Economy and Environment Program
for Southeast Asia
Tanglin PO Box 101
Singapore 912404
Phone: (65) 6831-6854
Fax: (65) 6235-1849
E-mail: eepsea@idrc.org.sg
Web site: www.eepsea.org

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Incentives for Wastewater Management in Industrial Estates in Vietnam

Le Quang Thong and Nguyen Anh Ngoc
Faculty of Economics, Nong Lam University,
Thu Duc, Ho Chi Minh City, Vietnam
(Iqtsta@hcm.vnn.vn)

This report provides information on the level and effectiveness of wastewater pollution control in industrial estates in four provinces of Vietnam. It finds low levels of wastewater treatment in many industrial estates in the areas surveyed and identifies significant negative effects on many rivers. It investigates why many estates and the factories that operate inside them have not invested in wastewater treatment plants. It also looks at why many companies (even those connected to treatments plants) choose not to comply with wastewater treatment legislation. Among the reasons for this poor performance are a lack of investment capital, poor law enforcement, low penalties for non-compliance and an inappropriate fee structure for wastewater treatment.

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INCENTIVES FOR WASTEWATER MANAGEMENT IN INDUSTRIAL ESTATES IN VIETNAM

Le Quang Thong and Nguyen Anh Ngoc

January, 2004

Comments should be sent to:
Le Quang Thong, Lecturer,
Faculty of Economics, Nong Lam University, Thu Duc, Ho Chi Minh City, Vietnam.
Tel number: +84 88 961708; Fax: +84 88 960713; Email: lqtsta@hcm.vnn.vn

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Le Quang Thong and Nguyen Anh Ngoc

EXECUTIVE SUMMARY

The development of the industrial sector in Vietnam has raised the urgent need for studies on its impact on the environment, especially that of wastewater generated by industrial estates. As the government continues to emphasize the role of industrialization through the growth of industrial and export processing zones, the need for imposing proper policies to keep industrial estates compliant with wastewater management has increased. The fact is that not all industrial estates have invested in common wastewater treatment plants. This raises the question of what influences industrial estates to invest in wastewater treatment facilities and what the government should do to keep industrial estates developed in an environmentally sustainable manner.

The study sites covered Ho Chi Minh City, Binh Duong Province, Dong Nai Province and Ba Ria-Vung Tau Province, all located in southern Vietnam, where the process of urbanization and industrialization has evolved the fastest. The main objective of this study is to determine the factors affecting investment on common wastewater treatment plants in industrial estates.

Data was collected from 32 industrial estates in the four study areas. The mode included several visits to Infrastructure Construction Companies and selected industries. Secondary data was collected from the Industrial Estates Management Boards in the same areas.

The study identified the following reasons why not all industrial estates have set up wastewater treatment plants: (i) financial constraints, (ii) lax investment policies on environmental requirements (so as to attract investors), and (iii) inappropriate regulations and weak implementation.

Recommendations to address the problem include the provision of incentives for environment compliance, such as financial support for investment in wastewater treatment facilities, and effective metering and charging mechanisms for the use of water.

1. INTRODUCTION

1.1 Background

Urbanization and industrialization have progressed relatively quickly in Vietnam over recent decades. The implementation of the "Doi Moi" (Innovation) Policy in 1986 has changed the process of industrialization. Aside from the increase in output and export earnings, the development of the industrial sector in Vietnam has also raised demands for studies on its impact on the environment, especially on the increasing level of wastewater generated. As the government continues to emphasize the role of industrialization through incentives provided for the growth of industrial zones and export processing zones, the need to keep industries compliant with wastewater management has increased. The reality is that not all industrial estates have invested in common wastewater treatment plants. Despite the fact that all registered enterprises are required to manage their wastewater properly under the Environment Protection Law (1994) and related regulations such as Decree No. 36/CP (1997), Decretive No. 264/TTg (1997) and Circular No. 08/KHDDT (1997), water pollution caused by industrial waste is still significant.

Although concerned authorities have improved environmental management in industrial estates over recent years, effective pollution control from national to local levels remains limited. This suggests a need for more effective regulation, enforcement and supporting services.

1.2 Statement of the Problem and Research Focus

The establishment of industrial estates is considered by policy-makers as an important strategy in achieving economic development. Numerous industrial zones have been constructed in Vietnam since 1993 to hasten industrialization throughout the country. In theory, industrial estates offer a potential environmental benefit by creating the opportunity for more effective industrial pollution control. In practice, however, many industrial estates have not implemented centralized or common wastewater treatment plants and hence, have created a greater threat to the water environment. This raises the question of what factors are causing this situation and what would be an appropriate approach to address the problem.

This study aims to provide an analytical overview of wastewater management in Vietnam based on key industrial estates located in Ho Chi Minh City, and Binh Duong, Dong Nai and Ba Ria-Vung Tau Provinces. The study also looks into the constraints of financing wastewater treatment plants in these industrial estates and presents the fundamental differences between estates with and without wastewater treatment plants. Finally, the study gives recommendations on how to improve wastewater management in industrial estates in order to contribute to sustainable development in Vietnam.

1.3 Research Objectives

The main objective of this research is to understand the economic and regulatory environment affecting investment decisions on constructing common wastewater treatment plants in industrial estates.

The specific objectives are as follows:

- To provide an overview of the set-up of industrial estates in Ho Chi Minh City, and Binh Duong, Dong Nai, and Ba Ria-Vung Tau Provinces, focusing on wastewater management in these sites, especially on investment in treatment plants and constraints, if any.
- To determine the fundamental differences between industrial estates with and without wastewater treatment plants.
- To compare the regulatory requirements for enterprises within and outside industrial estates.
- To identify factors influencing investment decisions on common wastewater treatment plants in industrial estates.
- To make recommendations to policy-makers.

2. INDUSTRIALIZATION IN VIETNAM

2.1 Industrialization in General

In the late 1980s, the Vietnamese government implemented a series of economic reforms to energize the economy and establish conditions for sustainable growth. The government focused on industrialization as the main means to achieve this. The vision is the creation of designated, diversified, export-oriented industrial zones equipped with good infrastructure.

With the introduction of the “Doi Moi" (Innovation) Policy in 1986, Vietnam has significantly opened itself up to international trade and investment, empowering the private sector and reforming state-enterprise systems. The industrial sector has attracted more and more investors, growing at a rapid rate. The production capacity of several industrial products has risen considerably. Industry’s contribution has increased from 26 percent of the Gross Domestic Product (GDP) in 1995 to more than 32 percent in 2002 (VDN, 2002) contributing to socio-economic stability and poverty reduction. As a result, GDP has more than doubled over the past decade.

The Ministry of Planning and Investment (MPI) reported that the number of foreign direct investment projects granted licenses in 2002 increased remarkably (VDN, 2002). The average annual growth rate during the 1990s was about 11.2 percent. The targeted average annual growth rate from 2001–2010 is 10 percent (VDN, 2002). The government regards industrialization as the key to accelerated economic growth in the coming decades. The restructuring of a number of industries has led to the development of more industrial and export-processing zones in Vietnam.

Vietnam's industrial sector currently accounts for approximately 32 percent of its GDP (VDN, 2002). The industrial and construction sectors were the main contributors to growth in 2001 – more than 7.2 percent. This trend continued in 2002, at 14 percent in the first quarter. Non-state domestic industrial production grew the fastest at 20 percent in 2001 while in the first quarter of 2002, industrial output grew by 21 percent. The state and foreign-invested sectors experienced more modest but still significant growth rates of around 12 percent. Collectively, the non-state domestic and the foreign-invested sectors now produce almost 60 percent of the total industrial output in the country (VEZ, 2002).

2.2 Industrial Estates

The establishment of industrial estates or zones in Vietnam is an important step towards industrialization. Industrial zones provide good infrastructure and facilities, thus attracting small and medium-sized enterprises. Industrial estates or zones in Vietnam can be classified into three types: Industrial Parks, Export Processing Zones, and Hi-Tech Industrial Zones. The differences among these lie in the market and level of technology used. In export processing zones, all products manufactured are exported to other countries whereas those produced in industrial parks are consumed locally. Only hi-technology industries are located in hi-tech industrial zones.

The main function of industrial estates is to supply industrial products for both domestic and export markets. The industries registered in estates belong to different categories, and vary in scale and type of ownership. Most of the industries are medium-scale and the common ownership is either joint stock or joint venture. Each industrial estate consists of various industries such as machinery, food processing, textile and garments, construction materials, electronic assembling, and chemicals. These estates are mostly located in suburban areas, far from main urban areas, or along coastal areas. There are no residential areas within industrial estates. Therefore, the measurement of pollution, including water pollution, is confined to the activities of the industrial estates.

As part of the industrialization and sustainable development process, enterprises are encouraged to move to industrial zones through urban upgrading programs or reconstruction programs. The number of industries in the estates has been steadily increasing, with corresponding increase on their effect on the environment.

In terms of investment in infrastructure, most industrial estates have new infrastructure and good investment conditions. Investment in infrastructure includes the construction of roads, electricity and water supply systems, warehouses, and waste treatment facilities.

Compared to other industrial areas, industrial estates are given high priority by administrative bodies to develop infrastructure facilities mainly to attract investors. Industrial estates should, therefore, speed up infrastructure construction.

Investors are attracted to register in industrial zones due to the following reasons: (i) reduction in tax for specific industries, e.g. machinery and food processing, (ii) exemption from import tax on raw materials, (iii) favorable conditions (like tax reduction, and subsidies for promotions, advertisement and employment) for industries that are considered less hazardous to the environment, (iv) provision of good infrastructure facilities, and (v) awarding of certificates to industries which promote environment protection.

In mid-1991, the Department of Industry and Department of Planning and Investment of Ho Chi Minh City (HCMC) suggested to the Municipal People's Committee and the then National Committee on Cooperation and Investment, (currently the Ministry of Investment and Planning), to establish the first export-processing zone in HCMC. Since 1994, the number of industrial zones has steadily increased (12 in 2002, and projected to grow to 15 in the next few years). By the end of 2000, Vietnam had 67 industrial zones of which three were export processing zones and one, a hi-tech zone (VEZ, 2002). These zones are spread out over 27 provinces of the country. Their development is closely related to the rate of economic growth of each region. Northern Vietnam has 14 estates, mainly located in Ha Noi City, and Hai Phong and Quang Ninh Provinces. The central region has 13, in the Thanh Hoa, Nghe An, Da Nang, Quang Nam, Quang Ngai and Khanh Hoa Provinces. Southern Vietnam has 40 estates, mostly located in HCMC and neighboring provinces such as Binh Duong, Dong Nai and Ba Ria-Vung.

In terms of capital investment, 260 industries with a total registered capital of USD 720 million from foreign investors and VND 3,500 billion (or about USD 240 million) from domestic ones were granted licenses in 1999. In 2000, more than 900 industries with a registered capital of about USD 8 billion were approved (VEZ, 2002). Aside from domestic enterprises, foreign investment came from 24 countries. By the end of 2002, there were more than one thousand foreign-invested projects established in industrial zones with a total investment of more than USD 10 billion, equivalent to one-third of Vietnam's total foreign capital. The industrial estates have provided employment to more than 300,000 people (VEZ, 2002).

The southern economic region, which consists of Ho Chi Minh City, and Binh Duong, Dong Nai, and Ba Ria-Vung Tau Provinces, has grown to be a major contributor to the national economy, accounting for about 32 percent of the overall revenues from all industrial zones in Vietnam and 60 percent of the total export revenue in 2002. In this region, the process of urbanization and industrialization has evolved the fastest, compared with other regions where land clearance and infrastructure construction are slower. The growth of industrial estates here can be attributed to concentrated investments in major industries like electronics, textile and garments, and food processing. Nearly 50 percent of the industrial estates have complete infrastructure. On average, the occupancy rate is 30 percent. Government and industrial zone authorities have actively participated in investment incentive

policies through, inter alia, the implementation of new regulations on administrative procedures. This has encouraged investors to increase their investment in industrial zones.

2.2.1 The Study Sites

The study sites were in Ho Chi Minh City, Binh Duong Province, Dong Nai Province and Ba Ria-Vung Tau Province. These places rank the highest in terms of number of industrial zones and industries. In Ho Chi Minh City, ten industrial zones have been operating, including two for export processing. Registered enterprises totaled 512 and the number is expected to increase in coming years. Binh Duong Province has seven industrial zones while Dong Nai Province has ten industrial zones under operation together with another nine to be established in the next ten years. Compared with other provinces, Ba Ria-Vung Tau Province has only five zones operating. However, Ba Ria-Vung Tau often ranks within the top three provinces with the highest amount of invested capital in the country. This indicates its potential to increase the number of industrial estates and expand existing ones.

Local authorities from Binh Duong and Dong Nai Provinces have offered incentives including simplified procedures, low land rental prices and favorable tax policies to lure foreign and domestic investors. Therefore, industrial estates in these two provinces have relatively grown rapidly. These estates specialize in export-oriented commodities such as electronics, processed food and beverages, garments, and footwear. In the case of Ba Ria-Vung Tau, its strategic location in a coastal area has attracted more investment for infrastructure. It accounts for a number of projects, namely steel, plastics, and chemicals, worth hundreds of millions of dollars in recent years.

