030
Solvents	19,783	36,163	66,532	124,306
Acid wastes	81,054	125,428	196,510	311,714
Alkaline wastes	21,952	34,235	54,024	86,198
Off-spec products	12	25	52	107
Aqueous organic residues	116	242	499	1,037
Photo wastes	8,820	16,348	30,398	57,809
Municipal wastes	7,231	11,787	19,090	31,093
Infectious wastes	46,674	76,078	123,219	200,699
TOTAL	1,149,327	1,993,602	3,458,763	5,996,840

Source: Adapted from TDRI Reseach Report No. 5; The Greening of Thai Industry: Producing More and Polluting Less; December 1990.

Figure 4-1.



Conversion to US$ based on 1US$=B6.6
Preliminary estimates; does not include collection, transport & disposal costs.

Source: Adapted from TDRI Research Report No. 6

Development Program study estimated that in 1991, Thailand's production of hazardous waste will amount to 2 million metric tons.[26]

A government operated facility at Bang Khuntien treats wastes from approximately 150 factories, primarily electroplating and textile companies. It stabilizes wastes (roughly 100 MT/day -- 10 percent of total estimated wastes) for subsequent disposal in landfills and does not include an incinerator. Studies are currently underway to site at least three additional facilities, with incinerators, in the BMR. A fifth treatment facility is planned for the eastern seaboard to treat wastes from petrochemical, refining and chemical plants.

Air Pollution: While the National Environment Board has the authority to set ambient air standards, it does not enforce these standards or provide emissions levels for specific industries. This is the purview of individual ministries which, to date, have yet to issue regulations pertaining to air quality (as opposed to water quality standards which have been set and prescribed by law).

The industrial sector is an important user of energy and thus a major contributor to air pollution in Thailand. Industry accounted for 27 to 30 percent if total energy consumption from 1977 to 1988. The industrial sector's energy demand from 1990 to 2011 is projected to remain between 27.7 percent to 30.4 percent of the share of total energy consumption, and the demand by fuel type for this sector consists of lignite, imported coal, natural gas, fuel oil, electricity and renewable energy.

The quantity of emissions of sulfur dioxide (SO_2) in the past -- and the foreseeable future -- is dominated by the output of the power generation sector's 245,340 tons, followed by the output of the industrial sector's 145,468 tons in 1988. Nitrogen oxide (NO_x) is mainly contributed by the transportation sector's 267,333 tons (67 percent), while the industrial sector, on the average, contributes only a small share of 43,236 (10 percent). The balance is contributed by electricity generation, refineries and residential and commercial sources. Carbon dioxide (CO_2) from industry sources accounted for 18.1 million tons or 21 percent of gaseous emissions in 1988 and will decrease to 6.9 million tons or 18 percent by 2011. The trend for suspended particulate matter (SPM) emissions from industry sources has increased from 207,020 tons or 25 percent in 1988 and is projected to reach 1.07 million tons or 67 percent by 2011.

According to government officials, for the immediate future, the government is targeting use of clean coal (rather than flue gas treatment) to combat air pollution. Currently available lignite is approximately 3-4 percent sulfur and 1 percent titanium contents, with significant amounts of ash and calcium. Minimal amounts of fly ash is sold to cement plants.

Focus in the Short-term:

- Development of centralized water waste treatment facilities is a top priority for Thai officials. Five plants are already being developed or in the planning stage. Private sector participation is an important component of Thailand's long-term environmental management strategy.

---

[26] *The Public health statistics in Thailand indicate that the incidence of occupational diseases, adjusted for population growth, has increased 4.4 times between 1978 and 1987. This may be explained, in part, by the fact that, with the notable exception of the Bang Khuntien treatment center in Thon Buri, the bulk of hazardous waste generated in Thailand is dumped freely into rivers and landfills or stored in drums on-site. While no assessment of the risks involved have yet been made, the experience in other countries suggests considerable risk to both public Health and groundwater supplies from this practice.*

- Hazardous/toxic waste treatment and disposal will also be of utmost importance in the next budget cycle (1992-1996). Currently only one experimental facility exists which disposes of treated wastes via landfills.

- Controversies over municipal waste disposal is mounting between local and national government officials with cities demanding the right to construct incinerators to dispose of solid wastes. In many locations, there is already a shortage of available sites for landfill.

- Increased enforcement of emission and effluent standards will also mean increased demand for industrial pollution control products.

- Clean coal technologies and equipment to recover sulfur and titanium are being sought by the government.

