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Reclaiming The Beautiful Island: Taiwan's Emerging Environmental Regulation

MICHAEL SCOTT FEELEY*

INTRODUCTION

In the early seventeenth century, Portuguese sailors landed on a fabled island floating in the sea of Fukien and declared it Ilha Formosa, the Beautiful Island. The Formosa of European colonization seems a far cry from present day Taiwan. The remarkable economic development of the Republic of China in the last forty years has transformed the Island into the world's thirteenth largest trading nation with an amassed foreign exchange surplus of some 74 billion U.S. dollars, second only to Japan. This industrial explosion, neither hindered by environmental controls nor accompanied by adequate infrastructure, has produced a densely populated, heavily polluted country with catastrophic public health and environmental problems. Smaller than the Netherlands, Taiwan's 14,000 square miles of


Taiwan is a tobacco leaf-shaped island located approximately 650 miles south of Japan and 90 miles east of the People's Republic of China in the sea off of Fukien. In addition to the Island of Taiwan, the Republic of China consists of 77 other islands including the Pescadores, Quemoy and Matsu. Guide to Doing Business with Taiwan Republic of China 5 (1985).

mountainous terrain\(^3\) supports a population of 20 million citizens — earning the Island the dubious distinction as the second most densely populated country on earth, after Bangladesh.\(^4\) In addition, the Island is home to some seven million manure-producing pigs.\(^5\)

In the last few years, the Taiwanese government has begun the process of attempting to regulate the causes of pollution and to initiate the cleanup of the Island. This abrupt change of policy reflects growing recognition of the dangers of the situation and responds to the popular outcry for environmental reform. A combination of factors — including the prosperity of the country, the level of pollution, popular unrest, changing international standards, and the relaxation of authoritarian rule — is spurring the newfound governmental attitude to environmental regulation.

This Article provides an introduction to the Taiwanese environmental regulatory scheme emerging from Taiwan's unique circumstances and the potential economic impact which may result. In order to appreciate the present situation, it is necessary to understand the political and economic history of Formosa. Part I reviews the development of the centuries-old colony into an independent and powerful state. The principles and policies of the Nationalist government which guided the country to its current prosperity are also responsible for its ecologic crisis. This first section describes the present situation, how it came to be, and the forces of change. Part II presents an overview of the specific environmental laws, regulations and policies already implemented and previews those being developed. While much of the efforts to date focus on information gathering, a comprehensive regulatory framework does exist and the government is rapidly enacting substantive measures to put teeth into its nascent policies. Part III discusses potential economic effects of the new environmental scheme. By adding new costs and requirements to businesses, regulation and remediation will impact domestic operations and operating costs, international trade and Taiwanese investment overseas. At the same time, opportunities will arise to meet the needs of the rapidly expanding market for environmental technologies and services on the Island.

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3. Taiwan is heavily mountainous with sixty peaks rising above 10,000 feet. The vast majority of Taiwanese live on the 25% of the country which constitutes the rich, alluvial plain along the west coast. M. LASATER, THE TAIWAN ISSUE IN SINO-AMERICAN STRATEGIC RELATIONS 91 (1984).


5. E. CHIEN, PROGRESS, HARMONY AND BALANCE: BUILDING A QUALITY SOCIETY 3 (Dec. 1989). Dr. Chien is the Administrator of the Environmental Protection Administration of the Republic of China.
PART I: FROM FORMOSA TO LITTLE DRAGON

A. Economic Transformation

Modern Taiwan began in 1949 when the Nationalist government of General Chiang Kai-shek lost its struggle against the Communist forces of Mao-Tsetung on Mainland China and fled to the Island of Formosa. Prior to the invasion of over a million mainland Chinese, drawn mostly from the upper echelons of society, the Island had endured centuries of foreign masters, including the Dutch, Spanish, Chinese and Japanese. Japan controlled the Island from 1895 until 1945. At the end of the Second World War, the Allies transferred control of Taiwan from the defeated Japanese Empire to the Nationalist rulers of China. Formosa became the haven for the retreating Nationalists and the center of the government-in-exile. The government of Taiwan still considers itself the only legitimate government of all of China.

Chiang Kai-shek and his Nationalist Mainlander-dominated Kuomintang party (“KMT”) established authoritarian rule over Taiwan...
immediately upon arriving on the Island.\textsuperscript{12} Due to the tense political situation, in 1950 the government decreed the Temporary Provisions Effective During the Period of Communist Rebellion, which prohibited opposition political parties and imposed martial law.\textsuperscript{13} These provisions framed the country's political life for thirty-five years. The tight control established by the staunchly anticommunist rulers permitted centralized economic planning infused with capitalistic principles.\textsuperscript{14}

The program of land reform instituted by the Nationalists, with American support,\textsuperscript{15} immediately after setting up power in Taipei demonstrates the use of economic incentives to create more broadly distributed wealth without alienating landowners.\textsuperscript{16} In 1949, the government reduced farm rents and increased the share each tenant farmer kept from crop yields. In 1951, the government sold public land to tenant farmers and, in 1953, compelled landowners to sell portions of their property to poor farmers. The landowners, in turn, were given the opportunity to obtain ownership interests in the four large industrial enterprises then established.\textsuperscript{17} In 1952, 36 percent of the farms were owned by the farmers who worked the land; by 1969, this figure had risen to 80 percent.\textsuperscript{18}

From 1953 to 1960, the first phase of economic planning concentrated on developing industry through agriculture. The government encouraged labor intensive production and substitution of domestic products for imports.\textsuperscript{19} During this initial period, priority was given to food, textiles and building materials.\textsuperscript{20} The second phase of eco-

\begin{footnotesize}
\begin{enumerate}
\item The Republic of China formulated its constitution on the Mainland in 1946 and transferred the system to Taiwan in 1949. The elected branches of government are the National Assembly, the Legislative Yuan and the Control Yuan. The two appointive branches of government are the Judicial Yuan and the Executive Yuan (cabinet). The National Assembly, composed mostly of Mainlanders elected in 1947, meets every six years. Its role is to elect the president and vice-president and to amend the constitution. From its inception, the presidency has wielded great power. \textit{Id.} at 3-4.
\item Chou and Nathan, \textit{Democratizing Transition in Taiwan}, 3 CONTEMP. ASIAN STUD. 3 (1987).
\item For a description of this authoritarian control structure, see Tai, \textit{The Kuomintang and Modernization in Taiwan}, in AUTHORITARIAN POLITICS IN MODERN SOCIETY 406 (S. Huntington & C. Moore 1970).
\item For discussion of Taiwanese land reform, see A. Koo, \textit{THE ROLE OF LAND REFORM IN ECONOMIC DEVELOPMENT, A CASE STUDY OF TAIWAN} (1968); Y. Ho, \textit{AGRICULTURAL DEVELOPMENT OF TAIWAN 1903-1960} (1966); and M. Yang, \textit{SOCIO-ECONOMIC RESULTS OF LAND REFORM IN TAIWAN} (1970).
\item Stikker, \textit{supra} note 15, at 447.
\item Tsai, \textit{supra} note 17, at 27.
\item LASATER, \textit{supra} note 3, at 96.
\end{enumerate}
\end{footnotesize}
nomic planning, 1960-1973, sought to change the basis of the national economy from agrarian to industrial. Taiwan emphasized labor-intensive production of both export goods to improve its balance of payments and domestic consumer products to compete with foreign imports.21 Electronic products and home appliances are examples of these export-oriented industries.22

The oil crisis of 1973 starkly demonstrated that while the economic basis of Taiwan had shifted from agricultural to industrial, the infrastructure had not kept pace with the transformation. The small Island-nation realized the danger inherent in its need to import virtually all basic materials, such as oil and steel, as well as many intermediate goods.23 In addition, the increasing rate of urbanization with its accompanying problems, skyrocketing inflation, and keener international industrial competition convinced the government to inaugurate a third phase of economic planning. In the mid-1970s the government adopted measures to shift Taiwan’s emphasis from light to heavy industrial development by promoting capital-intensive industries and the chemical manufacturing sector.24 From 1973 to the mid 1980s, the government developed the Ten Major Development Projects,25 the Accelerated Rural Development Program,26 and the