Ho Chi Minh City is the most attractive location in Vietnam for foreign investment. In 2002, the Municipal People's Committee approved 227 new foreign-invested projects with an approximate capital of USD 500 million (VEZ, 2002).

In spite of rapid growth, industrial zones still battle problems relating to management, proper infrastructure development, investment decisions, and environmental pollution.

2.2.2 Structure of Industrial Estate Management in Vietnam

In 1992, the Prime Minister granted permission to establish an industrial estate. (This was Tan Thuan, the first industrial estate to be established after 1975 when Vietnam was unified. Some had been established in Dong Nai Province before 1975.) The Ministry of Planning and Investment (MPI), the Ministry of Science, Technology and Environment (MOSTE) and the Ministry of Trade, and other related ministries, cooperated with the local municipal or Provincial People's Committee to form an Industrial Estate Management Board. The Industrial Estate Management Board then established an Infrastructure Construction Company (also called Infrastructure Development Company or Infrastructure Development Corporation). This unit has direct responsibility to carry out construction on industrial estates including that of common wastewater treatment plants.

The chart below (Figure 1) illustrates the role of different agencies in industrial estate management. The government leases the land to the management boards of the industrial zones who collaborate with the Department of Science, Technology and Environment (DOSTE) of the province to manage the zones. Each estate has an Infrastructure Development Company responsible for infrastructure facilities. The Department of Science, Technology and Environment is to ensure that each factory complies with environmental laws and to monitor the process and quality of water treatment by regular testing before disposal or reuse. There should be good coordination between the Industrial Estate Management Board and the Department of Science, Technology and Environment.

The Ministry of Science, Technology, and Environment (MOSTE) is one of the most important government agencies in environmental monitoring and control in industrial estates. The requirements for pollution control were established under the Law on Environmental Protection (1993) and it was followed by Government Decree No. 175/CP (Guidance for the Implementation of the Law on Environmental Protection, 1994).

The National Environmental Department is in charge of monitoring general environmental law compliance. At the provincial level, DOSTE is the organization that directly manages problems related to the environment. There are no environmental institutions below this provincial level. A main contributing factor to the failure by industries to observe environmental controls and to treat waste emissions is capacity and resource constraints in government agencies which remain largely dependent on self-reporting by the enterprises as a means of measuring compliance. The lack of enforcement remains a persistent feature in environmental legislation in industrial estates.

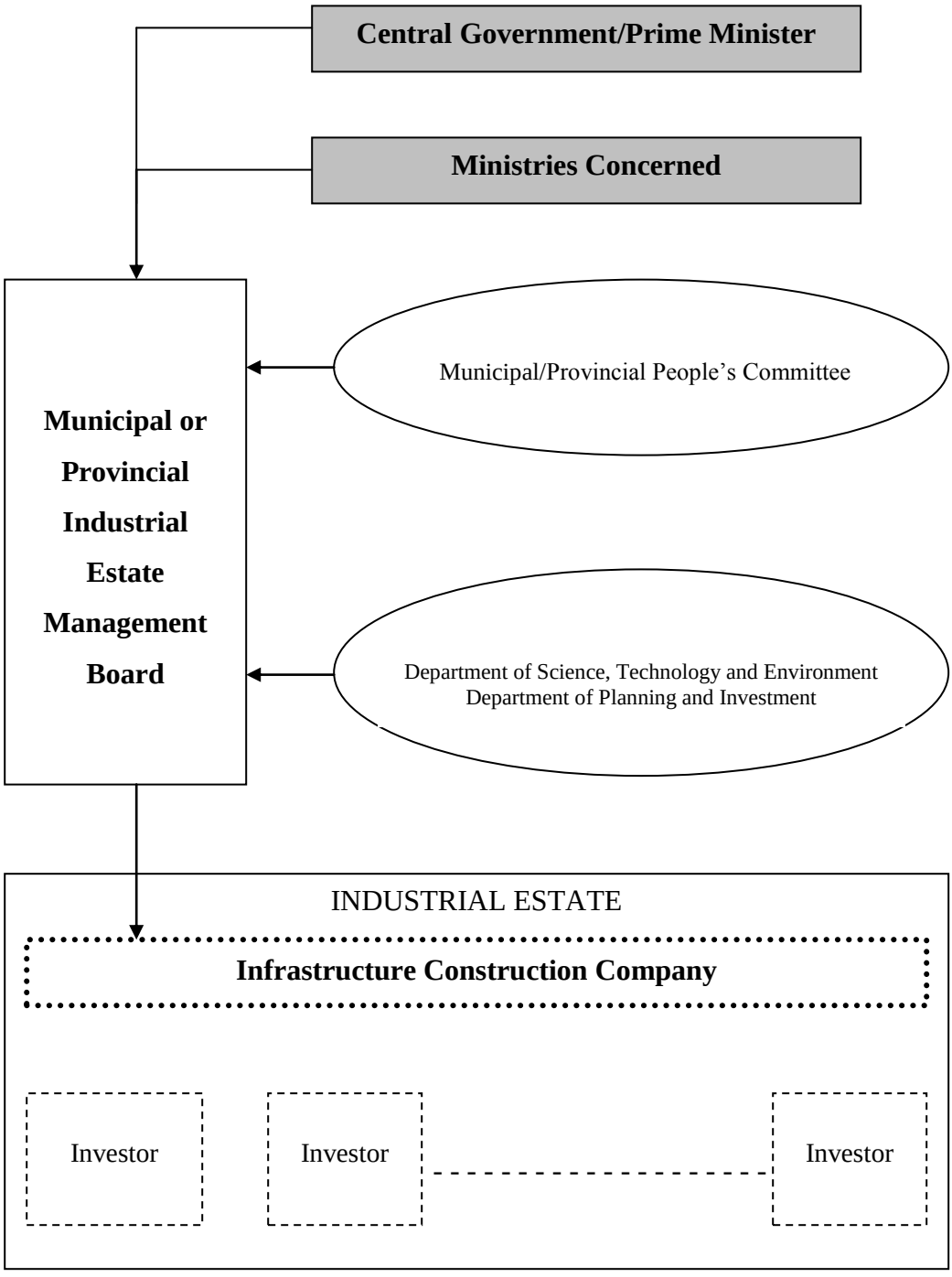

Figure 1. Structure of Industrial Estate Management

2.2.3 Government Activities in Recent Years

The government has put into effect the following actions concerning investment and environment protection, as presented in Table 1.

Table 1. Institutional Action on Investment and Environment Protection from 1998-2001

Year	Activities
1998	• Issued a new Decree (Decree on Foreign Investment Promotion, 1998) on foreign investment providing additional incentives to foreign investors. Amended the Law on Promotion of Domestic Investment, (1999) allowing domestic and foreign organizations and individuals, to buy shares or to contribute capital to domestic enterprises, including equitized (changing state-owned capital to equity) State-owned Enterprise, and provided additional incentives for new domestic investment. • Provided regulations on secured transactions (Decree 165/1999/ND-CP), enabling mortgages of land-use rights and houses, and collateralized lending on assets ranging from materials, machines, and production equipment to bonds, shares, and property rights. • Provided regulations on the organization and operation of a Development Support Fund (Decree 50/1999/ND-CP, July 8, 1999). The Fund is a point of access for medium and long-term development finance for private and public enterprises. • Revised Land Law to allow use of leasehold rights and land-use rights, including conversion and transfer of title, as collateral for banks or joint-ventures.
1999	• Approved the Enterprise Law and issued decrees to implement it, eliminating a number of discretionary restrictions on the establishment of private business.
2000	• Implemented the Enterprise Law which was approved in 1999 effectively by revoking unnecessary business licensing restrictions for 145 industries, trades, and services. • Revised the Foreign Investment Law (1996) to create more favorable conditions for foreign investors such as improving access to foreign exchange, allowing mortgaging of land by foreign banks in Vietnam, permitting automatic registration for export-oriented foreign investment projects, and making provisions for the government to issue guarantees for large infrastructure projects. • Established the first stock exchange center in Ho Chi Minh City, to deal in treasury bonds and shares of listed companies.
2001	• Created easy access to information by establishing an Enterprise Information Center under the Ministry of Planning and Investment (MPI) on enterprises registered under the Enterprise Law (Decision 75/2000/QD-BKH of Feb 28, 2001). • Allowed Vietnamese residing overseas to possess land-use rights, and decentralized the control and monitoring of land-use rights to enhance the functioning of the real estate market.

3. INDUSTRIAL POLLUTION CONTROL IN VIETNAM

3.1 Institutional and Legislative Framework of Industrial Pollution Management

The rapid increase in industrial activity combined with the lack of environmental protection measures has adversely affected the environment. Signs of environmental decay and the depletion of natural resources are particularly evident in big cities like Ho Chi Minh, Bien Hoa, and Ba Ria-Vung Tau (Su 2000). Public awareness of industrial pollution has increased in these cities through the reporting of cases of water pollution by the media and research institutions (Dang and Nhue 2000).

3.1.1 National Institutions

The Ministry of Science, Technology and Environment (MOSTE), established in 1992, and the National Environment Agency (NEA), established under MOSTE in 1993, are the government bodies in charge of environmental protection. Their main role is to promote scientific studies on the environment, formulate environmental policies, coordinate international cooperation on environmental issues, and screen large investment projects in terms of environmental impact.

The Ministry of Planning and Investment (called the State Planning Committee before being renamed last year) is the lead agency in charge of developing economic plans, preparing national investment plans, and determining external assistance requirements. Moreover, it is the agency in charge of approving foreign investment projects through a formal review process including environmental review.

3.1.2 Provincial Institutions

The Department of Science, Technology and Environment (DOSTE) plays an important role in monitoring the adherence of industries to environmental laws. The Municipal or Provincial People's Committee locally funds the DOSTE. DOSTE has formal authority to review and comment on the environmental impact of investment applications and to resolve pollution-related disputes. Particularly, the DOSTE of Ho Chi Minh City has taken an innovative approach in dealing with environmentally hazardous industries in the city. It annually identifies these industries and has created an annual monitoring program to ensure that they comply with the city's effluent limits within a certain period. The profiles of these industries are documented in a "Black Book". Any industry listed in the "Black Book" will be fined and ordered to shut down operations if the number of violations committed is excessive.

3.1.3 Legislation and Regulations

In Vietnam there are three main levels of environmental legislation: the National Environmental Protection Law (1993) and the 1995 National Environmental Standards,

administrated by MOSTE; sector-specific laws and regulations related to environmental and human health protection; and provincial-level environmental regulations and standards.

Industrial pollution control has become a matter of national priority. There are four major laws on environmental protection, and those related to water pollution control are as follows:

- The Law on Environmental Protection (1993),
- The Prime Minister's Decree on Environmental Protection (1993),
- Guidelines for Environmental Impact Assessment (1994), and
- Environmental Quality Standards (1994)

The Law on Foreign Investment (1996) in Vietnam and Government Decree No. 36/CP (1998) provide an attraction to industrial zone investors. The investment license approval process is decentralized and simplified for enterprises that invest and operate within industrial zones. They also get priority and favorable conditions on taxation, land-rent rates, etc. which investors who operate outside industrial zones do not receive.

According to the Law of Environmental Protection (LEP, 1993), all enterprises must have wastewater treatment facilities in order to protect and conserve the environment (LEP, 1993, Chapter II, Statement 16). The Department of Science, Technology and Environment is responsible to the Municipal or Provincial People's Committee in carrying out environment protection activities (LEP, 1993, Chapter IV, Statements 38, 39, and 40). It has the right to issue and recall certificates of environment standards (LEP, 1993, Chapter VI, Statement 37) resulting in the cessation of factory operations for a specified period of time.

Decree 76/2002/QD-UB (LEP, 1993, Article 19) states that the infrastructure companies of industrial estates must invest in building common wastewater treatment plants when the rented area reaches fifty percent of the total land area.

Decree 175/CP (LEP, 1993) on "Guidelines to the Implementation of Environmental Protection Law" issued by the Prime Minister in 1994, states that the Department of Science, Technology and Environment has to cooperate with local authorities to assess the environmental impact of projects, and to monitor and enforce the implementation of the Law of Environmental Protection (Chapter II, Statement 5). In terms of water pollution control, the guidelines emphasize the role of concerned agencies to monitor and test the quality of water treated by industries (Chapter VI, Statement 27).

The Enterprise Law (1999) determines the rights and responsibilities of enterprises. It also describes the role of infrastructure development companies in industrial estates.

3.2 Vision of the Government on Environmental Protection in Industrial Zones

The Government has a well-enunciated vision for environmental protection and the sustainable use of resources for the period 2001 to 2010 in the form of the National Strategy

for Environment Protection. The overall vision is to protect and improve the environment to enhance the quality of life and health of the people, and to ensure the sustainable development of the country. That vision is to be achieved through two strategic objectives, namely, (i) the prevention and control of pollution, and (ii) the improvement of environmental quality in urban, industrial and rural areas.

The full implementation of pollution control policies demands heavy financial outlay by investors. Thus finding a balance between effective pollution control and attracting investors to industrial zones is a challenging task for policy-makers.