5.0 Conclusions

The choice of which ASEAN countries U.S. environmental firms should target depends on individual corporations' philosophies regarding risks, required rates of return, payback period, short-term versus long-term strategies, etc. All things being equal, the U.S.-ASEAN Council's line-up for environmental sector trade/investment opportunities in ASEAN is provided in Figure 5-1. Singapore offers near-term market entre opportunities, particularly for firms interested in using it as a base for regional operations.

Much higher payback can be expected from Thailand and Indonesia, with Thailand boasting plans (and money) for several near-term projects in the waste water treatment and hazardous/toxic wastes sectors. Markets in Malaysia will be constrained in the short-term by the continued reluctance of the central government to intervene (financially or through regulatory actions) in the turf of municipal governments. Financial constraints will also limit the Philippine government's ability to invest in environmental infrastructure projects -- at least until their economy recovers around the mid-1990s.

Listed in Figure 5-2 are the U.S.-ASEAN Council's "Picks" for trade and investment targets in the environmental sector. Region-wide, demand for products and services related to hazardous waste management and treatment should be significant in the near-term. Training will also be critical, as will equipment related to industrial effluent control.

Figure 5-1

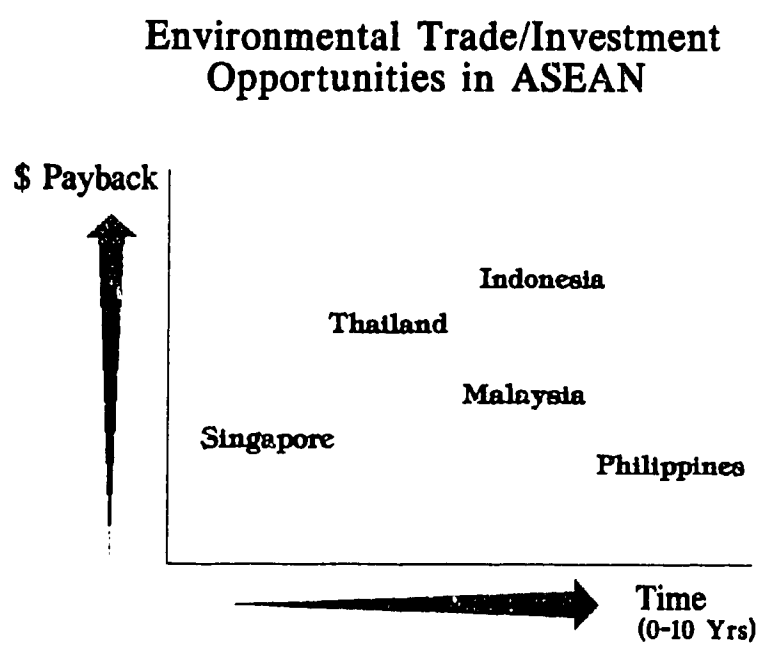


Figure 5-2.

Trade & Investment Picks (Next 1-3 Years)

Indonesia	Malaysia	Philippines	Singapore	Thailand
Industrial Effluent Training Water Treatment EIS Services	Hazardous Waste Treatment & Disp.[27] Municipal Waste Training Air Quality Monitoring Waste Water Treatment	Industrial Effluent	Hazardous Waste Treatment & Disp.[28] Solid Waste Disp. Consulting Services Emissions Control CFC Alternatives & Disposal Training	Hazardous Waste Treatment & Disp. Industrial Effluent[29] Municipal Waste Disp. Solid Waste Disp. Training

*Trade & Investment Picks (Next 3-6 Years)**

Indonesia	Malaysia	Philippines	Singapore	Thailand
Emission Control[30] Hazardous Waste Treatment & Disp. Municipal Waste CFC Alternatives & Disposal Clean Coal Tech.	Industrial Effluent CFC Alternatives & Disposal Auto. Pollution/ Cat. Converters	Municipal Waste Hazardous Waste Treatment & Disp. Training	Consumer Products Recycling	Emissions Control[31] Consulting Services Clean Coal Technology

* *These are in addition to the "Picks" prioritized for Years 1-3.*

---

[27] *Emphasis on electronics industry.*

[28] *Immediate opportunities for hazardous waste treatment/disposal related to port facilities.*

[29] *Especially for waste water treatment from pig farms.*

[30] *Related to transport ion sector.*

[31] *Related to the utility sector nationwide and the transportation sector in the Bangkok Metropolitan Region.*