21. Tsai, supra note 17, at 27.
22. LASATER, supra note 3, at 96.
23. Tsai, supra note 17, at 27.
25. The Ten Major Development Projects, at a cost of $6.7 billion, were aimed at production of energy and a more efficient transportation network. Six of these projects were concerned with transportation: the construction of the Sun Yat-sen National Freeway; railway electrification; the North Link Railway; the Chiang Kai-shek International Airport at Taoyoun; and the construction of harbors at Taichung and Suao. Three projects were designed to develop heavy and chemical industries: an integrated steel mill; Kaohsiung shipyard; and a petrochemical complex. The tenth was the building of nuclear power plants to develop new sources of energy.
26. The Accelerated Rural Development Program was aimed at protecting farmers' earnings, modernizing agriculture, increasing farm incomes, and employing farm workers more productively. The program included (a) the abolition of the rice-fertilizer barter system, (b) abolition of the education surtax on farmland, (c) easing of agricultural credit terms, (d) improvement of agricultural marketing, (e) strengthening of the rural infrastructure, (f) integrated use of improved cultivation techniques, (g) establishment of specialized agricultural areas, (h) strengthening of agricultural research and extension programs, (i) establishment of new industries in rural areas, and (j) increase in purchase price of rice paid to farmers.
Twelve New Development Projects as the mainstays of its plan aimed at teaching modern management techniques, building an efficient transportation system, and modernizing methods of industrial production. Since 1980, the government has focused on encouraging the service sector and advanced technologies.

The government credits these economic planning policies for Taiwan’s staggering economic achievement. Gross national product, 151 billion dollars in 1989, has grown at an average rate of 9 percent per year for the past twenty-seven years and driven per capita income to over 7,000 dollars. From 1985 through 1989, consumer price inflation averaged only 1.4 percent. Taiwan has amassed the second largest foreign reserves in the world, 74 billion dollars in 1989, and is currently the largest importer of gold, bringing in some 500 tons in 1988. Taiwan is now the thirteenth largest trading country with an international trade volume of 130 billion dollars in 1989. The Taiwanese government estimates its international trade volume will reach 350 billion dollars by the year 2000. Taiwan’s principal trading partners are the United States and Japan, but Taiwan has recently taken affirmative steps to increase its trade with European countries. Furthermore, Taiwan has achieved these impressive economic results while remaining diplomatically isolated.

Id. at 28.

27. Again, a heavy emphasis was placed on transportation as five of the twelve projects all dealt with transportation improvement: around-the-island railroad; three new cross-island highways; Kaohsiung-Pingtung regional traffic improvement; the second and third phases of Taichung Harbor construction; and widening of the Pingtung-Kaohsiung highways. The other seven projects included two for agriculture, two for industrial plants, and three for sociocultural development. Id.


30. Maitland, supra note 4, at 7.


32. Sharma, supra note 2.

33. Tanzer, Taiwan’s Long March Toward Democracy, FORBES, Apr. 3, 1989, at 48, 52.

34. Sharma, supra note 2.


36. Of the total amount of goods exported from Taiwan in 1989, 36% went to the United States, 13.7% to Japan, 10.6% to Hong Kong and 3.9% to West Germany. Taiwan, supra note 31, at 3. Of the total amount of goods imported by Taiwan, 30.7% came from Japan, 23% from the United States, 5% from West Germany, 4.2% from Hong Kong and 3.1% from Australia. Id.

37. In 1988, Taiwan’s trade with European Community Countries reached $15 billion, including $2.4 billion with the Netherlands, $3 billion with the United Kingdom, and $1.6 billion with France. E. Chien, supra note 5, at 2.
Taiwan's prosperity has dramatically changed the social situation of the Taiwanese. The emphasis on industrialization has fostered the emergence of a large and prosperous middle class, which is increasingly nonagrarian and nonrural. The private sector has grown sharply as the percentage of privately owned businesses jumped from 43.4 percent in 1952 to 85.6 percent in 1987. The gap between the income levels of the top 20 percent of the population and the lowest 20 percent has narrowed from a ratio of fifteen to one in 1950 to five to one in 1985. In the last twenty-five years, the percentage of the population attending school has risen and the illiteracy rate has fallen.

With the advent of the 1980s, abundant private wealth, rising educational levels, and proliferating media criticism have loosened the control of the one-party State and have given rise to an outspoken citizenry demanding wide-ranging changes. Growing social unrest led to the lifting of martial law in July 1987 and the rescinding of newspaper restrictions in January 1988. Nationalists who are originally from the Mainland no longer have exclusive control of the gov-

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38. The Peoples Republic of China and the Republic of China each claim sole sovereignty over the other. The international community in general recognizes Beijing as the government of The Mainland. The difficult dilemma of the "two Chinas" has resulted in the political, not economic, isolation of Taiwan. A vast literature exists on the issue. For example, see CHINA AND THE TAIWAN ISSUE (H. Chiu 1979); ABOUT FACE: THE CHINA DECISION AND ITS CONSEQUENCES (J. Tierney, Jr. 1979); J. SHEN, THE U.S. & FREE CHINA: HOW THE U.S. SOLD OUT ITS ALLEY (1983); and THE FUTURE OF TAIWAN: A DIFFERENCE OF OPINION (V. Li 1980).

39. The number of people engaged in agrarian occupations has declined and those engaged in industrial and professional jobs has increased. "An examination of Taiwan's labor force distribution in 1963 showed 49.7 percent in agricultural-related activities, 21.0 percent in industrial and manufacturing professions, and 29.3 percent in service professions; in 1985 it was 17.6 percent in agriculture, 42.3 percent in industry, and 40.1 percent in service." Tsai, supra note 17, at 30, 31.

40. Tien, supra note 24, at 111.


42. In 1962, student enrollment was 86.4% for compulsory education (ages six to fifteen), 96.5% for primary education, and 3.9% for higher education. By 1985, these numbers improved to 99.9% for compulsory and primary education, 90.9% for secondary education, and 13% for higher education. In the same time period, the number of schools increased from 3,140 to 6,285 and the number of full-time teachers rose from 75,455 to 186,494. Tsai, supra note 17, at 31, 32.


43. Tien, supra note 24, at 105.

44. Id. at 105. See also, Winkler, Institutionalization and Participation on Taiwan: From Hard to Soft Authoritarianism?, The China Quarterly 99, at 481-99 (Sept. 1984).
government.\textsuperscript{46} Opposition parties, long outlawed and suppressed, are now legal and have won offices in recent elections.\textsuperscript{46} Rather than relying unquestioningly on the authoritarian state, personal wealth has fostered independence on the part of the people. As economic security and confidence grow, the Taiwanese have afforded more attention to social issues such as democratic politics, labor issues, women's rights, and the environment.\textsuperscript{47}

B. Environmental Situation

The price of Taiwan's economic achievement includes the environmental desolation of the Island. The problem is particularly critical in the two largest cities, Taipei and Kaohsiung, where the population explosion and industrialization are concentrated. Fuel burning plants cause 70 percent of the air pollution in Kaohsiung; motor vehicles cause 90 percent of the air pollution in Taipei.\textsuperscript{48} Over the last decade, the number of factories has increased over 100 percent to almost 90,000, and the number of motor vehicles has risen 300 percent to over 10 million.\textsuperscript{49} The density of motor vehicles recently reached more than 275 vehicles per square kilometer.\textsuperscript{50}