4. METHODOLOGY AND DATA COLLECTION

Wastewater management in industrial estates is the core issue in this study. The study team conducted several surveys and meetings with industrial zone managers, infrastructure construction companies, and investors of industrial zones in Ho Chi Minh City, and Binh Duong, Dong Nai, and Ba Ria-Vung Tau Provinces to gather primary and secondary data. In addition, collaboration with the Department of Science, Technology and Environment (DOSTE) in the four study sites was established in order to gather information on water pollution control in industrial estates. To compare the differences between enterprises located inside and outside industrial estates, a number of surveys were carried out on selected industries with the support of the DOSTE in each locality.

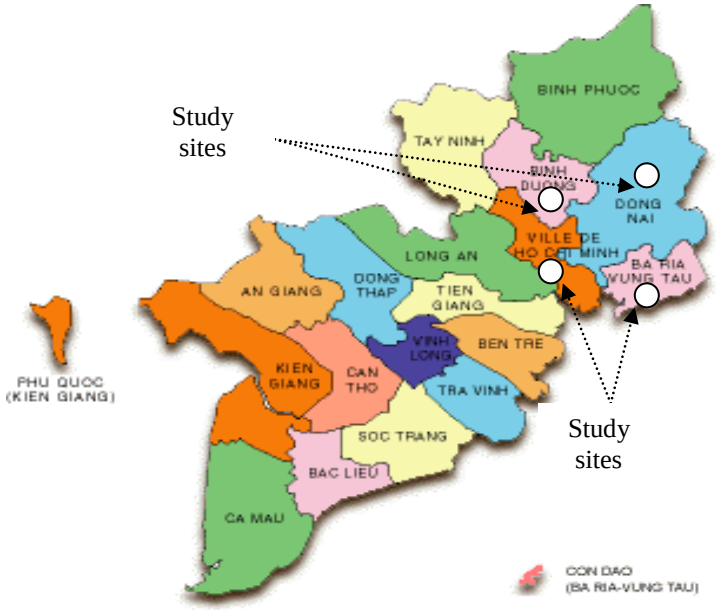

Figure 2. Map of South of Vietnam Showing the Four Study Sites

Surveys were conducted in seven industrial estates in Binh Duong Province, ten in Dong Nai Province, five in Ba Ria-Vung Tau Province, and eight industrial estates and two export processing zones in Ho Chi Minh City. Although samplings were confined to only one city and three provinces in the south of Vietnam, they actually covered up to 48 percent of the total number of industrial estates in the country at the time the study began (32 out of 66 industrial estates in Vietnam). Moreover, these study sites were the most attractive locations to both domestic and foreign industrial investors. In particular, the study sites presented different characteristics in terms of number of common wastewater treatment plants (WWT) and the rate of investment.

In each of the 32 industrial estates, two to three factories which contributed the most to water pollution were visited. Information gathered from interviews conducted helped identify the factors affecting the respective companies' decisions on environment compliance, and possible steps to ensure compliance. Descriptive analysis and trends were used in interpreting the data collected.

5. RESEARCH FINDINGS

5.1 Description of the Growth of Industrial Estates in the Study Areas

5.1.1 Binh Duong Province

Binh Duong has experienced rapid growth, especially in industry and infrastructure construction. The province has seven industrial zones operating with six new ones being planned or constructed, attracting numerous investment project proposals from domestic and foreign investors.

Towards the end of 2002, all industrial estates of the province received more than 200 projects totaling hundreds of millions of dollars in investment capital. The list of the industrial estates visited in Binh Duong Province is presented in Table 2.

Table 2. General Description of Industrial Estates in Binh Duong Province

Name of industrial estate	Date of establishment	Area (ha)	Investment capital (USD million)	Type of ownership
Viet Huong	1996	46	11.4	Viet Huong Joint Stock Corporation
Song Than 1	1996	180	24.9	State-owned
Song Than 2	1997	319	29.3	Thanh Le Joint Stock Corporation
Dong An	1997	123	16.1	Hung Thinh Joint Stock Company
Binh Duong	1996	26	1.6	State-owned
Tan Dong Hiep	1997	163	22.5	Joint Stock
Viet-Sing	1997	292	50.8	Joint Venture

Source: Industrial Estates Management Board of Binh Duong, and Viet-Sing Management Board, 2002.

All industrial parks of Binh Duong Province were established in 1996 or later. Except for Binh Duong and Song Than 1, the other industrial zones in the province have joint stock company ownership. Viet-Sing Industrial Zone has its own management board (Viet-Sing Management Board), while the other six industrial zones are under the management of the Industrial Estates Management Board of Binh Duong Province. These management boards have the right to issue construction permits, import/export quota certificates, and other such documents.

Table 3 shows that the majority of the enterprises are in the food processing, garment, and chemical industries. The overall average percentage of registered enterprises in relation to total land capacity of the industrial zones is 65 percent. For estates with and without common wastewater treatment (WWT), the average percentage is 73 and 40, respectively.

Table 3. Current and Expected Numbers of Investors in Industrial Estates of Binh Duong Province

Name of industrial estate	Number of investors	Expected number of investors at full capacity	Major industrial sectors
Viet Huong	28	50	Garments, lacquer ware, cosmetics, plastic
Song Than 1	41	50	Textile, chemicals, food processing, brewery
Song Than 2	40	60	Electrical appliances, beverages, chemicals
Dong An	47	70	Wood product, garments, furniture, footwear
Binh Duong	20	45	Electrical appliances
Tan Dong Hiep	18	50	Food processing, garments
Viet-Sing	70	80	Food processing, medicine, garments, leather products

Source: Industrial Estates Management Board of Binh Duong, and Viet-Sing Management Board, 2002.

Table 4 shows industrial zones that have already built common wastewater treatment (WWT) plants. Out of the seven industrial zones, only Binh Duong and Tan Dong Hiep have not yet constructed WWT plants. Industries in Binh Duong Industrial Zone are less of a threat in terms of water pollution, therefore there is less pressure to construct WWT plants. Tan Dong Hiep Industrial Zone has insufficient capital to construct WWT due to the low number of investors.

Table 4. Common Wastewater Treatment Plants in Binh Duong Province

Name of industrial estate	With common WWT plant	Name of operator	Capacity of common WWT plant (m^3/day)	Estimated discharge (m^3/day)
Viet Huong	Yes	Viet Huong Joint Stock Company	1,500	1,000
Song Than 1	Yes	Thanh Le Joint Stock Corporation	2,000	1,500
Song Than 2	Yes	Thanh Le Joint Stock Corporation	2,000	1,200
Dong An	Yes	Hung Thinh Joint Stock Company	2,000	600
Binh Duong	Not yet	-	-	300
Tan Dong Hiep	Not yet	-	-	300
Viet-Sing	Yes	Vietnam-Singapore Joint Stock Company	6,000	4,500

Source: Industrial Estates Management Board of Binh Duong, and Viet-Sing Management Board, 2002.

The Vietnam-Singapore Industrial Zone's common WWT plant has the highest capacity of 6,000 m^3/day, followed by Dong An, Song Than 1, Song Than 2 and Viet Huong, with treatment capacities ranging from 1,500 m^3/day to 2,000 m^3/day. These figures show that the operated capacities are low compared to the full capacities possible. The law requires investors in industrial zones without common WWT plants to build their own wastewater treatment plants. In reality, however, this has not been fully implemented due to the high costs involved.

The infrastructure construction company in each industrial zone has the function of building infrastructure facilities, including common wastewater treatment plants. Binh Duong, Song Than 1 and Song Than 2 industrial zones have the same infrastructure construction company, that is, the Thanh Le Joint Stock Development Corporation. Dong An Industrial Zone has the Hung Thinh Construction Joint Stock Company as its operator. Viet-Singapore and Viet Huong Industrial Zones have the Vietnam-Singapore Joint Stock Company and Viet Huong Joint Stock Company respectively.

As at the end of 2002, only the common WWT plants in the industrial zones in Viet-Sing, Song Than 1 and Song Than 2 operated above 70 percent capacity. In Viet Huong and Dong An, the operating level was lower than 50 percent of the full capacity.

The capital needed for common WWT treatment plants varied according to the size of the industrial estate and the level of technology the factories used. The lowest capital invested was USD 0.9 million (Viet Huong) and the highest was USD 1.6 million (Viet-Sing).

Table 5. Number of Factories and Common WWT Plants in Binh Duong Province

Name of industrial estate	Number of factories and wastewater treatment requirements			Number of factories not connected to common WWT plant		Number of factories connected to common WWT plant	
	Required	Not required	Total	With treatment	Without treatment	With pre-treatment	Without pre-treatment
Viet Huong	19	9	28	9	6	13	0
Song Than 1	29	12	41	7	12	18	4
Song Than 2	30	10	40	3	8	23	6
Dong An	29	18	47	7	11	15	14
Binh Duong	2	18	20	2	18	0	0
Tan Dong Hiep	11	7	18	8	10	0	0
Viet-Sing	60	10	70	5	5	55	5
Total	**180**	**84**	**264**	**41**	**70**	**124**	**29**

Source: Industrial Estates Management Board of Binh Duong, and Viet-Sing Management Board, 2002.

Based on the type of industry, factories are required to treat their wastewater by themselves or through centralized facilities. There are 264 factories in the seven industrial zones in Binh Duong Province, of which 180 (68%) are required to treat their wastewater. One hundred and fifty three (58%) of them are connected to common WWT plants. The remaining 111 factories (42%) have set-up their own wastewater treatment or sewerage facilities independent of common treatment plants.

Factories with big scale production and high volumes of wastewater disposal (such as those in the paper, food processing or textile industries) have either to set-up their own wastewater treatment facilities or use the common WWT plant of the industrial zone. Depending on the level of pollution in the wastewater, factories have to pre-treat their wastewater to required standards before discharge. (Factories must pre-treat their wastewater from Level C to Level B, before discharging to the common WWT plant which will further treat the water up to Level A.) Small scale factories with limited capital and land area find it cheaper to use common WWT plants rather than set up their own.

Table 6. Wastewater Treatment Fees in Industrial Estates of Binh Duong Province

Name of industrial estate	Form of charges	Wastewater treatment fees (USD/m^3)
Viet Huong	80% of incoming water, exemption for first 3 years	0.25
Song Than 1	80% of incoming water	0.22
Song Than 2	80% of incoming water	0.22
Dong An	75% of incoming water 70% of incoming water if ground water source	0.25
Viet-Sing	80% of incoming water	0.19

Source: Industrial Estates Management Board of Binh Duong, and Viet-Sing Management Board, 2002.

The methods of determining wastewater treatment fees are not uniform. However, they have one thing in common. They are usually based on the quantity of water consumed,

which is measured by water meters. Volumes charged vary by industrial zones and range from 70–80 percent (Table 6). The rates charged also vary among industrial zones, ranging from USD 0.19 per m^3 (Viet-Sing) to USD 0.25 per m^3 (Dong An and Viet Huong).

One disadvantage of this method of charging is that it does not fully consider the kind of production and level of pollution involved. It only takes into account the total volume of water discharged. The industries thus view it as unfair thereby negatively affecting their willingness to pay the fees.

Another weakness in industrial zones is the construction of the drainage system. The drainage system supports all factories that produce wastewater regardless of whether the wastewater is pre-treated or not. Those that do not pre-treat their wastewater can easily illegally discharge it into the common drainage system.

Most of the industrial zones in Binh Duong Province are newly established ones, ranging from small to medium scale. Therefore, their total volume of wastewater is below the full capacity of common WWT plants which are thus under-utilized.

5.1.2 Ho Chi Minh City

Ho Chi Minh City (HCMC) is an important economic region, attracting the highest number of investors compared to other areas. Industrial production in HCMC constitutes the major proportion of national economic output, contributing some 35 percent of the national GDP in the years 2001 and 2002. At the end of 2001, HCMC had about 30,000 small to medium enterprises. As at 2002, it had a total of ten industrial zones with more than 200 industries, together with two export processing zones with 150 industries in operation.

Ho Chi Minh City Export Processing and Industrial Zones Authority (HEPZA) is the highest local authority in HCMC, overseeing all industrial estate activities. According to HEPZA's regulations, industrial wastewater must be treated by the factory's treatment facilities to meet required standards before discharging the wastewater into a main collection pipeline. Each factory must send periodic reports on the results of wastewater treatment to HEPZA which conducts an annual inspection of pollution control measures in each factory.

As quoted in "Environmental Protection Activities" (VIZ, 2002), in the year 2001, the industries in HCMC discharged daily into the Sai Gon River and other rivers, an average of 100,000 m^3 out of a total volume of 650,000 m^3 of wastewater produced in the city.

Except for the industrial estates with common wastewater treatment plants, most industrial wastewater is not treated according to environmental requirements before being discharged into the rivers. Although both DOSTE and HEPZA have monitored the situation, there are still inadequate wastewater treatment facilities. The poorly treated wastewater is discharged to the city's rivers, causing very bad impact on the environment and threatening future economic development.

In 2002, Ho Chi Minh City had ten industrial zones in operation, of which two are export processing zones. Another six industrial zones are planned to be built in the next few

years. Towards the end of 2002, all industrial estates in HCMC had received more than USD 1.5 billion worth of investment through hundreds of projects registered.

Industrial estates in HCMC have been established since 1992 starting with the Tan Thuan Export Processing Zone. Tan Thuan is a joint-venture between Vietnam and Taiwan. The ownerships of other estates are either state or joint stock corporations. The total leased area of all the estates is nearly 1,500 ha.