The Island's rivers are severely contaminated with huge volumes of untreated pollutants such as sewage, industrial waste, solid waste, and animal waste, all of which are poured in daily. Almost all of the rivers are polluted to the point that fish life is becoming extinct.\textsuperscript{62} Thirty-two percent of Formosa's major rivers are dangerously contaminated.\textsuperscript{62} There are only five sanitary sewer systems in the coun-

\begin{thebibliography}{99}
\item[45.] During the first twenty years of Nationalist rule, virtually all important KMT party positions and governmental posts were occupied by mainlanders. This has changed inexorably over the last several years as the proportion of mainland-born Taiwanese has declined to 5%. By 1988, 52% of the KMT Central Standing Committee were native-born Taiwanese and 11 of the 24 cabinet post were held by native-born Taiwanese. Furthermore, the members of the National Assembly, elected in 1947 and still in office, are dying out. This natural attrition is clearing out a reactionary element impeding the democratic development of the Island. By the time of the next scheduled election in 1992, it is estimated that Taiwan-elected members will form the majority of the Legislative Yuan and the Control Yuan. Tien, supra note 24, at 115-18.
\item[46.] For a discussion of political opposition to the KMT and the recent legalization of non-KMT political parties, see generally Chou and Nathan, supra note 13.
\item[47.] For a review of the political and electoral history of Taiwan, including evaluations of the restrictions on political activity and the role of the media, in light of the 1987 elections, see Elections in Taiwan: Report of a Staff Study Mission to Taiwan December 1-9, 1987, to the Committee on Foreign Affairs, U.S. House of Representatives (August 1988).
\item[48.] \textit{Rapidly Growing Markets for Pollution Control Equipment}, 10 East Asian Executive Reports No. 5, May 15, 1988, at 24 [hereinafter \textit{Rapidly Growing Markets}].
\item[49.] Maitland, supra note 4.
\item[50.] E. CHEN, supra note 5, at 3.
\item[51.] Stikker, supra note 15, at 449.
\item[52.] Chen, UPI, April 29, 1990.
\end{thebibliography}
try which service only 2 percent of the provincial population and 10 percent of the city dwellers in Taipei and Kaohsiung.63 Less than 1 percent of human excrement is accorded even primary sewage treatment. Consequently, wide-spread water contamination gives Taiwan the highest hepatitis rate on earth.64 Industrial pollution caused by the growth in factories has negatively affected the level of life expectancy.65 Furthermore, the country's seven million pigs, 195 per square kilometer,66 produce as much pollution as the sewage generated by the Island's 20 million human inhabitants.67

Taiwan generates 82 kilograms per person per day of household refuse.68 Eighty-seven percent of the garbage is deposited in landfills while only 1.4 percent is incinerated.69 In the last several years, municipal waste has changed not only in amount, but also in composition. Affluence and modernization have replaced traditional refuse with plastics, paper, leather, rubber, and kitchen residue which are less degradable and more combustible.70 Additionally, Taiwan's factories produce over 30 million metric tons of industrial waste each year, of which 2.9 million metric tons include hazardous pollutants.71

Factories using chemicals and related products account for 60 percent of Taiwan's hazardous waste. Polychlorinated biphenyls (PCBs), heavy metals and pesticides are of particular concern.72 In 1988, a soil survey indicated that 12.5 percent of all arable land has high concentrations of heavy metals, and this figure is projected to double by the year 2000. Agricultural use of pesticides is 11 kilograms per hectare, triple the amount used in the United States.73

53. In terms of biochemical oxygen demand, the total daily waste water discharge as of 1988 is 3.36 million kilograms. Industrial waste water constitutes 54% and domestic sewage constitutes 25% of this amount. Rapidly Growing Markets, supra note 48.
54. Maitland, supra note 4.
55. See generally, Ting and Jou, Industrial Pollution and the Regional Variations of Life Expectancy at Birth in Taiwan, 58 SOCIOLOGICAL INQUIRY No. 1, 87 (Winter 1988); see also, LIU AND CHAO, AN ECONOMIC ANALYSIS OF SOCIAL RESOURCES AND MORTALITY LEVEL IN TAIWAN (1979).
56. E. CHIEN, supra note 5, at 3.
57. See Rapidly Growing Markets, supra note 48.
58. Republic Battles, supra note 35, at 5.
60. See N. Boston, Environment and Waste Management: Taiwan/Canada Business Opportunities, at 2 (Discussion paper given at the Third Joint Meeting of the Canada-Taiwan Business Association, April 9-11, 1989).
62. See ENVIRONMENTAL PROTECTION, supra note 59, at 17.
63. E. CHIEN, supra note 5, at 3-5.
The environmental destruction of Taiwan has spawned a grassroots ecological movement with broad-based support. Local residents, often elderly farmers, provide the driving force behind the movement. Workers and fishermen are actively involved, and opposition political parties are championing environmental reform against the ruling KMT. The intelligentsia — university professors, scientists, and writers — have embraced the movement. In 1988, the respected Academia Sinica, in conjunction with the National Taiwan University, issued its broadside on the dangers of pursuing current economic growth targets without radical action on the environment.

The movement is taking action, not merely verbally protesting. The 1984 Bhopal tragedy, where a gas leak from a pesticide plant left thousands dead, became a rallying point for Taiwanese environmental activists. Protestors sacked offices of the San Huang Pesticide Company and forced the company to move within two years. In 1985, environmentalists successfully prevented Dupont from locating a titanium dioxide plant in central Taiwan. Banner-waving citizens have occupied buildings and shut down facilities resulting in a slowdown of several government investment projects valued at over 35 billion dollars, including highways and an underground rail system. Power shortages have affected the Island as residents refused to allow unsightly, threatening electrical stations and nuclear power plants to be constructed.

The petrochemical industry, which accounts for 12 percent of the gross national product of Taiwan, is the movement’s main object of focus. In 1988, protestors temporarily shut down eighteen petrochemical plants which polluted their fishing grounds. Local resi-
dents threatened mass suicide to prevent the construction of a fourth and fifth naphtha cracker plant by the state-owned China Petrochemical Corporation. The plants, which make a petroleum distillate, are valued at 2.5 billion dollars. In 1989, villagers rebuffed an attempt by Formosa Plastics, Taiwan's largest conglomerate, to build a sixth cracker. This complex was ultimately located in Texas.

This backdrop of seething discontent has jolted the government into action. In 1982, the government reformulated the Bureau of Environmental Sanitation into the Bureau of Environmental Protection. As the environmental crisis and protests mounted, in 1987, the government elevated the Bureau to cabinet level status as the Environmental Protection Agency ("EPA"). The EPA is spearheading the legislative and policy response to the Island's environmental problems.

PART II. OVERVIEW OF TAIWANESE ENVIRONMENTAL REGULATION

For many years, Taiwan passed environmental laws modeled from those of the United States, but neglected to include enforcement mechanisms or penalties. In response to the public outcry described previously, this has begun to change recently. The government has increased the EPA's funding from 6.15 million dollars in 1987 to 154 million dollars in 1990. Over seventy pieces of environmental legislation are currently in the legislative process; and several enforcement projects, focused on specific pollution sources, are underway. The EPA is responsible for developing policies and ordinances to protect the environment.

A. Organization of the EPA

The Administrator of the EPA reports directly to the Executive Yuan and supervises an organization composed of seven bureaus which are responsible for national environmental efforts: Compre-

72. Quinn, supra note 67.
75. E. Chien, supra note 5, at 3.
76. See supra notes 63-72 and accompanying text.
77. Chen, supra note 52.
78. E. Chien, supra note 5, at 7-8.
79. For a discussion of the political structure of Taiwan, see supra note 12.
hensive Planning, Air Quality Protection and Noise Control, Water Quality Protection, Solid Waste Control, Environmental Sanitation and Toxic Substance Control, Performance Evaluation and Dispute Settlement, and Environmental Monitoring and Data Processing. The EPA maintains supervisory authority over the three provincial and municipal agencies charged with environmental protection.

The EPA has codified its policy approach into eight basic principles derived from the data collected over the last few years: 1) establishment of a more sound environmental protection system involving the vertical integration and streamlining of data collection, policymaking, implementation and enforcement; 2) rapid passage of effective environmental legislation; 3) implementation of projects designed to abate the effects of water, air, waste, noise and odor pollution; 4) encouragement of privatization for environmental protection projects and responsibilities in order to capitalize on foreign high-technology and private investment; 5) establishment of an effective environmental monitoring system; 6) exercising more control over nuclear waste management and disposal; 7) increasing inspection equipment and manpower for local environmental protection authorities; and 8) intensifying ecological preservation efforts to maintain a balanced ecosystem and promote a rational use of natural resources. The EPA has initiated measures reflecting these goals; however, for the most part, these enumerated principles remain in the conceptual phase.

B. Air Pollution Regulation

The EPA classifies air pollution into four categories: stationary sources (industrial and fuel burning), vehicular sources, solid waste disposal (open burning), and construction activities. To monitor air quality, the government maintains 174 national and locally controlled monitoring stations throughout the Island. Only nineteen of

81. These agencies are the Taiwan Provincial Department of Environmental Protection, the Taipei Municipal Department of Environmental Protection, and the Kaohsiung Department of Environmental Protection. At the county level (supervised by the Provincial Department), responsibility for environmental protection rests with 12 Environmental Protection Bureaus. In counties without an Environmental Protection Bureau, the Second Section of the Bureau of Health is in charge. ENVIRONMENTAL PROTECTION ADMINISTRATION, REPUBLIC OF CHINA, AN INTRODUCTION TO ENVIRONMENTAL PROTECTION IN THE TAIWAN AREA 6-7 (Oct. 1989) [hereinafter INTRODUCTION]. For statutory authority, see Rule of Organization for Environmental Protection Bureau of Taipei Municipal Government, May 10, 1982; and Rule of Organization for Environmental Protection Bureau of Kaohsiung Municipal Government, May 10, 1982.
82. E. CHIEN, supra note 5, at 7.
83. E. CHIEN, supra note 5, at 4.
these stations, operated by the national government, are equipped to detect the complete range of pollutants. Local monitoring stations consist of manual detection of dust, total suspended particulates, and lead particles only.\textsuperscript{84}

The Pollution Standard Index ("PSI") measures air quality on a scale from zero to 500. The Taiwanese government reports that for the Island as a whole — including the vast, sparsely inhabited mountainous regions — the PSI indicates "moderate" air quality which is within the fifty to 100 range. However, in the heavily populated urban regions, the PSI has reached 240, which falls within the "bad" range. A PSI of 300 is considered "Hazardous."\textsuperscript{85} Monitoring indicates that the most serious air pollutants are total suspended particulates, ozone, hydrocarbons, carbon monoxide, sulfur dioxide and nitrogen oxide.\textsuperscript{86}

To reduce air pollution generated from stationary sources, the government has established more stringent emission standards for specified geographic regions, such as Taiwan Province, and for specific industries, such as cement manufacturers.\textsuperscript{87} To enforce these standards, the EPA has taken several steps, including expanding its inspection force from 250 to 900 officers in September 1989.\textsuperscript{88} The EPA has also created a control system which rates corporations as: 1) meeting emission standards, 2) improving, or 3) forced to close or relocate.\textsuperscript{89} Currently, the twenty-eight state-owned companies must report their annual emissions. Excess emitters are fined and forced to take corrective action within a specified time period. Similar pressure is being brought on private industries, with a focus on the

\textsuperscript{84} INTRODUCTION, supra note 77, at 16.

\textsuperscript{85} Id.

\textsuperscript{86} ENVIRONMENTAL PROTECTION, supra note 59, at 7.

\textsuperscript{87} Currently promulgations include: Ambient Air Quality Standards in the ROC Taiwan Area, promulgated October 1, 1975; Emission Standards of Air Pollution, promulgated July 21, 1978; Emission Standards of Air Pollutants for Stationary Sources in Taiwan Province, promulgated August 18, 1986; Emission Standards of Air Pollutants for Stationary Sources in Taipei City, promulgated December 2, 1987; Emission Standards of Air Pollutants for Stationary Sources in Kaohsiung, promulgated August 14, 1986; Emission Standards of Air Pollutants for Electric Furnace of Steel Industry in Kaohsiung City, Taiwan Province, promulgated August 1, 1985; Emission Standards of Granular Pollutants for Cement Industry in Kaohsiung City, Taiwan Province, promulgated February 21, 1986; and Emission Standards of Air Pollutants for Coking Industry in Taipei City, promulgated February 10, 1987.

\textsuperscript{88} Maitland, supra note 4.

\textsuperscript{89} By 1989, 133 corporations have complied with the emission standards, 23 are classified as improving, and 41 have stopped operating or relocated. A similar rating system is in place for private industrial wastewater producers. E. CHIEN, supra note 5, at 9.
ninety-two largest emitters. Furthermore, pending legislation will amend the Air Pollution Control Act to establish a permit system, technician licensing scheme, self-monitoring and reporting system for industry, and economic incentives for implementing pollution controls.

The government established a major environmental initiative called The Blue Sky Project to improve the air quality in the greater Taipei and Kaouhsiung areas. The goal is to reduce the PSI level to below 100 (the moderate range) by 1992. In addition, the EPA has initiated two special enforcement programs. Project Flying Eagle utilizes a police helicopter unit to survey stationary sources, particularly factories and open-air burning. Project Rambo conducts weekly raids of polluters, especially those involved in nocturnal air emissions, dumping or water discharge.

Due to the staggering number of vehicles in Taiwan — over 10 million as of 1990 — the EPA is also concentrating on mobile source emissions. Several provisions and regulations are already in effect.

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90. By 1989, 95% of the heaviest polluters had completed pollution control measures of some sort. The government predicts that these actions will result in a reduction of some 50,000 tons of particulates. INTRODUCTION, supra note 81, at 17.
91. Air Pollution Control Act, as Amended May 4, 1983.
92. INTRODUCTION, supra note 81, at 17.
93. The Blue Sky Project seeks to notify polluters and inspect pollution sources in light of the new air emission standards, to implement a check and maintenance system for vehicles, and to identify and improve sources of odor in the northern Kaouhsiung region. INTRODUCTION, supra note 81, at 46.
94. ENVIRONMENTAL PROTECTION, supra note 59, at 29.
95. E. CHIEN, supra note 5, at 8.
The EPA predicts that these measures will arrest the degeneration of air quality beginning in 1991. Currently, Taiwanese vehicles must observe European standards. However, by July of 1991, the U.S. emission standards, which are the most stringent in the world, will come into force. To reduce the amount of sulfur oxide discharged by vehicles, the government is promoting a Low Sulfur Fuel Policy. In 1989, the sulfur content of gasoline was lowered to 2 percent with the intention of a reduction to 1.5 percent in 1990 and to 1 percent in 1993.

Although not asked to be a signatory due to the political issue of Taiwan's international status, the Republic of China has voluntarily agreed to observe the Montreal Protocol on Substances that Deplete the Ozone Layer. The treaty agrees to eliminate 50 percent of the world's chlorofluorocarbons by 1998 in an effort to reduce the release of chemicals that can destroy the stratospheric ozone which shields the earth from dangerous solar radiation. In addition, the EPA has established both short term and long term air pollution goals for seven other major pollutants.

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97. INTRODUCTION, supra note 81, at 18.
98. Republic Battles, supra note 35, at 5.
99. ENVIRONMENTAL PROTECTION, supra note 59, at 7 (As of 1983, the law required diesel-powered vehicles to use low sulfur content premium diesel fuel).
100. INTRODUCTION, supra note 81, at 17.
101. Taiwan was a province of China from 1945 until 1949. In 1949, communist revolutionaries overthrew the government of General Chaing Kai-Shek. The deposed rulers withdrew to Taiwan but continued to represent the mainland country at the United Nations until 1971, when it was replaced by China. Currently, Taiwan is not a member of the United Nations. Republic Battles, supra note 35, at 5-6.
102. Air pollution goals for 1991 are: 470 ppm per year for suspended particles, .05 ppm per year for sulfur dioxide, 10 ppm per day for carbon monoxide, .05 ppm per day for nitrogen dioxide, 1 ppm per 6am to 9pm period for hydrocarbons, .12 ppm per hour for ozone, and 1.5 ug/m3 per 3 month period for lead. Air pollution goals for 1996 are: 100 ppm per year for suspended particles, .03 ppm per year for sulfur dioxide, 10 ppm per 8 hour period for carbon monoxide, .05 ppm per day for nitrogen dioxide, .31
C. Water Pollution Regulation

The lack of an adequate sewage system means that virtually all of Taiwan's raw sewage is discharged into rivers and lakes.\textsuperscript{105} The rivers tend to be short and steep with relatively clean water at the source. Uncontrolled wastewater discharges from municipal, industrial, domestic, livestock and refuse leachate sources have seriously polluted major rivers and contaminated the water table.\textsuperscript{106} The volume of river water is insufficient to dilute the massive amounts of discharge even in the wettest seasons. During the dry season, the problem is compounded.\textsuperscript{107} Furthermore, the land is able to retain only 21 percent of its annual precipitation. The remaining 79 percent is lost to evaporation or flows into the ocean as runoff.\textsuperscript{108} The combination of scarce water, massive discharges, and nonexistent sewage treatment creates an overwhelming water contamination crisis.