Table 7. General Description of Industrial Estates in Ho Chi Minh City

Name of industrial estate	Date of establishment	Area (ha)	Investment capital (USD million)	Type of ownership
Le Minh Xuan	1997	100	79.6	Joint Stock
Tan Tao	1996	250	227.2	Tan Tao Joint Stock Corporation
Vinh Loc	1997	207	118.8	State-owned
Tay Bac Cu Chi	1997	215	68.3	Joint Stock
Tan Binh	1997	142	90.5	State-owned
Linh Trung 1 EPZ	1992	62	120.1	Joint Venture
Linh Trung 2	1997	60	98.4	Joint Stock
Binh Chieu	1996	28	85.7	Joint Venture
Tan Thoi Hiep	1997	29	42.5	Joint Stock
Tan Thuan EPZ	1991	300	637.6	Joint Venture

Source: HCMC Export Processing & Industrial Zones Authority, 2002.

As indicated in Table 8, the main industries are textile, garment, food processing, and electrical appliances. The ratio of actual registered enterprises to full occupancy is about 7:10. Tan Thuan Export Processing Zone and Le Minh Xuan Industrial Zone have the highest occupancy (above 90 percent), followed by Linh Trung 1, Vinh Loc and Tan Tao.

Table 8. Characteristics of Industrial Estates in Ho Chi Minh City

Name of industrial estate	Number of factories	Expected number of factories at full capacity	Major industrial sectors
Le Minh Xuan	119	130	Textile, dyeing, paper product electrical equipment, chemicals, machine
Tan Tao	80	120	Food processing, textile,

			dyeing, chemicals, electrical appliances, paper product
Vinh Loc	42	60	Electronics, garment, plastic, construction materials
Tay Bac Cu Chi	28	90	Food processing, textile, garment, electrical equipment, paper products
Tan Binh	49	95	Food processing, textile, electronics, machine
Linh Trung 1 EPZ	45	50	Clothes, wood processing, electrical equipment
Linh Trung 2	12	35	Clothes, wood processing, paper products
Binh Chieu	14	30	Food processing, paper product, chemicals, machine
Tan Thoi Hiep	22	40	Food processing, textile, garment, products from metal
Tan Thuan EPZ	105	115	Food processing, beverages, electronics, textile

Source: HCMC Export Processing & Industrial Zones Authority, 2002.

Although all ten industrial zones had committed to building common WWT plants by the year 2003, only 50 percent of them had WWT plants at the end of 2002. These are Le Minh Xuan, Tan Tao, Linh Trung 1, Linh Trung 2 and Tan Thuan.

The industrial zones with common WWT plants have 80 percent (361 out of 450 registered enterprises) occupancy, while the zones without common WWT plants have only about 49 percent occupancy (155 out of 315 registered enterprises).

According to Table 9, the Tan Thuan Export Processing Zone treatment plant has the highest capacity at 10,000 m^3 per day, followed by Linh Trung 1 & 2, Tan Tao and Le Minh Xuan. Similar to the scenario in Binh Duong Province, these figures show that there still exists a significant gap between actual and full capacities of treatment plants. Among the five industrial estates with common WWT plants, Linh Trung 1 has the highest ratio of actual capacity over full capacity, followed by Le Minh Xuan, Linh Trung 2, Tan Tao and Tan Thuan. It is noticeable that in the case of Tan Thuan, the estimated volume discharged daily is far below full treatment capacity even with full occupancy.

Table 9. Common Wastewater Treatment Plants in Ho Chi Minh City

Name of industrial estate	**With common WWT plant**	**Name of operator**	**Capacity of common WWT plant (m^3/day)**	**Estimated discharge (m^3/day)**
Le Minh Xuan	Yes	Binh Chanh construction company	2,000	1,200
Tan Tao	Yes	Tan Tao construction company	3,000	1,500
Vinh Loc	Not yet	Cholimex company	-	1,500

Tay Bac Cu Chi	Not yet	Cu Chi Trade and Investment company	-	Not available
Tan Binh	Not yet	Tan Binh Import-Export company	-	1,500
Linh Trung 1 EPZ	Yes	Linh Trung joint venture company	3,000	2,500
Linh Trung 2	Yes	Phu Nhuan construction and trade company	5,000	2,500
Binh Chieu	Not yet	Ben Thanh general company	-	Not available
Tan Thoi Hiep	Not yet	Tan Thoi Hiep Ltd. Co	-	Not available
Tan Thuan EPZ	Yes	Tan Thuan joint stock corporation	10,000	3,500

Source: HCMC Export Processing & Industrial Zones Authority, 2002.

As for the other provinces, the infrastructure construction companies of industrial estates in HCMC are also called construction companies, investment companies or joint stock corporations, with similar functions, particularly investing in infrastructure for registered industries. Except for the Cholimex Company (Vinh Loc) and Tan Binh Import-Export Company (Tan Binh), all other infrastructure companies in HCMC are under joint stock or joint venture ownership.

The capital outlay for investment on treatment plants varied by industrial zones. The lowest cost was USD 1.2 million (Binh Chieu) and the highest cost was USD 2.8 million (Tan Thuan) – heavy capital outlays. The infrastructure company of a small industrial zone with a limited number of investors will, therefore, give priority to setting up other facilities rather than a wastewater treatment plant.

For industries connected to common WWT plants, their wastewater must be pre-treated up to Level B before being discharged into the common treatment system. For industrial zones without common WWT plants, the factories that produce polluted water must treat it themselves, up to standard emission Level A, as specified by the Law of Environmental Protection (1993). It is difficult and costly for investors to meet this specification.

Small enterprises with limited capital and land area will thus find it easier and cheaper to treat their wastewater through the estate's centralized treatment plant rather than treating it themselves.

However, some factories choose not to use common treatment plants. These are usually large-scale industries which produce high volumes of wastewater daily, like the textile and food processing industries in Le Minh Xuan, Tan Binh, Vinh Loc and Tan Thoi Hiep estates, and treat their own water.

Table 10. Number of Factories and Common WWT Plants in Ho Chi Minh City

Name of industrial estate	Number of factories and wastewater treatment requirements			Number of factories not connected to common WWT plant		Number of factories connected to common WWT plant	
	Required	Not required	Total	With treatment	Without treatment	With pre-treatment	Without pre-treatment
Le Minh Xuan	97	22	119	21	26	52	20
Tan Tao	65	15	80	12	8	46	14
Vinh Loc	25	17	42	15	27	0	0
Tay Bac Cu Chi	16	12	28	16	12	0	0
Tan Binh	36	13	49	30	19	0	0
Linh Trung 1 EPZ	31	14	45	0	10	27	8
Linh Trung 2	8	4	12	0	4	8	0
Binh Chieu	5	9	14	5	9	0	0
Tan Thoi Hiep	13	9	22	13	9	0	0
Tan Thuan EPZ	72	33	105	6	27	55	17
Total	**368**	**148**	**516**	**118**	**151**	**188**	**59**

Source: Source: HCMC Export Processing & Industrial Zones Authority, 2002.

According to Table 10, there are 516 factories in the industrial zones operating in Ho Chi Minh City, of which 368 (71%) are required to treat their wastewater. About 48 percent (247 out of 516) are connected to a common WWT plant.

In estates with common WWT plants, 273 out of 361 (76%) factories are required to treat their wastewater, and in the estates without WWT plants, the ratio is 95 out of 155 (61%). For factories which are not connected to common WWT plants, 118 out of 269 (44%) treat their wastewater. This proportion is 39 out of 114 (34%), and 79 out of 155 (51%), for estates with and without common WWT plants, respectively. Information on how many of them actually meet the required standard, however, could not be obtained through the research interviews.

Table 11. Wastewater Treatment Fees in Industrial Estates in Ho Chi Minh City

Name of industrial estate	Form of charges	Wastewater treatment fees (USD/m^3)
Le Minh Xuan	90 % of used water, paid monthly	0.20
Tan Tao	80 % of incoming water	0.25
Vinh Loc	-	-

Tay Bac Cu Chi	-	-
Tan Binh	-	-
Linh Trung 1 EPZ	80 % of incoming water	0.38
Linh Trung 2 EPZ	80 % of incoming water	0.38
Binh Chieu	-	-
Tan Thoi Hiep	-	-
Tan Thuan EPZ	3% over total revenue	-

Source: Infrastructure companies of HCMC's estates, 2002.

The WWT fees applied in HCMC industrial estates are not uniform. They range from USD 0.20 per m^3 (Le Minh Xuan Industrial Park) to USD 0.38 per m^3 (Linh Trung Export Processing Zones). The quantity of water consumed, measured by water meters, is usually the basis for charging. The infrastructure company at Le Minh Xuan Industrial Park charges the highest rate, i.e. 90 percent of the water consumed. On the other hand, Tan Thuan charges based on the total revenue of the respective companies. Compared with the industrial zones in Binh Duong Province (Table 6), the WWT fees of those in HCMC are higher (Table 11).

5.1.3 Dong Nai Province

Dong Nai Province is one of the major industrial centers in the south of Vietnam. Similar to HCMC and Binh Duong Province, Dong Nai Province's estates developed fast in terms of numbers as well as capital investment. Dong Nai Industrial Zones Authority (DIZA) has the function of managing all industrial estate activities within the province. As at the end of 2001, there were 250 projects registered in Dong Nai's industrial estates with a total investment capital equivalent to USD 2.7 billion. In 2002, Dong Nai ranked among the highest in terms of the number of industrial estates established and the magnitude of investment in them. The overall average leased area in its industrial estates was 63 percent. The names of the ten industrial estates operating in Dong Nai Province are presented in Table 12. The province aims to establish seven more industrial zones by the year 2010.

Water pollution is an important issue in Dong Nai as wastewater from its industrial zones is the major source of pollution of its rivers. Except for some industrial zones with common treatment plants, many enterprises still lack wastewater treatment facilities or do not fully comply with environmental regulations, so untreated wastewater is often discharged directly into the rivers.

Table 12. General Description of Industrial Estates in Dong Nai Province

Name of industrial estate	Date of establishment	Area (Ha)	Investment capital (USD million)	Type of ownership
Bien Hoa 1	1963	335	368	Joint Stock
Bien Hoa 2	1993	365	420	Joint Stock
Amata	1994	760	275	Joint Venture
Loteco	1996	100	77	Joint Venture
Nhon Trach 1	1995	430	Not available	Joint Stock
Nhon Trach 2	1997	350	Not available	Joint Stock
Nhon Trach 3	1997	368	30	Joint Stock
Go Dau	1995	186	Not available	Joint Stock
Ho Nai	1999	226	Not available	Joint Stock
Song May	1998	471	Not available	Joint Stock

Source: Dong Nai Industrial Zones Authority, 2002.

Among the operating industrial zones of Dong Nai, Bien Hoa 1 is the oldest. It was constructed in 1963, and has been upgraded in recent years. All of the industrial zones have ownership in the form of joint stock or joint venture. Due to the advantage of physical conditions, for example, location and land availability, industrial zones in Dong Nai Province are relatively large compared with other provinces.

Bien Hoa 2, Bien Hoa 1 and Amata industrial zones have received the highest capital investment due to their location and level of development (Table 13).

Table 13. Characteristics of Industrial Estates in Dong Nai Province

Name of industrial estate	Number of factories	Expected number of factories at full capacity	Major industrial sectors
Bien Hoa 1	69	70	Machine, textile, construction materials, chemical, electrical appliances
Bien Hoa 2	106	110	Food processing, tobacco, textile, wood processing, paper products, electrical appliances
Amata	29	40	Textile, paper products, plastic, chemicals
Loteco	18	35	Equipment, machine, textile, construction materials
Nhon Trach 1	15	80	Textile, suitcase, chemicals, equipment
Nhon Trach 2	19	50	Textile, chemicals
Nhon Trach 3	16	60	Textile, dyeing
Go Dau	16	80	Chemicals, electrical equipment
Ho Nai	26	70	Construction materials, textile, garment, chemicals, electronics
Song May	12	70	Food processing, textile, metal products

Source: Dong Nai Industrial Zones Authority, 2002.

Industries in Dong Nai's estates concentrate on textiles, paper, chemicals, food processing and electrical appliances.

Average ratio of actual registered enterprises over numbers at full occupancy is nearly 50 percent (326 out of 665). In Bien Hoa 1, 2 and Amata industrial zones, however, the occupancy is almost 100 percent. Other estates like Nhon Trach's, Go Dau and Song May have quite low occupancy rates. In estates with common treatment plants, 184 (53%) out of 345 factories are required to treat wastewater, and in the estates without treatment plants, the ratio is 142 (44%) over 320 factories.