The EPA classifies water pollution as solid waste and leachate, municipal wastewater, industrial wastewater, and livestock farming wastewater. Leachate from landfills near aquifers and riverbanks poses a serious risk, but little is yet known as to the quality and quantity of this type of pollution. Municipal wastewater provides the greatest volume of pollution, but the contamination concentration is the least problematic. Industrial wastewater is second to municipal wastewater in terms of volume and concentration. Livestock wastewater constitutes a small amount of the pollution, but it is the most dangerous.\textsuperscript{109}

Since 1975, the government has attempted to tackle water pollution primarily by researching the situation and developing long-range plans.\textsuperscript{110} In spite of Taiwan's new commitment to preventing ppm per 6am to 9pm period for hydrocarbons, .12 ppm per hour for ozone, and 1.5 ug/m\textsuperscript{3} per 3 month average for lead. INTRODUCTION, supra note 80, at 19.

105. E. CHIEN, supra note 5, at 3. See also supra notes 51-54 and accompanying text.

106. ENVIRONMENTAL PROTECTION, supra note 59, at 11. See also supra notes 51-56 and accompanying text.

107. INTRODUCTION, supra note 81, at 22.


109. Id.

110. Some of the EPA's achievements over the past decade are:

To Announce the Standards of River & Stream Classification and the Quality of the Stream: The standards of wastewaters discharged by factories and mines was announced and water pollution control zones were delineated in accordance with what were stipulated in Regulations Governing Water Pollution.

To Map Out Preventive Plans for Water Pollution in Certain Valleys: Eleven plans for preventing water pollution on a valley basis have been mapped out in order to thoroughly solve the problems of water pollution.

To Set Up Water Pollution Monitoring Posts and Networks: To date, 69 water quality monitoring networks consisting of 201 monitoring posts have been completed, and 88 irrigation canal monitoring networks consisting of 102 monitoring posts have been completed. Further, 94 groundwater quality monitoring posts have been completed. Materials regarding water quality have been
and abating water contamination,\textsuperscript{111} the EPA's policy is still principally involved with gathering information and creating data banks as a prelude to promised action. Two major examples of this approach are the Blue Sea Project, which is concerned with marine and coastal water quality, and the Safe Drinking Water Project, which focuses on groundwater quality. The Blue Sea Project consists of two phases. First, the EPA intends to formulate a plan to control harbor pollution and effectuate cleanup by 1991. Second, the EPA plans to accomplish actual coastal area control and cleanup by 1995.\textsuperscript{112}

The Safe Drinking Water Project consists of three phases. First,

\begin{itemize}
  \item To Control the Wastewaters Discharged by the Factories and Mines: The standards of the wastewaters discharged by the factories and mines have been published and site checks have been made often. It is estimated that 50\% of BOD and 45\% of suspended solids have been reduced in industrial pollution as a whole.
  \item To Control Household Sewage and livestock Farming Wastewaters: The sewage systems were mapped out by the Residence & City Development Bureau of the Taiwan Provincial Government, the Taipei City Government, and the Kaohsiung City Government in order to speed up sewage system construction. The plans for the treatment of the wastewaters from livestock farming have been prepared by the Agriculture and Forest Department of the Taiwan Provincial Government.
  \item To Investigate and Control Heavy Metals and Poisonous Substances: Completed the work of tracing and controlling such special pollutants as pesticide, mercury, cadmium, lead, copper, chrome, and arsenic. To Coordinate Industrial Bureau and International Trade Bureau to Formulate Strategy Measures: In conjunction with the Industrial Bureau, the measures governing the piping systems of wastewaters discharged from industrial zones were completed and rules stating that paper mills be separately operated as pulp plants and paper plants were formulated. The International Trade Bureau formulated and completed the measures on controlling the import of poisonous substances and supervising the quantities used.
\end{itemize}

\textit{Taiwan 2000, supra} note 66, at 154-55.


\textsuperscript{112} \textit{INTRODUCTION, supra} note 81, at 23.
the EPA intends to establish a databank and warning system for
ground water quality, implementing the initial system in the Taipei
basin. Second, the EPA is investigating water quality and pollution
in reservoirs in order to strengthen the pollution control of watersheds and prevent eutrophication. Currently, the EPA is concentrat-
ing on the Fong-shan and Ahgong-dian reservoirs and Kinmen Is-
land's Tai Lake.\textsuperscript{113} Third, the EPA plans to develop a drinking water
sanitation improvement program for the Taiwan area.\textsuperscript{114}

As part of its effort to prevent future contamination of the water,
the EPA has launched the Industrial Wastewater Control Project.
The central government has assigned priority control status to cer-
tain industries and pollution sources.\textsuperscript{115} Priority control status
sources include: factories along the Keelung River and several
streams,\textsuperscript{116} 144 major public and private corporations, petrochemical
and paper manufacturing industries, fermentation industries, indus-
trial park wastewater treatment plants, large pig farms,\textsuperscript{117} and hospi-
tals.\textsuperscript{118} The EPA has developed a schedule of implementing intensive
control of additional industries over the next few years.\textsuperscript{119} If a speci-
fied source violates effluent standards, the EPA will notify the party
and designate a three to six month deadline by which corrective ac-
tion must be taken.\textsuperscript{120} The frequency and amount of fines levied for
violations rose 50 percent in 1988 and are expected to increase even
more. Except for small pig farms and certain mining operations and
factories, the EPA expects most water pollution sources to improve
100 percent by 1992.\textsuperscript{121}

The Clean River Project is the most ambitious task already ap-
proved and underway. It plans a comprehensive cleanup of the Is-
land's rivers and streams. The centerpiece and first phase of the pro-

\textsuperscript{113} Id. at 24.
\textsuperscript{114} Id. at 46.
\textsuperscript{115} See id. at 27.
\textsuperscript{116} Keelung River is one of the three main branches of the Tam Shui River. It
travels 87 kilometers and covers 204 square kilometers of river valley. Keelung is one of
the most polluted rivers in Taiwan due to industrial wastewater, coal mines, household
sewage and garbage drainage. \textit{Taiwan 2000}, supra note 66, at 140.
\textsuperscript{117} The EPA has initiated Project Ham in an effort to impose tight controls on
the 7 million pigs comprising the pig farming industry. The Project's first phase concen-
trates on farms with more than 1,000 pigs. E. CHIEN, supra note 5, at 8.
\textsuperscript{118} \textit{Introduction}, supra note 81, at 27.
\textsuperscript{119} The schedule for implementing intensive controls of specified types of waste
water is: by 1990, dye-works, textile, chemical engineering and electric plating industries;
by 1991, fish markets waste water treatment agencies, food industries, school and institu-
tional laboratories, septic tanks and community sewage; by 1992, fur industries, indus-
trial waste water treatment plants and human waste treatment plants. \textit{Id.}
\textsuperscript{120} See id.
\textsuperscript{121} As an example of a special enforcement plan, the EPA has instituted Project
\textit{Kill Rats} to catch factories which use clandestine underground pipe systems to discharge
waste water. E. CHIEN, supra note 5, at 9.
gram is the Tan-Shui River Basin Cleanup Project. The Tanshui River system comprises the largest basin in northern Taiwan and plays a principal role in the economic development and living quality of the Taipei metropolitan area. The waterways are heavily polluted. Consequently, the government approved the eight year project in 1988 at an estimated cost of one billion dollars.

The Clean River Project has two objectives: first, to eliminate dry season problems of odor and oxygen deficiency by 1991; and second, to dramatically improve the water quality by 1995. The first phase of the project calls for the construction of a sewage system in Taipei’s watershed regions, a suburban Taipei sewage system and interceptor, a Taipei municipal sewage system and interceptor, and

122. See Introduction, supra note 81, at 25.

Pollution sources: According to investigations conducted by the EPA, there are five pollution sources for the Tanshui River Basin. They are:

A. Domestic wastewater: The population is 4.6 million in the Tanshui River Basin. Most of the domestic and municipal wastewater is not treated properly, but is drained to the river directly. This is the major pollution source for the river basin. Assuming the pollution equivalent Biochemical Oxygen Demand (BOD) per person per day is 40 grams, then the pollution quantity discharged into the river is about 118.8 tons BOD per day.

B. Industrial wastewater: There are 934 factories along the Tanshui River Basin. Among them, there are 163 dyeing and finishing factories, 154 chemical factories, 134 ceramic factories, 113 metal treatment and 100 plating factories. These five industries take up 71.06% of the total 934. If the theoretical amount of pollutant is expressed by BOD, then about 61.3 tons are produced per day. If the actual discharge rate is used, then about 42.6 tons of BOD is drained into the river every day.

C. Solid wastes: It has been found that the refuse produced in this area is about 5,126 tons per day. About 2,500 tons of refuse is treated by Futekeng Sanitary Landfill Plant in Taipei City every day. There are about 1,300 tons of residual refuse which is not treated suitably and is openly dumped along the river side. This untreated refuse produces a bad odor and destroys the environment. Besides, the leachate from the open dumping fields flows into the river; thus deteriorating water quality.

D. Wastewater from livestock farming: Agricultural development along the Tanshui River Basin is very prosperous, so it is a very common place for animal husbandry, especially in Taipei County. There are about 300 thousand pigs in all. If each pig discharges 0.20 kg BOD per day, then the total pollutant will be about 60 tons BOD per day. Half of this pollutant is not treated before it is drained into the river. So the water quality is badly polluted.

E. Non-point pollution source: Besides the above pollution sources, there is pollutant produced from heavy rain, construction activities, and use of pesticide and fertilizer. There is still no detailed information on these sources so far.

Id.

124. Id. at 1.
common facilities between the Taipei municipality and the Taiwan province. In addition, open dumping fields along the river are being closed or improved, and sanitary landfills and incineration plants are being constructed. The second phase of The Clean River Project will extend cleanup and sewage system construction to other waterways and regions.

D. Solid Waste Regulation

Taiwanese law divides solid waste into two classifications: ordinary waste and industrial waste. “Ordinary waste” refers to “garbage, excrement and urine, dead bodies of animals, or other solid or liquid waste produced by non-industrial organizations which is enough to pollute the environment.” “Industrial waste” is either “hazardous” or “ordinary” depending on the harmful nature of the material.

Garbage in Taiwan is now generated at a rate of 13,954 metric tons per day. It is estimated that by the year 2000, this figure will reach 36,500 tons per day. As for industrial waste, Taiwan currently produces over 50,000 tons per day, and while it is difficult to project the volume of industrial waste in the year 2000, Taiwan will undoubtedly increase its production of industrial waste in the future.

The EPA has begun to crack down on widespread dumping of solid waste and has instituted a major program to upgrade solid waste disposal. In 1985, the government established the Municipal

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125. INTRODUCTION, supra note 81, at 25.
126. THE TANSUI RIVER BASIN CLEAN-UP PROJECT, supra note 123, at 7. See infra notes 132-35 and accompanying text.
127. The second stage includes cleanup of the Kee-lung River, the Er-jen, Wu, Lao-chie, Hsin-chie, Hser-che, Nan-kan and Pu-hsin Streams; further cleanup of the Tansui River; planning cleanup and flood prevention for the Hou-chin and Dian-pao Streams; and subsidizing the planning of the Kaohsiung suburban sewage system. INTRODUCTION, supra note 81, at 25.
130. TAIWAN 2000, supra note 66, at 181.
131. See id. at 200.
Solid Waste Disposal Project at an initial cost of 1 billion dollars.\textsuperscript{132} When the project is completed sometime in 1991, Taiwan will have sixty-seven sanitary landfills, one composting plant, twenty-three waste-to-energy plants, and 191 dumping sites will be closed or improved.\textsuperscript{133} The treatment volume of solid waste will rise from the 1986 level of 13,954 metric tons per day, to 16,355 metric tons per day.\textsuperscript{134}

In addition, the EPA is using approximately 220 million dollars from profits of the state-run China Petroleum Corporation to construct three waste-to-energy plants and five municipal solid waste incinerators.\textsuperscript{135} Incineration is an attractive disposal method, particularly for urban waste, since it occupies a small amount of space.\textsuperscript{136} By 1993, 2300 tons of municipal solid waste will be incinerated daily, rather than the current amount of 191 tons. This program will increase the percentage of solid waste disposed of by incineration from 1.4 percent to 12.7 percent.\textsuperscript{137}

Recently, Taiwan launched an extensive recycling campaign. The EPA estimates that 39 percent of the nation's waste is recyclable, but the EPA has targeted 20 to 25 percent as a realistic goal.\textsuperscript{138} Project Recycle focuses on fifteen different items: PET bottles, tires, lubricant, iron cans, mercury batteries, aluminum cans, plastics, paper, agricultural pesticide cans, pesticide cans, capacitors, fluorescent tubes, vehicles, glass bottles, and motorcycles.\textsuperscript{139}

Hazardous waste provides special problems. Taiwan currently produces nearly 3 million tons of hazardous waste each year.\textsuperscript{140} Due to improper or incomplete treatment and disposal, chemical and chemical-related industries are responsible for over 60 percent of the total generated hazardous waste.\textsuperscript{141} Accidents involving PCB poisoning of rice-chaff oil and chemical leaks have highlighted the danger, but so far the government has taken little action to address the issue.\textsuperscript{142} In

\begin{thebibliography}{99}
\bibitem{132} E. 
\bibitem{133} INTRODUCTION, supra note 81, at 28.
\bibitem{134} ENVIRONMENTAL PROTECTION, supra note 59, at 15.
\bibitem{135} INTRODUCTION, supra note 81, at 28, and ENVIRONMENTAL PROTECTION, supra note 59, at 15.
\bibitem{136} TAIWAN 2000, supra note 66, at 188. This is a particularly attractive method in light of the limited land available in Taiwan. \textit{Id}.
\bibitem{137} ENVIRONMENTAL PROTECTION, supra note 59, at 15.
\bibitem{138} Republic Battles, supra note 35, at 5.
\bibitem{139} E. 
\bibitem{140} Republic Battles, supra note 35, at 5.
\bibitem{141} INTRODUCTION, supra note 81, at 30. There are over 60,000 factories handling thousands of different chemicals. \textit{Id}.
\bibitem{142} For an analysis of certain priority pollutants in Taiwan, see TAIWAN 2000,
1987, the Executive Yuan approved a revised short term control measure on industrial wastes which included such hazardous wastes as PCBs, heavy metals and pesticides; however, little appears to have resulted from this action. In addition, the EPA has promised (but not yet acted) to set up a hazardous waste control system, and to issue licenses to state-owned and private waste clearance and disposal companies.\footnote{144} The general plan which the EPA has formulated to prevent toxic chemicals from endangering public health is for the most part still on the drawingboard.\footnote{144}

The EPA has announced its intention to force certain industries

\footnotesize{supra note 66, at 202-23.}

\footnotesize{143. Environmental Protection Agency of the Republic of China, The Perspective of Environmental Protection in Taiwan Area (October 1988), reprinted in TAIWAN 2000, supra note 66, at 735-48.}

\footnotesize{144. The EPA stated:}
\footnotesize{On the whole, we do not yet have a complete chemical substance control pro-gram to prevent toxic chemicals from endangering human health and polluting the environment. Our administration is currently working on just such a program. Part of such a program would involve monitoring potential sources of toxic chemical pollution, such as factories: Factories would be required to register with the EPA. They would also be required to keep detailed records on all phases of chemical handling (e.g., amount of chemical sold, name of buyer, etc.). These factories would submit reports on their activities every 3 months for review by environmental protection authorities, while these authorities would also carry out random on-site inspections in order to verify factory reports.}
\footnotesize{Our administration is presently working on the 'Nationwide Chemical Disas-ter Prevention and Response System Project. The project involves coordinating with other authorities in the central government in establishing a special committee. Such a committee would regularly meet to discuss chemical prevention issues and promote prevention work.}
\footnotesize{In order to reach our goals, the administration's major strategies are as follows:}
\footnotesize{1) Regularly inspect chemical substances in use. Make available to the public a list of toxic chemicals regulated by the government.}
\footnotesize{2) Promote the Toxic Chemical Databank Project—set up a data bank on toxic chemicals, including information on factories that handle toxic chemicals. Such information will be put on a computer network, and help in the prevention of chemical disasters.}
\footnotesize{3) Promote the nationwide 'Chemical Disaster Prevention and Response Sys-tem'. [sic] Plan and set up the 'Chemical Disaster Prevention System' by coor-dinating with related authorities in the central government. Supervise local au-thorities in chemical disaster prevention.}
\footnotesize{4) Promote toxic substance research and development. Promote research con-cerning the affect of toxic substances on human health. Cooperate with aca-demic and research institutes in developing short-term toxicity testing techniques.}
\footnotesize{5) Control the production, import, sale and use of residential pesticides. A committee formed by the EPA will review the information on these pesticides concerning toxicity and efficacy. Encourage pesticide manufacturers to strengthen quality control.}
\footnotesize{6) Accelerate the promulgation of laws and regulations governing residential pesticide and bioreagent control.}
\footnotesize{7) Educate the people about the proper use of pesticides.}

\footnotesize{INTRODUCTION, supra, note 81, at 33.}
which produce hazardous waste or large quantities of solid waste to develop their own industrial solid waste disposal programs. Each program, tailored to the specific industry, would address: product processing procedures, amount of waste, waste disposal methods, waste minimization plans, hazardous waste alert emergency action plans, and plans for waste disposal during bankruptcy. This self-reporting and monitoring policy, however, exists only in concept.