Table 14. Common Wastewater Treatment Plants in Dong Nai Province

Name of industrial estate	**With common WWT plant**	**Name of operator**	**Capacity of common WWT plant (m^3/day)**	**Estimated discharge (m^3/day)**
Bien Hoa 1	Not yet	SONADEZI	-	Not available
Bien Hoa 2	Yes	URBIZ	4,000	3,000
Amata	Yes	SONADEZI and ACP	1,000	250
Loteco	Yes	LOTECO IZ	1,500	300
Nhon Trach 1	Yes	URBIZ	4,000	1,000
Nhon Trach 2	Not yet	CIC2	-	Not available
Nhon Trach 3	Not yet	TNC	-	Not available
Go Dau	Yes	SONADEZI	3,000	1,000
Ho Nai	Not yet	CICC	-	Not available
Song May	Not yet	JSMIZD	-	Not available

Source: Dong Nai Industrial Zones Authority, 2002.
Notes:
SONADEZI: Corporation for the Development of Bien Hoa Industrial Zone
URBIZ: Corporation for the Development of Urban and Industrial Zone
ACP: Amata Corporation Public Co., Thailand
LOTECO IZ: Long Binh Techno Park Development Company
CIC2: Civil Industrial Construction Number 2
CICC: Construction and Invest Consult Company
TNC: Tin Nghia Corporation
JSMIZD: Joint Venture for Song May Industrial Zone Development

Infrastructure development agencies in Dong Nai's industrial zones are joint stock corporations/companies. Table 14 shows that five out of ten industrial zones in Dong Nai, namely, Bien Hoa 2, Amata, Loteco, Go Dau and Nhon Trach 1 already have common wastewater treatment (WWT) plants under operation. Bien Hoa 2, one of the biggest estates in Dong Nai Province, and Nhon Trach 1 both have a common WWT plant with a capacity of 4000 m^3 per day; followed by Go Dau, Loteco and Amata with a capacity of 3,000 m^3 per day, 1,500 m^3 per day, and 1,000 m^3 per day, respectively.

In the industrial zones without common WWT plants, factories have to treat their wastewater themselves according to required standards. Some enterprises located in industrial zones with common treatment plants also treat their wastewater independently. For example,

in the Bien Hoa 2 industrial zone, the Fujitsu Company treats 1,600 m^3 of wastewater per day using its own treatment facility, and the Bien Hoa Sugar Company daily treats 1,000 m^3 of wastewater.

As at the end of 2002, the Bien Hoa 2 Industrial Zone could operate its treatment plant at 75 percent capacity. Plants in the other zones were running at only 30 percent or lower. Although Bien Hoa 1 has been established longer and has a high number of industries, its wastewater treatment has been done mainly by the industries themselves. The limitation of land area and high cost of reconstructing existing facilities are major constraints to setting up a centralized treatment plant.

Newer estates registered look forward to having common treatment plants in coming years. The construction of a common wastewater treatment plant is, however, very expensive for estate investors. The lowest cost is about USD 1.0 million (Loteco) and the highest cost is USD 3.0 million (Bien Hoa 2).

Table 15. Number of Factories and Common WWT Plants in Dong Nai Province

Name of industrial estate	**Number of factories and wastewater treatment requirements**			**Number of factories not connected to common WWT plant**		**Number of factories connected to common WWT plant**	
	Required	**Not required**	**Total**	**With treatment**	**Without treatment**	**With pre-treatment**	**Without pre-treatment**
Bien Hoa 1	47	22	69	40	29	0	0
Bien Hoa 2	87	19	106	0	15	69	22
Amata	17	12	29	0	12	5	12
Loteco	12	6	18	2	4	8	4
Nhon Trach 1	8	7	15	0	7	5	3
Nhon Trach 2	7	12	19	3	16	0	0
Nhon Trach 3	9	5	14	9	5	0	0
Go Dau	11	5	16	0	5	6	5
Ho Nai	17	9	26	10	16	0	0
Song May	7	5	12	4	8	0	0
Total	**222**	**102**	**324**	**68**	**117**	**93**	**46**

Source: Dong Nai Industrial Zones Authority, 2002.

According to Table 15, there are 324 factories in Dong Nai Province's ten industrial zones, of which 222 (69%) are required to treat their wastewater. In estates with common treatment plants, 182 (72%) over 253 factories are required to treat wastewater. For the ones without common treatment plants, this ratio is 40 (56%) over 71 enterprises. Among 185 enterprises not connected to a common plant, 68 (37%) treat their wastewater by themselves.

Table 16. Wastewater Treatment Fees in Industrial Estates in Dong Nai Province

Name of industrial estate	Form of charges	Wastewater treatment fees (USD/m^3)
Bien Hoa 1	-	-
Bien Hoa 2	80% of incoming water	0.25
Amata	80% of incoming water	0.22
Loteco	80% of incoming water	0.28
Nhon Trach 1	80% of incoming water	0.24
Nhon Trach 2	-	-
Nhon Trach 3	-	-
Go Dau	80% of incoming water	0.26
Ho Nai	-	-
Song May	-	-

Source: Infrastructure companies of Dong Nai's estates, 2002.
Note: For the industrial estates without common wastewater treatment plants, all factories producing polluted wastewater are required to self-treat their wastewater. These industries do not have to pay treatment fees to the infrastructure company but still pay land rental; the average cost is about USD 0.1/m^2 per year.

The rate applied in Dong Nai's estates ranges from USD 0.22 to USD 0.28 per m^3, charged on 80 percent of incoming water. Industries in estates without common plants must treat their wastewater using their own facilities. Information on how many actually complied with environmental regulations is not available as some factories refused to reveal such information.

5.1.4 Ba Ria-Vung Tau Province

Located in a coastal area, this province is attractive for industrial development, mainly due to favorable conditions for transportation and discharge of wastewater. The province's economic growth rate is higher than that of other areas in Vietnam. Currently, five estates operate in Ba Ria-Vung Tau Province.

Major industries in Ba Ria-Vung Tau produce oil and gas, construction materials, seafood, fertilizers, and chemicals. Industrial parks in this province are fairly new, with a low occupancy rate. The province's DOSTE, in cooperation with the Industrial Estates Management Board requires factories to pre-treat their wastewater up to level B before discharge into a common treatment plant. The fully treated water is then disposed into the Dong Nai and Thi Vai Rivers.

Table 17. General Description of Industrial Estates in Ba Ria-Vung Tau Province

Name of industrial estate	Date of establishment	Area (ha)	Investment capital (USD million)	Type of ownership
Dong Xuyen	1996	161	19.4	Joint Stock
My Xuan A	1996	123	21.0	Joint Stock
Phu My 1	1998	954	57.2	State-owned
My Xuan B1	1998	200	18.6	Joint Stock
My Xuan A2	2001	313	21.4	Joint Stock

Source: Industrial Estates Management Board, Ba Ria-Vung Tau, 2002.

Industrial zones in Ba Ria-Vung Tau Province have been established since 1996 starting with Dong Xuyen and My Xuan A, followed with Phu My, My Xuan B1, and My Xuan A2. Only Phu My 1 Industrial Zone is state-owned. Others belong to joint stock companies. Phu My 1 has the highest level of investment in terms of capital and land area.

Table 18. Characteristics of Industrial Estates in Ba Ria–Vung Tau Province

Name of industrial estate	Number of factories	Expected number of factories at full capacity	Major industrial sectors
Dong Xuyen	20	70	electrical appliances, fertilizer
My Xuan A	16	60	food processing, construction materials, chemicals
Phu My 1	25	100	electricity, fertilizer, gas, steel, chemicals
My Xuan B1	7	40	food processing, brewery
My Xuan A2	9	60	construction materials, electrical appliances

Source: Industrial Estates Management Board, Ba Ria-Vung Tau, 2002.

Investors in Ba Ria-Vung Tau industrial zones concentrate on chemicals, food processing and electrical appliances. The average ratio of registered enterprises over figures expected at full occupancy is rather low at 23 percent (77 out of 330). Dong Xuyen Industrial Park has the highest proportion at 29 percent. In terms of leased area, the average ratio of leased land over available land is below 20 percent.

Table 19. Common Wastewater Treatment Plants in Ba Ria-Vung Tau Province

Name of industrial estate	With common WWT plant	Name of operator
Dong Xuyen	Not yet	Urban Development and Construction Company of Ba Ria-Vung Tau
My Xuan A	Not yet	Joint stock company
Phu My 1	Not yet	Urban Development and Construction Company of Ba Ria-Vung Tau
My Xuan B1	Not yet	Joint Stock
My Xuan A2	Not yet	Joint Stock

Source: Industrial Estates Management Board, Ba Ria-Vung Tau, 2002

None of the industrial zones have constructed common treatment plants due to the limited number of factories registered. Data on wastewater volumes discharged by industries is not available, despite the fact that water environment in Ba Ria-Vung Tau is polluted as in the case of the Thi Vai River. The DOSTE of Ba Ria-Vung Tau has already appealed to the central government to help rectify the water pollution problem of the Thi Vai River.

Table 20. Number of Factories and Common WWT Plants in Ba Ria-Vung Tau Province

Name of industrial estate	Number of factories and wastewater treatment requirements			Number of factories not connect to common WWT plant		Number of factories connected to common WWT plant	
	Required	Not required	Total	With treatment	Without treatment	With pre-treatment	Without pre-treatment
Dong Xuyen	6	14	20	4	16	0	0
My Xuan A	10	6	16	5	11	0	0
Phu My 1	12	13	25	6	12	0	0
My Xuan B1	3	4	7	0	7	0	0
My Xuan A2	4	5	9	4	5	0	0
Total	**35**	**42**	**77**	**19**	**51**	**0**	**0**

Source: Industrial Estates Management Board, Ba Ria-Vung Tau, 2002.

Table 20 shows that there are 77 factories in all five operating estates in Ba Ria-Vung Tau Province, of which 35 factories (45%) are required to treat their wastewater. Only 27 percent of them, however, actually comply with this requirement.

5.2 Comparative Analysis

5.2.1 Comparison of Estates With and Without Common WWT Plants

In theory, all industrial zones must complete the construction of all infrastructure systems, including water treatment facilities, before commencing operations. However, as described in previous sections, not all meet this requirement. Therefore, it is interesting to compare the differences between two groups of industrial estates, namely those with and those without common wastewater treatment plants.

- All export-processing zones have common WWT plants (e.g. Tan Thuan and Linh Trung in Ho Chi Minh City), and the industries in them are strictly required to comply with environmental laws.

- Industrial estates with common WWT plants have a higher occupancy rate than estates without, as presented in Table 21.

Table 21. Occupancy Rates in the Study Sites

Province/City	With common WWT plant (%)	Without common WWT plant (%)
Binh Duong	73	40
Ho Chi Minh City	80	49
Dong Nai	53	44
Ba Ria-Vung Tau	-	23

- Industries with highly polluted wastewater are required to build treatment plants or to move into estates with common WWT plants.
- The location of industrial estates without common WWT plants is relatively far from urban centers, so there is less pressure on environmental law compliance as compared to those nearer the cities.

- The age and the size of an industrial estate are not determining factors in the construction of common WWT plants. Rather, this is determined by occupancy rates and the type of industry of the respective industrial estates.

5.2.2 Comparison of Enterprises Connected and Not Connected to Common WWT Plants

- For the four study sites, it was found that factories connected to common WWT plants produced a higher level of pollutants than those not connected. These industries, namely, textile, bleaching and dying, chemical products and food processing, were hazardous to the water in the environment. It would be very costly for these enterprises to treat their wastewater up to level A if they did it by themselves. Industries that did not produce polluted wastewater, on the other hand, did not have to connect to common treatment systems.

- The scale of operations affected the decision to connect to common WWT plants. Except for a few enterprises with large-scale production (for example, factories in Bien Hoa 2, Amata and Song Than 1), most factories connected to common WWT plants are medium-scale operations.

- The decision on whether to connect to a common WWT plant is not affected by the type of ownership or age of the factory.

5.2.3 Comparison of Enterprises Located Outside and Inside the Estates

- Most enterprises located outside the industrial zones are domestic enterprises with relatively low investment capital, compared with those inside the industrial estates. Enterprises outside the industrial zones are mainly joint stock companies owned by domestic investors.

- Industries inside the industrial zones have more diversified types of ownership such as state-owned, joint venture, and foreign-owned. Most of the foreign investors are from Asia (namely, China, Korea, Japan, Singapore, and Thailand), followed by Europe (namely, Italy, Netherlands, Germany, Belgium, France, and Denmark), the United States and Australia. The capital from foreign sources comprises 50 percent or above of the total invested capital in the industrial estates.

- Industries located outside the industrial zones are often old ones, established dozens of years ago before the onset of industrial estates and environmental protection laws in Vietnam. They understood that moving into an industrial estate would require compliance with wastewater treatment regulations and feared that this would be too costly for them and a curb on their commercial activities.

- There are also new enterprises located outside the industrial zones because they cannot afford the cost of entering, or do not meet other requirements to qualify to enter an industrial zone. Moreover, some of them believe that environmental monitoring by local authorities would be less stringent for industries located outside industrial zones as compared to those located within.

- The low number of enterprises registered (i.e. low occupancy rates) in the industrial estates leads to an under-utilization of common WWT plants. This is the case in most of the estates mentioned in this study. Almost 80 percent of common treatment plants in Binh Duong, Ho Chi Minh City and Dong Nai are working far below full capacity.

Other comparisons are presented in Table 22.