The government, through the vigorous efforts of the EPA, has taken major strides toward improving the Island's environmental situation, despite the fact that critics charge that economic considerations generally trump environmental considerations when the two conflict. The EPA has and will continue to devote much of its energy to collecting data as a prerequisite for developing regulations and proposing projects, but concrete measures like the Tanshui River cleanup are already in full swing and the government seems committed to its new environmental policy. However, Taiwan's dedication to abating pollution and remediating contamination will be put to the test if expanding environmental regulations seriously begin to affect the economic performance of domestic businesses. The economic consequences of environmental regulation are now coming to the fore.

**PART III. ECONOMIC CONSEQUENCES OF ENVIRONMENTAL REGULATION**

For the past forty years the Taiwanese government has pursued a tightly controlled economic policy characterized by economic incentives and little concern for the environment. Any regulatory attempt to cleanup the resulting contamination and prevent future pollution may dampen the national prosperity, at least in the short term. The long term benefits, however, could more than compensate for any initial negative economic impact. Environmental regulation will affect production costs, encourage Taiwanese investment abroad, and spawn a new market for control technologies and services on the Island.

**A. Operating Costs and Balance Sheets**

Taiwan owes much of its economic success to low cost operations. In the recent past, Taiwanese businesses could hire workers cheaply,
expect high productivity, and avoid overhead expenses associated with environmental regulations. Setting aside the contributing effects of the growing organized labor movement, environmental regulation of agricultural, livestock, and manufacturing operations will impose new costs on the businesses in question. Such costs may include design and installation of pollution control equipment, development of new production methods, or replacement of currently utilized chemicals. Meeting emission standards may require reducing production, discontinuing certain products, or reformulating ingredients and processes. Emission standards and zoning enforcement may also result in forced relocations or shutdowns. Since open discharge or dumping is being curtailed, companies will have to install treatment systems or contract out for waste disposal. In addition, government monitoring and filing requirements will add further charges.

The immediate effect of such new costs and restrictions on formerly unfettered discharge, is likely to be increased product prices, which could reduce Taiwan's competitiveness in the international marketplace. In the last few years, other Pacific Rim countries like Malaysia and Thailand have been experiencing a surge in economic prosperity along the lines of the Taiwan model. In fact, many Taiwanese are looking to these emerging powerhouses for investment opportunities. Increased regulation often means increased costs, which may result in either less profit or higher prices. Manufacturers and producers in the United States have long complained that unregulated countries like Taiwan have an unfair business advantage. With Taiwan's emerging environmental regulatory scheme, some Taiwanese businesspersons are beginning to share the sentiments of their American counterparts.

In addition to increased costs associated with environmental regulation and pollution prevention, enormous expenses may be incurred to cleanup existing contamination. The EPA has announced its support for the polluter-pays principle. Under this theory, those parties responsible for the contamination must remediate it, even if the pollution occurred fully in accordance with existing laws. The

147. Sharma, supra note 2; Foreigners Optimistic About Investing In Taiwan, CENTRAL NEWS AGENCY, May 28, 1990.
148. Tien, supra note 24, at 126-27.
149. See supra notes 87-92 and accompanying text.
151. See infra notes 158-66 and accompanying text.
152. Quinn, Investment Crunch Feared As Worker Unrest Rocks Taiwan, REUTERUS Bus. REP., Mar. 29, 1989.
153. INTRODUCTION, supra note 81, at 47.
154. For a discussion of the “polluter pays” approach, see generally, ENVIRONMENT AND TRADE: THE RELOCATION OF INTERNATIONAL TRADE AND ENVIRONMENTAL
monumental character of the Island’s pollution will require vast sums of money for remediation. Such liability could have a serious financial impact on businesses for decades to come. Since resources directed by the government toward environmental matters are derived for the most part from direct or indirect taxation, the billions of dollars required to cleanup Taiwan and regulate future compliance will affect the national economy, as well as the allocation of social expenditures.

As an Island-nation, Taiwan is acutely aware of the finite nature of its natural resources, and of the need to avoid dependency on importation of essential goods. Adequate infrastructure and environmentally safe discharge operations can play a central role in bolstering the Island’s economy. Efficient use of material resources, full scale recycling, restructured operations, and proper waste disposal is economically sound policy since it squeezes the most benefit out of each material and protects limited resources from spoilation, depletion, or misuse. The economic value of a healthy, happy working population is difficult to calculate. It is hard to assign a quantitative value to “quality of life” variables, but the tide of popular unrest over ecological issues indicates that the Taiwanese citizenry generally regard the value as quite high.

Taiwan must now pay heavily for having deferred environmental expenses during its meteoric economic rise. This will likely result in greater costs and higher prices for goods, which will make Taiwan a less desirable source for products, services and investment in the short term. However, it does not mean that Taiwan’s prosperity will precipitously decline, but the economy may slow down somewhat from its phenomenal pace. The country now appears willing to draw on its amassed wealth to remediate and restructure itself as a more pleasant, healthy, and efficient land in which to live and economically compete in the next millennium.

B. Taiwanese Foreign Investment

Environmental costs constitute a major force in driving cash-rich Taiwanese to invest outside Taiwan. Until the political liberaliza-
tion of 1987, the Taiwanese government severely restricted Taiwanese investment overseas. However, in July of 1987, the government lifted its restrictions on overseas investment, and consequently foreign investment has skyrocketed.\textsuperscript{160} The remarkable prosperity of the last several years has flooded Taiwan with cash. The environmental reforms, sharp appreciation of the local currency, and labor unrest are propelling Taiwanese liquidity to foreign targets such as other Southeast Asian countries, Mainland China, and the United States to the tune of 10 billion dollars in 1989.\textsuperscript{163}

In 1988, Taiwanese invested 2 billion dollars in Thailand, Malaysia, Indonesia, and the Philippines.\textsuperscript{162} Taiwan is now the top foreign investor in the Philippines and is second only to Japan in Thailand and Malaysia. The Taiwanese are drawn to invest in other Southeast Asian countries for several reasons. These nations are geographically near Formosa and offer economically-priced raw materials and abundant cheap labor (for example, a Thai worker earns one-fifth of what a Taiwanese would receive for the same job).\textsuperscript{163} In addition, there are large Chinese communities in these countries which provide a point of contact.\textsuperscript{164} Furthermore, Taiwan can take advantage of the duty free benefits the other states enjoy for their exports to the United States under the generalized system of preferences.\textsuperscript{165} Finally, the Southeast Asian countries have welcomed Taiwanese investment as preferable to the traditional multinationals of the United States and Europe and the increasing domination of the area by Japan.\textsuperscript{166} Such opportunities have caused Taiwan to modify its traditional trading patterns by exporting intermediate goods, rather than final products, to the Southeast Asian countries and to China (via Hong Kong). Factories in these nations supply the labor and then export the finished product.\textsuperscript{167}

\textsuperscript{160} Yang, \textit{The States Are Vying For Those New Taiwan Dollars}, \textit{Bus. Wk.}, Jan. 11, 1988.

\textsuperscript{161} Moore, \textit{Cashing Out}, \textit{FAR EASTERN ECONOMIC REVIEW}, (Apr. 12, 1990), at 55.

\textsuperscript{162} Tanzer, supra note 33, at 49.

\textsuperscript{163} Sharma, supra note 2.

\textsuperscript{164} Id.