Table 22. Comparison of Enterprises Located Inside and Outside Industrial Estates

Item	Inside industrial estates	Outside industrial estates
Administration	Management Board of Industrial Zone and Export Processing Zone provides licensing approval within a few months	Long process which sometimes takes years
Tax structure for manufacturers	4-5 years tax exemption after first profitable year; further 4 years at 50% reduction; 10% profit tax thereafter	2 years tax exemption after first profitable year, 15-25% profit tax thereafter
Land tax	None	Tax levied according to land category, size, and location
Road system	Complete system built by the Infrastructure Company	Very expensive and sometimes not completed. It is usually built at a higher cost due to the higher price of land
Labor	Supplied by IZ Management Board for a nominal fee to ensure workforce quality and quantity	Depends on labor agencies who charge monthly commissions
Value added tax on output	0%	10%
Imported raw material	No need to verify supply sources of materials imported	Verification required

5.2.4 Reasons that Impede the Construction of Common Wastewater Treatment Plants in Industrial Estates

The very high cost of construction is the main factor constraining investment in common WWT plants. A common WWT plant with a capacity of 1000 m^3 per day may cost anything from USD 1.2 million (Loteco, Dong Nai), or USD 1.6 million (Viet-Sing, Binh Duong), to USD 3.4 million (Bien Hoa 2, Dong Nai). This expenditure alone comprises some 25-30 percent of the total investment capital of an infrastructure construction company.

The number of factories per industrial zone differs, although the regulations governing the estates are the same in that all of them have to invest in a centralized treatment plant. Except for very good industrial zones like Viet-Sing and Song Than of Binh Duong Province, Amata and Bien Hoa 2 of Dong Nai Province, Tan Thuan and Linh Trung of HCMC, the incentive to invest in a common treatment plant in an estate is affected by the number of occupants. The managers of these industrial zones try to attract more investors by lowering the water treatment fees.

One of the main goals of an infrastructure company is to make profit, which may be in conflict with environmental priorities. If the infrastructure company is a joint stock corporation, the decision of whether and when to invest in the construction of a common treatment plant depends on the agreement of the shareholders and the actual rate of the estate's development. The majority of the construction companies are joint venture or joint stock ownerships. Given the fact that they have no support from the government and the incentives for compliance to environmental protection are limited, it leads to a decision to delay the construction of the treatment plant ("the longer, the better" attitude). Cases like Ba Ria-Vung Tau and many other industrial zones without centralized treatment facilities are examples of this.

5.2.5 Reasons that Reduce Investors' Incentive to Comply with Pollution Control Regulations

Presently, there are no measures in place to control and monitor the volume of water used and wastewater discharged. In general, wastewater from different factories in an estate flows into a common system without distinguishing the source, volume and level of effluents. Imposing a standard rate on all who use the common WWT plant regardless of these factors appear unfair to those which do not generate much wastewater. This study found that only in Viet-Sing of Binh Duong Province, Tan Thuan and Linh Trung of HCMC, and Bien Hoa 2 of Dong Nai Province are the rates of treatment fees imposed on factories dependent on the volume of wastewater and level of effluents produced. In other industrial zones, the rates of treatment fees are set without considering these factors.

According to water pollution control regulations, factories must pre-treat their wastewater before discharging it into the estate's common treatment system. This poses a problem for those whose wastewater volume is low, making it very costly to treat their wastewater.

5.3 Infrastructure Construction Companies and Their Investment in Common Wastewater Treatment Plants

It is interesting to find answers to these questions:

a) Why is it that not all the industrial zones have common WWT plants?

b) Do infrastructure development companies intentionally delay the process of building WWT plants because they feel the costs outweigh the benefits?

c) What will it cost investors to connect to common WWT plants?

An infrastructure construction company has the responsibility to build the infrastructure facilities to support an industrial estate's operations including those of individual factories. Building common wastewater treatment facilities is a government order to the Industrial Estates Management Board. Once the common WWT treatment plant is completed, the infrastructure construction company determines the treatment fees and decides on the most appropriate way to collect the fees. In theory, the wastewater treatment fee should be used to finance monitoring operations and the maintenance of the WWT plant facilities.

In reality, the infrastructure company acts like a business entity. It builds and operates all infrastructural projects, including common WWT plants, for profit. However, the water treatment fee, in turn, affects a prospective investor's decision to invest in an industrial estate. Establishing an effective charging method is a problem for the infrastructure construction company. Presently, the fees vary across industrial estates depending on their characteristics and level of development.

A wastewater treatment plant can also be considered as a non-business unit. It may be viewed as a technical component of an industrial estate, offering a more attractive environment to enterprises. However, the absence of profit producing targets may lead to ineffective management and control especially of the wastewater discharged. In Binh Duong Province, the common WWT plants are not used purely as a profit-making tool. They contribute by upgrading the industrial estates' infrastructural set-up so as to attract investors. Common WWT plants are constructed and put into operation early, regardless of how many enterprises have registered. As a result, the growth rate of industries in Binh Duong Province estates is high. Meanwhile, in Ho Chi Minh City and Dong Nai Province, the common treatment plants are run as businesses by the infrastructure construction companies, limiting the rate of investment in the industrial zones here.

In Ba Ria-Vung Tau Province, none of its industrial zones have a common WWT plant yet. Given limited capital and low occupancy rates in the industrial estates, infrastructure construction companies in Ba Ria-Vung Tau have little incentive to construct WWT plants. The government needs to intervene to monitor the industries' activities and to help the industrial estates in building common treatment plants.

As found at the study sites, not all industrial estates can afford to invest in common wastewater treatment plants. Except for a few industrial estates with strong capital injection, e.g. Vietnam-Singapore Industrial Park in Binh Duong Province, Tan Thuan and Linh Trung Export Processing Zones in Ho Chi Minh City, and Amata Modern Industrial Park in Dong Nai Province, the others face financial constraints. Therefore they prefer to invest in other infrastructural systems such as roads, and electricity and water supply, rather than in common WWT plants in the initial stages of the estate's operation.

Thus, the answers to the question as to why not all industrial estates have common WWT plant could be summed up as follows:

a) Very high cost of constructing a common WWT plant as compared to other infrastructural systems.

b) Low efficiency – if the common WWT plant operates at less than full capacity.

c) The investment policy is biased towards attracting enterprises to register into industrial estates. Industrial estate authorities understand that it is hard to impose a very high rental rate in order to cover the treatment fees in the beginning stages. Therefore, they delay the construction of common wastewater treatment plants for as long as they can.

Cooperation between the Department of Science, Technology and Environment (DOSTE), the Industrial Zone's Management Board and the Infrastructure Construction Company is very important in wastewater management. Each must abide by the Law of Environmental Protection and related regulations. However, these agencies have different objectives and functions. The industrial zone management board would like to increase the number of investors, the infrastructure construction company looks forward to profit, and the

officials from DOSTE have to regularly monitor the factories' compliance to environmental laws. There is a need for regulations that would clarify how to make investors compliant with the Law of Environmental Protection, their accountability to the Industrial Zone Management Board and DOSTE, and the benefits they will enjoy if they improve their investment in wastewater management. With such regulations, the collaboration among the relevant agencies and the effectiveness of pollution control measures would improve.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This study shows that water pollution has become a serious issue in the industrial estates of Ho Chi Minh City, and Binh Duong, Dong Nai and Ba Ria-Vung Tau Provinces. The growth of the industrial estates in these areas has been accompanied by adverse environmental impacts.

The central government and local authorities have issued a number of regulations on water pollution control. They have also designed a framework for industrial estate organization so as to enable strict control over environmental pollution. Through this framework, the government expects to have good cooperation among all the relevant agencies and individual enterprises of the estates, and create good incentives to encourage enterprises to comply with environmental regulations. In fact, it has achieved some measure of success in industrial estates like Tan Thuan, Linh Trung, Tan Tao (HCMC), Viet-Sing, Song Than (Binh Duong), Bien Hoa 2 and Amata (Dong Nai).

Small and medium-sized enterprises generally cannot afford to invest in and operate their own treatment systems. Although common WWT plants would be a more cost-effective solution for these enterprises, it is still expensive for them. Other obstacles to setting up common WWT plants are the lack of incentives by infrastructure construction companies to invest in such plants, and the process of monitoring the common WWT plants. The Government should intervene to help these small and medium-sized industries.

The management of industrial estates is different from that of enterprises. Industrial estates are controlled by state and relevant agencies according to various regulations, environmental standards, and so on. Industrial estate management boards can prepare their own environmental standards and tools to implement these, playing multiple roles in pollution control measures.

The analysis of investment on common WWT plants has to consider both the view of the government (industrial estate management boards) as well as that of implementers (infrastructure construction companies and registered enterprises). The former cares about the structure and composition of industries, pollution load generated and effective pollution control systems. The latter, on the other hand, is profit-oriented since they have to invest in infrastructure. Suitable policies that can satisfy the objectives of both would lead to effective implementation of and compliance to pollution control regulations.

All four study sites faced problems in water pollution control due to insufficient and inefficient common WWT plants, and difficulties in quantifying appropriate treatment fees

and monitoring the compliance of investors. In addition, authorities in certain areas give priority to attracting investors to industrial zones over adherence to water pollution control regulations as in the case at Ba Ria-Vung Tau, where none of the industrial zones had common WWT plants under operation at the time of this study. Several other industrial zones in Dong Nai, Binh Duong, and Ho Chi Minh City were the same. This imbalance in priorities is likely to persist. Water pollution control in industrial estates definitely needs reform.

In measuring the volume of water consumed, both water quantity and quality should be considered. The reasonable use of water and water pollution control measures should be viewed in unison. Each industrial zone's infrastructure company, within the bounds set by the industrial estate management board, regulates the price of the water and wastewater treatment fees. The guiding principle in pricing is cost recovery.

Lack of wastewater treatment facilities, especially common WWT plants, together with inappropriate monitoring procedures has led to large amounts of untreated wastewater being discharged into rivers. Serious water pollution was observed in Dong Nai River (Dong Nai),) Sai Gon River (HCMC), and Thi Vai River (Ba Ria-Vung Tau). According to the industrial zone management boards, there are two points that need serious attention: (i) policy and management issues, and (ii) funds for construction of pollution control facilities.

Aside from financial constraints, limited land area is another major constraint to the construction of common WWT plants. This is usually the case for older industrial zones which were established decades ago and are located near urban centers. To meet environmental regulations, these industrial zones can only compel their industries to treat their wastewater by themselves.

In contrast, many newly established industrial estates have large areas for infrastructure construction, for example, in Ba Ria-Vung Tau Province. However, they do not invest early in common WWT plants due to limitations in terms of occupancy rates and capital. Without pressure from the government, the industrial estate is likely to place low priority on building the plant.

There exists various factors affecting the effectiveness of pollution control measures in industrial zones, including how the infrastructure companies conduct their business, type of industries located within the estate, and type of investors.

The priority of infrastructure construction companies is to make profit. So, their first choice is not always the investment in common WWT plants.

The type of industries located within the industrial zone has a significant impact on the effectiveness of pollution control measures. For example, water pollution control in Le Minh Xuan industrial zone is worse than in other industrial zones. Le Minh Xuan industrial zone has several high-pollutant industries, which the authorities have failed to adequately address in their pollution control planning. They are now facing heavy pressure to rectify this.

Type of investors is another factor affecting compliance in pollution control. In general, reputable industries comply better and invest more in wastewater treatment facilities.

The cost of treatment depends on the standards to be met. There are different requirements depending on the location of the industrial estate, for example, industrial estates located in upstream areas must treat their wastewater up to level A before disposing it into the river, while others are required to do so up to levels B or C depending on their location along the river.

Given the characteristics of industrialization in Vietnam, particularly the development of new industrial estates playing key roles in the development of the national economy, there is an opportunity to prevent industrial pollution at this early phase (with technology from developed countries who are willing to invest in Vietnam's industrial zones) rather than having to pay heavily later to remedy damage caused by industrial pollution.

6.2.1 Environmental Institutions and Legal Framework

The effort to reduce water pollution in the industrial estates of Binh Duong, Ho Chi Minh City, Dong Nai and Ba Ria-Vung Tau has focused on the development of environmental institutions and legal frameworks. Effective regulations should correspond with the administrative capabilities of regulatory agencies, such as DOSTE and the industrial zone management boards. The success of implementing environmental protection regulations depends not only on the enforcement but also on the collaboration between the industrial estate management boards, infrastructure construction companies, and owners of factories located in the industrial estates.

There is a need for a proper assessment to identify the exact level of pollution produced by industrial estates. None of the sample estates had conducted any such assessment. Such assessment will provide the individual enterprises as well as the relevant authorities with important environmental information in order to address the problem of pollution. Wastewater discharged via common treatment systems comes from different factories and the pollutant levels vary. Pollution control schemes based on the quantity of wastewater collected are deemed to be unfair by those who discharge small volumes. To avoid this, an appropriate fee scheme should be developed based on the classification of wastewater discharged.

To encourage the factories to comply with regulations, there should be a proper system of environmental management in every industrial estate, overseeing all monitoring, measuring, and reporting systems, including a precise charging system for common wastewater treatment services.

There are also legislative constraints. The penalty imposed for non-compliance with environmental standards is not high enough to act as an effective deterrent. Fines charged in all sample industrial estates in HCMC, and Binh Duong and Dong Nai provinces were generally at a maximum of USD 200. Only under exceptional conditions was a higher penalty imposed. Keeping in mind that the capital investment in a wastewater treatment facility is very high, offenders will prefer to breach the law and pay the penalty if the penalty for violation is low. Initiating a change in behavior will require the adoption of a penalty that will reflect a closer balance with the cost of investing in a wastewater treatment facility.