\textsuperscript{165} Id. The Generalized System of Preferences (GSP), 19 U.S.C. §§ 2461-2463 (1980), grants trade preferences to certain products from developing countries. Under the GSP, the U.S. recognizes that economic development of the third world requires the assistance of developed nations. Accordingly, the GSP gives preferential treatment to specified products of underdeveloped countries without requiring reciprocity. In addition to obtaining lower tariff rates, developing countries can ship goods duty free into the U.S. and other major industrial markets. Although they differ in certain aspects, these special arrangements have been implemented by the U.S., the European Economic Community, Japan and other major industrialized markets. For more information on the GSP see J.K. Barton & B. Fisher, \textit{INTERNATIONAL TRADE AND INVESTMENT} 514-28 (1986); T. Clasen, \textit{FOREIGN TRADE AND INVESTMENT} § 6:15 (1987).

\textsuperscript{166} Sharma, supra note 2.

\textsuperscript{167} Tanzer, supra note 33, at 49-50.
The Taiwanese government forbids direct investment in Mainland China, but in reality, Taiwanese commercial interests are building hundreds of factories in the People’s Republic. China has no labor shortages and no environmental activists.\(^\text{168}\) Recently, the Hong Kong branch of China International and Investment Corporation established a consulting service for Taiwanese interested in investing on the Mainland. China is actively encouraging such investment.\(^\text{169}\) Businesspersons attracted to the financial benefits of investing in China are pressuring Taipei to reevaluate its policy of no contacts with the Mainland and, as a result, noticeable relaxation is occurring.\(^\text{170}\)

The United States is actively seeking Taiwanese investment. Fourteen states have opened or plan to open offices in Taipei to attract capital.\(^\text{171}\) Taiwanese companies and individuals have already invested billions of dollars in United States real estate, and now they are beginning to build factories and acquire businesses in America.\(^\text{172}\) For example, when environmentalists prevented Formosa Plastics, Taiwan’s largest conglomerate, from building a petrochemical plant outside of Taipei in 1989, the company constructed the 1.3 billion dollar complex in Texas.\(^\text{173}\) Such investments are becoming more common.\(^\text{174}\)

Environmental activism and regulation are fueling economic pressures at home which discourage plowing profits back into the Island. Furthermore, the liberalization of foreign investment rules has provided an outlet for cash amassed by Taiwanese companies and businesspersons. Accordingly, the government is attempting to balance the popular demands for costly environmental reforms with the threats by the business community to send more capital outside the country.\(^\text{175}\) As environmental regulations expand, however, the trend

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\(^{168}\) \textit{Id.} at 49.  
\(^{169}\) \textit{Hong Kong CITIC Branch Helps Taiwan Business Executives Invest In Mainland,} XINHUA NEWS AGENCY, May 4, 1990.  
\(^{171}\) Yang, \textit{supra} note 160.  
\(^{172}\) Tanzer, \textit{supra} note 33, at 52.  
\(^{173}\) \textit{Id.}  
\(^{174}\) Taiwan is also interested in investment in Mexico and other South American countries. \textit{Reception in L.A. to Greet ROC Investment Delegation to Mexico,} CENTRAL NEWS AGENCY, June 2, 1990 (Taiwan recently sent delegations to Mexico and South American countries to study the investment environment and locate possible joint-venture partners).  
\(^{175}\) An example of a recent change in Taiwan’s financial structure geared toward encouraging domestic investment is the modification of the banking statutes. In an effort
to further overseas investment will only increase.

C. Markets for Environmental Technologies and Services

Regulation is the life blood of the environmental service and technology industry. The EPA estimates that over the next ten years approximately 40 billion dollars will be spent on environmental protection in Taiwan.\(^{176}\) This includes both public and private sector expenditures. The enormous national projects, including transportation systems, sewage, and remediation, will cost billions of dollars.\(^{177}\) However, Taiwan recognizes that it does not have the sophistication or capabilities to undertake these tasks without substantial foreign assistance; consequently, lucrative opportunities exist for overseas businesses to supply the Island with equipment, technical expertise and ongoing consulting and operating services.\(^{178}\)

There are over 130 registered pollution control firms operating in Taiwan. Many of these domestic firms have technical cooperation agreements with Japanese manufacturers rather than with American or other western businesses. Nonetheless, approximately 65 percent of Taiwan's pollution control market is supplied by foreign firms. Of this foreign market, United States firms command about one-third of the trade and the Japanese provide about one-half.\(^{179}\) Importation of pollution-related control equipment is expected to increase at an annual rate of 40 percent through at least 1992. Furthermore, such equipment is not subject to import tariffs.\(^{180}\)

Solid and hazardous waste treatment systems will be in the greatest demand, but there will be a steady growth in air and water pollution control markets as well.\(^{181}\) The sheer enormity of environmental problems and lack of controls or infrastructure presents huge markets in virtually every field.\(^{182}\) The six largest buyers of wastewater treatment systems accounted for 70 percent of the purchases.\(^{183}\) Historically, the private industrial sector has accounted for over 80 per-

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\(^{176}\) E. CHIEN, supra note 5, at 11.

\(^{177}\) See supra notes 110-12, 122-24, and 132-36 and accompanying text.

\(^{178}\) Boston, supra note 60, at 1-3.

\(^{179}\) Rapidly Growing Markets, supra note 48.

\(^{180}\) Id.

\(^{181}\) Id.

\(^{182}\) See supra notes 48-62 and accompanying text.

\(^{183}\) Id.
cent of the pollution control equipment purchased, with the vast majority going to four industries: nonmetallic products, basic metal, plastics, and chemical materials and products.\textsuperscript{184} The ten major state-run corporations will spend 3.5 billion dollars by 1994 on pollution control equipment.\textsuperscript{185} The demand for pollution control equipment is only predicted to continue to broaden and increase.\textsuperscript{186}

In addition to actual project construction, equipment supplying, and technical consulting, Taiwan offers further opportunities to provide environmental services to the public and private sector. Taiwan is committed to privatization of a full-range of compliance, treatment, and disposal services. Accordingly, the government seeks to accelerate formation of private environmental protection enterprises.\textsuperscript{187} The EPA foresees an immediate need for businesses engaged in solid waste disposal including collection, transport and disposal, incineration, and landfills; testing of vehicular emissions, hygiene-related chemicals and pesticides, and toxic chemicals; private industrial wastewater treatment; disease-related pest control; drinking water quality monitoring; and maintenance of air quality monitoring stations.\textsuperscript{188}

Rather than attempt to establish a bureaucratic behemoth to engage in every aspect of the herculean task of compliance and cleanup, Taiwan is tapping the entrepreneurial skills and expertise of the private sector to further environmental protection. In typical Taiwanese fashion, the government is setting the policy and providing financial incentives to accomplish the goal.\textsuperscript{189} The economic rewards are available to all competitors in the international marketplace; consequently, foreign firms with equipment and expertise to sell have a tremendous opportunity in Taiwan.

\textbf{CONCLUSION}

Taiwan purchased its economic success at the price of its environmental wellbeing. Prosperity, however, has allowed the growing middle and upper classes to put increasing value on an improved quality of life. Financial confidence provided the impetus to demand both

\begin{flushleft}
184. \textit{Id.}
187. \textit{INTRODUCTION}, \textit{supra} note 81, at 47.
188. E. CHIEN, \textit{supra} note 5, at 10-11.
189. \textit{See supra} notes 15-28 and accompanying text.
\end{flushleft}
democratic reforms and serious efforts to confront the catastrophic health consequences and strain on the natural resources of the Island caused by decades of unregulated commercial activities.

Government policy has changed in response to this popular outcry and the deepening awareness of the fiscal, social and political dangers of permitting the environment to degenerate further. The EPA has formulated a comprehensive regulatory scheme geared toward controlling pollution, cleaning up existing contamination, and improving the Island's infrastructure to handle the increasing population and concomitant waste. This scheme is only now beginning to be implemented and it will face difficult challenges as commercial interests clash with proposed regulations. The costs, at least in the short run, are high in terms of money expended, increased burdens on business, and incentives to invest outside the country. Such expense, however, is really interest coming due. Taiwan mortgaged its physical wellbeing in order to achieve its outstanding economic success. Now, either the debt must be paid, or Taiwan will risk disastrous results. If the shrewd commercial acumen and diligence which fueled Taiwan's meteoric rise is channeled into environmental reforms, as the emerging regulatory structure indicates, the reclaiming of Formosa is a promising investment.