A key issue is how to monitor compliance by the various enterprises. As management boards and relevant agencies mainly depend on self-reporting by the factories as a mean of determining compliance, the process of monitoring is weak. This study found that department and management board officials conducted checks on compliance to pollution control regulations only a few times per month. Therefore, factories are generally left unchecked to discharge untreated water into the rivers. Even in industrial zones that already had common WWT plants, it was found that some plants stopped operating when there was no visit from environmental agencies and the factories freely discharged untreated water into the rivers.

Aside from using surface water, many industries in Ho Chi Minh City, and Binh Duong and Dong Nai Provinces, were found to utilize groundwater. The free use of groundwater by effluent-generating industries is associated with the lack of effective mechanisms for regulating and charging for groundwater extracted. There are limited deterrents for reducing groundwater extraction. The absence of appropriate mechanisms for regulating groundwater utilization helps investors avoid paying the full wastewater treatment charge, which is based on the volume of water used from the Municipal supply.

6.2.2 Common Wastewater Treatment Plants and Own Treatment Plants

The requirement to build common wastewater treatment plants is based on the Law of Environmental Protection (1999) and other related regulations. DOSTE and provincial industrial management boards are to monitor this. The grievances raised by industrial zones regarding common wastewater treatment facilities are as follows:

- The current system of charging a uniform rate for all in an industrial zone with a common WWT plant is deemed unfair as the volumes and level of pollutants discharged by different factories can vary quite significantly.
- The under-utilization of treatment plants in most of the sample estates.
- The lack of incentives, e.g. absence of rewards, for compliance.
- The lack of subsidy for investment in wastewater treatment.
- Low rate of construction of common WWT plants.

All industrial zones, especially in Dong Nai and Ba Ria-Vung Tau Provinces, should speed up infrastructure construction. The relevant government bodies should implement action plans with specific measurement targets. Firstly, they need to improve the environment for investment by creating favorable conditions for investment such as credit facilities, support programs and fair laws. Secondly, there should be appropriate management mechanisms for specific industrial zones. The government, with the industrial estates management boards should concentrate on reducing pollution by the proper identification of pollutants and effluents discharged, better monitoring procedures and careful selection of industries for the zone.

The number of industries in Ho Chi Minh City, and Binh Duong, Dong Nai and Ba Ria-Vung Tau Provinces is increasing. To maximize the capacity of the industrial zones, the management boards should develop the existing industrial zones rather than establishing new ones.

Industrial zones in Binh Duong Province, Ho Chi Minh City, and Dong Nai Province have a common problem: the need to manage increasing amounts of polluted discharge especially wastewater. With the government's requirement to move industries into industrial estates, a higher need for pollution control in industrial zones is called for. This is especially

true for Ho Chi Minh City where there is a large number of industries and the Municipal People's Committee has planned to relocate many industries into industrial zones.

The strategy for more effective wastewater management in industrial zones should be built upon the policies already established by central and local government through a combination of the following factors:

- More effective regulations and enforcement.
- Imposition of a practical and realistic charging system for wastewater disposal and treatment, including wastewater produced from groundwater use.
- Encouragement and provision of incentives to invest in wastewater treatment, either own or common facilities.
- Informed forecasts of the expansion of industries and corresponding plans for building common WWT plants in order to meet the increase in the number of industries.

6.2.3 Compliance of Investors

This issue is raised based on the observed response of investors in complying with environmental laws. The analysis takes into account the type of industry and ownership as in the cases of Viet-Sing Industrial Park (in Binh Duong), Amata Industrial Park (in Dong Nai), Tan Thuan and Linh Trung Processing Zones (in HCMC) and Amata Industrial Park (in Dong Nai) which all have hi-tech, multinational industries. Multinational corporations are often seen to comply better with environmental laws.

Key considerations in the efforts to reduce water pollution in industrial zones and to increase incentives for compliance include the need for an effective metering and charging mechanism for water use.

The cooperation between industrial estates management boards, infrastructure construction companies, enterprises, and local authorities such as DOSTE, is very important to ensure good compliance from the enterprises.

Lastly, the compliance of an investor depends on mechanisms to regulate and charge for groundwater extracted. The current use of groundwater indicates a lack of effective mechanisms to regulate and charge for it. Estimates derived from surveys in selected industrial estates suggest that daily extraction of groundwater by industrial estates is of a similar magnitude to effluence flows by the factories. This situation was found in some industrial zones located in Ho Chi Minh City, namely Tan Binh, Binh Chieu, Vinh Loc, Tan Tao, and Linh Trung Export Processing Zone, and in Dong An and Song Than Industrial Zones of Binh Duong Province. The lack of appropriate mechanisms for regulating groundwater use allows industries to avoid or lessen the wastewater treatment fee which is based on the volume of water used from the Municipal water supply.

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APPENDIX 1: CIRCULAR 27

GENERAL DEPARTMENT OF CUSTOMS

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

Ref. No. 27 TC/CSTC

Hanoi. 25 May 1996

CIRCULAR

Providing financial regulations for infrastructure development companies and management boards of industrial zones

Pursuant to the Decree 192/CP dated 25 December 1994 of the Government, providing Regulations on Industrial Zones, the Ministry of Finance hereby provides guidance on financial regulations for infrastructure development companies, service companies and Management Boards of Industrial Zones.

(I) Financial regulations for infrastructure development companies

A. Principles to set prices, costs:

Under Article 9 of the Regulations on Industrial Zones, infrastructure development companies while fixing land lease prices, workshop leases or sale prices and services costs must obey the following principles:

1. Infrastructure development companies must work out a price list and fix costs for leasing infrastructure facilities and public services and submit the fixed prices and costs to the Management Board of Industrial Zones for approval before they are applicable.

The fixed prices and costs must be suitable with the investment for the construction of the infrastructure facilities and public services by the companies.

2. If factories in industrial zones are available (for old industrial zones that are restored according to Decree 192/CP), infrastructure development companies are responsible to work out price lists and fix costs for leasing infrastructure facilities and public services, and take those costs to public negotiations with the factories for agreement and then submit them to the Management Board of Industrial Zones for approval before they are applicable.

If the prices and costs fixed by infrastructure development companies cannot be negotiated by factories in industrial zones, the companies must work out prices and costs and submit them to the Management Board of Industrial Zones for approval before they are applicable.

3. The Management Board of Industrial Zones are responsible to consider price reasonability, reappraise the fixed prices and costs submitted by infrastructure development companies and inform the final decision to the infrastructure development companies.

4. If an infrastructure development company wishes to change the currently applicable prices and costs, the company must inform the Management Board of Industrial Zones and the concerning

factories in the industrial zone before beginning the change, at least 60 days prior, and must redefine the prices and costs under the above principles 45 days before the date of the application.

5. Infrastructure development companies can collect the land rent and the costs for using public services for many years of the use but the maximum period must not exceed the operation duration of the companies stated in the investment license.

B. Regulations on taxation and land rent:

1. Infrastructure development companies pay priority taxes stated in the Law on Domestic Intensive Investment, the Law on Foreign Investment in Vietnam. The Law on Taxation and attached documents provide implementation guidance.

2. If an infrastructure development company collects the land rent and the costs for using public services once for many years of use, it must pay the following taxes:

+ Turnover tax: to pay tax for the whole turnover gained from releasing land and public services for the period of collection, under the Law on Turnover tax.

+ Revenue tax: infrastructure development companies must define their annual turnover gained from releasing land and public services; define logical expenditure of the year (expenses of fixed assets depreciation, wages, costs for management activities, servicing, infrastructure improvement) according to regulations of the Revenue tax, in order to decide the Revenue tax to be paid.

Infrastructure development companies using foreign investment capital must contribute land rent to the State under the regulations stated in the investment license, according to Decision 1417/TCDN dated 31 December 1994 of the Ministry of Finance.

Domestic infrastructure development companies must contribute land rent to the State under the Prime Minister's decision (if any) or under regulations of the Provincial People's Committees, according to the Decision of the Ministry of Finance 1357 TC/QD/TCT dated 30 December 1995.

3. If in industrial zones there are other service companies operating public services, aside the infrastructure development, companies, the definition of prices, costs, taxes and land rent shall also be carried out on the principles stated in this Circular.

II. Financial regulations for the Management Board

1. The Management Board of Industrial Zones apply financial regulations to the State budget based enterprises: expenses for the Board's operation are paid by the State budget according to the existing42 delegation of budget management; all earnings within industrial zones must be contributed by the Management Board to the State budget.

2. The Management Board of Industrial Zones are allowed to collect fees in accordance with their duties entrusted by the State management bodies as regulated, such as fees for granting a construction license and fees for appraising projects, if any. Management Board of Industrial Zones can work out a list of fees in accordance with the operation of the industrial zones, and the local factual situation and submit to the State authoritative bodies for approval.

3. The Management Board of Industrial Zones are responsible to consider, appraise, and approve the prices and costs submitted by the infrastructure development companies, and services companies (if

any) before the infrastructure development companies apply the prices and costs. The Management Board of Industrial Zones are responsible to control the application of prices and costs, managed by infrastructure development companies.

III. Implementation provisions

This Circular comes into effect from the signed date. The General Taxation Development (body), the State Treasury, the General Development (body) for the management of State capital and assets in enterprises, the Management Boards of Industrial Zones, and infrastructure development companies take responsibility to implement this Circular. During the implementation, if there appear any problems, they must be reported to the Ministry of Finance for resolution.

FOR MINISTRY OF FINANCE

DEPUTY MINISTER

PHAM VAN TRONG

(Signed)

APPENDIX 2: DECREE 36/CP

THE GOVERNMENT
Decree No. 36/CP

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom – Happiness

Hanoi, 24 April 1997

DECREE

Issuing The Regulations On Industrial Zones, Export Processing Zones and Hi-Tech Zones

THE GOVERNMENT

Pursuant to the Law on Organization of the Government of September 30, 1992;
Pursuant to the Law on Promotion of Domestic Investment of June 22, 1994;
Pursuant to the Law on Foreign Investment in Vietnam of November 12, 1996;
With a view to expanding and raising the effectiveness of the activities of forming, building, developing and managing industrial zones, export processing zones and hi-tech zones;
At the proposals of the Minister of Planning and Investment, the Minister of Science, Technology and Environment, the Minister of Industry and the Chairman of the Vietnam Board of Management of Industrial Zones,

DECREES:

Article 1. To issue together with this Decree the Regulations on Industrial Zones, Export Processing Zones and Hi-Tech Zones in replacement of the Regulations on Export Processing Zones issued together with Decree No. 322-HDBT of October 18, 1991 of the Council of Ministers (now the Government) and the Regulation on Industrial Zones issued together with Decree No.l92-CP of December 28, 1994 of the Government.

Article 2. This Decree takes effect 15 days from the date of its signing. The earlier provisions which are contrary to this Decree are now annulled.

Article 3. The Ministers, the Heads of the relevant ministerial-level agencies, the Heads of the agencies attached to the Government, and the Vietnam Board of Management of the Industrial Zones shall be responsible to guide in detail the implementation of the Regulation issued together with this Decree.

Article 4. The Ministers, the Heads of the ministerial-level agencies, the Heads of the agencies attached to the Government, the Chairman of the Vietnam Board of Management of the Industrial Zones, the People's Committees of the Provinces and cities directly under the Central Government shall have to implement this Decree.

ON BEHALF OF THE GOVERNMENT

THE PRIME MINISTER

VO VAN KIET

(Signed)

APPENDIX 3: DECISION 1414

MINISTRY OF LABOUR & WAR INVALIDS & SOCIAL AFFAIRS

SOCIALIST REPUBLIC OF VIETNAM WAR
Independence - Freedom - Happiness

No. 1414/1997/QD-BLDTBSXH

Hanoi, 17 November 1997

DECISION

On the Delegation with Authority of Number of Tasks on Labour Management for the Management Boards of the Industrial Zones, Export Processing Zones and High Technology Zones of the Provinces and Cities under the Central Authority

MINISTER OF LABOUR & WAR INVALIDS & SOCIAL AFFAIRS

Pursuant to Decree No. lS/CP of the Government dated 2 August 1993 regulating the duties, rights and responsibilities of the Ministries and ministerial equivalent bodies regarding the State management:

Pursuant to Decree No. 96/CP of the Government dated 7 December 1993 regulating the functions, duties, powers and structural organization of the Ministry of Labour & War Invalids and Social Affairs:

Pursuant to Decree No. 36/CP of the Government dated 24 April 1997 promulgating the Regulations on Industrial Zones, Export Processing Zones and High Technology Zones:

To implement Directive No. 264/TTg of the Prime Minister dated 24 April 1997 regarding the promulgation of the guiding document for implementing a number of works to perform the Regulations on Industrial Zones, Export Processing Zones and High Technology Zones:

At the proposal of the Director of the Personnel and Training Department, the Director of the General and Legislation Department:

DECIDES

Article 1:

To delegate with authority to the Management Boards of the Industrial Zones, Export Processing Zones and High Technology Zones (hereinafter collectively referred to as the Boards) of the provinces and cities under the central authority to implement some works in respect of the labour management in the enterprises which are under the respective management authority of the Boards as follows:

1. To keep track, examine, and supervise the implementation of' the labour policies and allowances for labourers such as salary, bonus, social insurance, working and breaking times, and the compensation of labour accidents in the enterprises in accordance with the labour laws.

2. To guide the enterprises to execute labour contracts, to construct labour rules, to sign labour collective agreements (if any) in accordance with the laws; to guide and to receive the application files

of labourers in the enterprises, and then to forward such application files to the Department of Labour & War Invalids and Social Affairs for the issuing of labour books.

3. To guide, examine, and supervise the enterprises to comply with the regulation on labour safety and hygiene, environmental protection, and labour protection such as providing personal protection means, feeding-up allowances, and labour protection for labourers working for the enterprises.

- Making statistics, and reporting labour accident situations that occur in the enterprises which are under the management authority of the Boards:

- Receiving, declaring and registering application files for the use of machinery, equipment, materials and substances strictly requiring labour safety, and then forwarding them to the State Labour Inspectors under the Ministry of Labour & War Invalids and Social Affairs for issuing the license.

4. To guide the enterprises to set up the Conciliation Council of Units in accordance with the Labour Code and Circular No. lO/LDTBXH-TT dated 25 March 1997 of the Ministry of Labour & War Invalids and Social Affairs; to send the conciliators to deal with the labour disputes arising out from the provinces or cities where the Conciliation Council has not yet been established.

- When collective labour disputes or strikes occur in the enterprises, the Boards shall guide the parties in dispute to comply with legalized proceedings, and promptly inform the Department of Labour & War Invalids and Social Affairs, and the Ministry of Labour & War Invalids and Social Affairs for joint settlement.

5. To issue work permits for expatriate employees working less than three (3) months; to receive the application files of those who are working for three (3) months and more, and then to forward such application files to the Ministry of Labour & War Invalids and Social Affairs for issuing work permits.

6. The Boards shall be responsible to get the labour recruitment demands in enterprises operating in the industrial zones; to guide the enterprises to undertake labour recruitment in accordance with Decree No.72/CP of the Government dated 31 October 1995 providing detailed regulations on the implementation of a number of Articles of the Labour Code on employment.

7. To keep track, every six months, and annually, and to conduct ad-hoc checks on the situation of labour management in the industrial zones for reporting to the Department of Labour & War Invalids and Social Affairs, and the Ministry of Labour & War Invalids and Social Affairs.

Article 2:

1. To receive, consider, evaluate and make decisions on the registration of labour collective agreements and to approve the labour rules of the enterprises operating in the industrial zones under the authority of the Director of the Department of Labour & War Invalids and Social Affairs of the provinces and cities under the central authority.

2. After fifteen (15) days as from the date on which this Decision comes into force, Directors of the Departments of Labour & War Invalids and Social Affairs where the Boards have been established shall be responsible for issuing the authorizations subject to Clause 1 of this article.

3. With respect to the industrial zones which are located in the inter-provincial area, the Department of Labour & War Invalids and Social Affairs shall issue the authorization to the Boards where the head office of such industrial zones is located in accordance with Article 2 of this Decision.

Article 3:

The Boards shall be responsible for co-ordination with State labour management bodies in respect of examining and inspecting compliance with the provisions of labour laws, and investigating labour accidents occurring at the enterprises, if required.

Article 4:

People's Committees of the provinces and cities under the central authority shall monitor the co-ordination to implement this Decision among the Department of Labour & War Invalids and Social Affairs and the Boards.

Article 5:

This Decision shall be of full effect after fifteen (15) days as from the signing date. The previously issued texts which are inconsistent with this Decision shall be hereby repealed.

Article 6:

Directors of the relevant organizations, Directors of the Department of Labour & War Invalids and Social Affairs, and the Boards shall be responsible for implementing this Decision.

MINISTER OF LABOUR & WAR INVALIDS AND SOCIAL AFFAIRS

TRAN DINH HOAN

(Signed and Sealed)

APPENDIX 4: INTER-MINISTERIAL CIRCULAR 02

THE INTER-MINISTRIES
THE MINISTRY OF CONSTRUCTION

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

THE GOVERNMENT PRICE COMMISSION

No. 02/TTLB

Hanoi, April 28, 1997

INTER-MINISTERIAL CIRCULAR

THE MINISTRY OF CONSTRUCTION - THE GOVERNMENT PRICE COMMISSION

Providing Guidelines on the Methods of the Price Determination and the Authority to Determine the Price for Consumption of Clean Water in Urban Areas, Industrial Zones (and) Rural Populated Areas

Clean water is an essential type of product for household, production and service needs of all classes of the population. The need to satisfy the clean water needs of the society, especially in Urban Areas, Industrial Zones and Rural Populated Areas, is very urgent.

Presently, only part of the essential demand for use of clean water in urban areas and industrial zones is satisfied; the level of per capita water supply remains too low. The quality of clean water from the water supply system(s) of enterprises lacks stability and in many places still fails to meet Vietnamese Standards and the provisions of the World Health Organization.

For many years, the Party and the State have paid great attention to investment in the development of the water sector. Many investment projects for upgrading the existing water supply system and building new water supply facilities in urban areas, industrial zones and rural populated areas have been and are currently being initiated and implemented. However, the price for clean water consumption in the various urban areas, industrial zones and rural populated areas is currently computed differently in every locality and is still heavily subsidized, thus still failing to encourage the ratio of losses both at the clean water industrial stage and the consumption stage.

Pursuant to Government Decree No. 5G/CP dated October 2,1996 on State Enterprises engaging in Public Utility Activities, the Inter-Ministries of the Ministry of Construction and the Government Price Commission provide the following guidelines on the methods of price determination and the authority to determine the price for consumption of clean water in urban areas, industrial zones and rural populated areas as follows:

A. METHODS OF DETERMINING THE PRICE FOR CLEAN WATER

I. Principles of determining the price for clean water consumption

1. Determining the price for clean water must reflect the course orientations (and) policies of the Party and the State in respect of the close relationship between economic development and social life.

2. The price for clean water shall ensure that all cost factors during the process of production, distribution and consumption of clean water are correctly and fully calculated in order for clean water production and business enterprises to be able to stay in business and develop.

3. Clean water prices must be specified in detail and in a reasonable manner for each category of consumption of clean water use for households, production, services, administration, etc., for purposes of encouraging all households to use water economically and avoiding wastage.

II. Methods of identifying cost factors and price for clean water consumption

1. Methods of Identifying Cost Factors and Items Constituting the Cost Price of Clean Water

The content of the costs of clean water production shall include:

1.1. Costs for raw materials, materials, fuels, (and) direct motive forces (abbreviated as "costs for materials"), such as:

- Money for (purchase of) raw water (for enterprises that must purchase raw water);

- Subsidiary materials for water treatment; and

- Fuel, motive forces.

Costs for materials shall be determined as reasonable subject to the (following) two conditions:

+ The use of materials shall not exceed the fixed limits promulgated by the competent authority; (and)

+ The price of materials must not exceed the level of market prices at the time of computing (the costs).

1.2. Direct labour costs:

Shall include: costs for wages/salaries and allowances in the nature of wages/salaries, social insurance, medical insurance and trade union expenses for workers directly (engaged) in production at the enterprise.

1.3 General production cost:

Shall be the general costs (arising at the various workshops):

- Costs for wages/salaries and allowances in the nature of wages/salaries, social insurance, medical insurance and trade union expenses for employees at (the) workshop(s);

- Costs for raw materials, materials, (and) fuels;

- Cost for production tools;

- Service costs for external procurement;

- Depreciation of fixed assets; (and)

- Other monetary costs.

1.4. Costs for sale of goods:

Shall include the costs arising during the process of selling clean water, such as:

- Costs for wages/salaries and allowances in the nature of wages/salaries, social insurance, medical insurance and trade union expenses for employees recording water meter readings and employees collecting water charges;

- Advertising costs;

- Costs for the allocation of water meters (costs for meters and costs for installation); (and)

- Others.

1.5. Costs for managing the enterprise:

Shall include costs for business management, administrative management and costs of a general nature of the enterprise as a whole:

- Costs for wages/salaries and allowances in the nature of wages/salaries, social insurance, medical insurance and trade union expenses for cadres and employees of the enterprise's offices;

- Depreciation of fixed assets of the enterprise's offices;

- Administrative costs;

- Postal costs;

- Transportation costs;

- Charges (payable) for the use of capital from the (state) budget;

- Natural resources tax, land use fees or land rent (if any);

- Loan interest (if any);

- Costs for business trips; (and)

- Other costs.

B. AUTHORITY TO DECIDE ON PRICES AND MANAGEMENT OF PRICES FOR CLEAN WATER CONSUMPTION

1. From time to time, depending on the actual state of production and consumption of clean water in urban areas, industrial zones (and) rural populated areas, the Ministry of Construction shall direct, in co-ordination with the Government Price Commission, (the provision of) guidance (in respect of), (and) supplement and amend the methods for appropriately determining the price of clean water products.

2. The People's Committees of the Provinces and Cities directly under the Central Authority shall decide on the prices for clean water consumption in the localities, direct the authorities responsible to inspect the state of compliance with clean water consumption prices in urban areas, industrial zones and rural populated areas.

3. Clean water production and business companies shall submit to the People's Committee of the (concerned) Province or City directly under the Central Authority (their) clean water consumption

pricing plans. The Department of Finance and Prices of the province (or) city (with respect to IIochiminh City the Price Commission) shall, in coordination with the Department of Construction, or the Department of Transport and Public Works, evaluate the clean water consumption pricing plan and present (the same) to the People's Committee of the province or city for decision.

4. Clean water production and business enterprises must regularly inspect the state of consumption and payment of water rates of/by consumer households, in order to take timely measures to remedy losses of clean water and combat water rates collection losses.

C. ORGANIZATION OF IMPLEMENTATION

1. The Inter-Ministries: the Ministry of Construction and the Government Price Commission shall organize periodical or ad-hoc inspections as to the establishment of prices, the promulgation of prices and the management of prices for clean water consumption in accordance with the contents of this Circular in respect of all enterprises producing and doing business in clean water in the entire country.

2. The Chairperson of the People's Committee of the Province or City directly under the Central Authority (concerned) shall decide on the price(s) for clean water consumption in the locality; (and), simultaneously report such decision to the Ministry of Construction and the Government Price Commission for monitoring purposes.

This Circular shall take effect as from the date of signing. Previous instruments guiding the determination of prices and the authority to determine prices for clean water consumption in urban areas, industrial zones and rural populated areas shall no longer have implementing effect.

If problems arise during the process of implementing this Circular, the localities are requested to reflect the same promptly to the Inter-Ministries: the Ministry of Construction and the Government Price Commission, so as to carry out a review (or) make supplements (and/or) amendments, as appropriate.

THE CHAIRMAN OF THE GOVERNMENT PRICE COMMISSION

NGUYEN NGOC TUAN

(Signed and Sealed)

ON BEHALF OF THE MINISTER OF CONSTRUCTION

THE VICE-MINISTER

DANG NGHIEM CHINH

(Signed and Sealed)

APPENDIX 5

Industrial Wastewater: Limitation Values of Parameters and Maximum Allowable Concentration of Pollutants

No.	Parameters and Substances	Unit	Limitation Values		
			A	B	C
1	Temperature	^oC	40	40	45
2	pH value		6 - 9	5,5 - 9	5 - 9
3	BOD_5 (20^oC)	mg/l	20	50	100
4	COD	mg/l	50	100	400
5	Suspended solids	mg/l	50	100	200
6	Arsenic	mg/l	0.05	0.1	0.5
7	Cadmium	mg/l	0.01	0.02	0.5
8	Lead	mg/l	0.1	0.5	1
9	Residual Chlorine	mg/l	1	2	2
10	Chromium (VI)	mg/l	0.05	0.1	0.5
11	Chromium (III)	mg/l	0.2	1	2
12	Mineral oil and fat	mg/l	Not detectable	1	5
13	Animal-vegetable fat and oil	mg/l	5	10	30
14	Copper	mg/l	0.2	1	5
15	Zinc	mg/l	1	2	5
16	Manganese	mg/l	0.2	1	5
17	Nickel	mg/l	0.2	1	2
18	Organic phosphorous	mg/l	0.2	0.5	1
19	Total phosphorous	mg/l	4	6	8
20	Iron	mg/l	1	5	10
21	Tetrachlorethylene	mg/l	0.02	0.1	0.1
22	Tin	mg/l	0.2	1	5
23	Mercury	mg/l	0.005	0.005	0.01
24	Total nitrogen	mg/l	30	60	60
25	Trichlorethylene	mg/l	0.05	0.3	0.3
26	Ammonia (as N)	mg/l	0,1	1	10
27	Fluoride	mg/l	1	2	5
28	Phenol	mg/l	0.001	0.05	1
29	Sulfide	mg/l	0,2	0,5	1
30	Cyanide	mg/l	0.05	0.1	0.2
31	Coliform	MPN/100 ml	5000	10000	--
32	Gross alpha activity	Bq/l	0.1	0.1	--
33	Gross beta activity	Bq/l	1.0	1.0	--

Source: Industrial Wastewater Discharge Standards, TCVN 5945, 1995

Note: A, B & C represents the Government's measure of the cleanness of the wastewater.
A: cleanest, B: less clean, and C: least clean.

APPENDIX 6

CENTRAL WASTEWATER TREATMENT PLANT IN
AN INDUSTRIAL PARK IN HO CHI MINH CITY

APPENDIX 7

WASTEWATER TREATMENT PLANT IN OPERATION