

Final Report

On the Road to a More Ecological Industrial System: The Role of Waste Exchanges in Ho Chi Minh City

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EXECUTIVE SUMMARY

Purpose and Objectives of Research:

In this report, waste exchange opportunities in Ho Chi Minh City are assessed.

The objectives of the report are:

- § To provide an understanding of the planning or institutional structures that influence industrial waste management in Ho Chi Minh City;
- § To identify the potential role of waste-exchanges as a tool for encouraging eco-industrial behaviour;
- § To explore various planning policies and forms of outside assistance that may be needed in order to promote waste exchanges in Ho Chi Minh City.

Context:

Increased urbanization and industrialization are being experienced throughout Vietnam. Consequently, industrial waste generation is becoming a growing concern. The situation is especially acute in Ho Chi Minh City, the economic engine of Vietnam. It is home to over 30,000 medium and large-scale industrial establishments and the numbers of both domestic and foreign investment are rapidly increasing. Although the local government has tried to implement a variety of both regulatory and voluntary programs address problems associated with industrial waste, the results have been inadequate. Consequently, more innovative, voluntary-based policies waste reduction options need to be explored.

The *Industrial Ecology* concept is gaining recognition throughout the world and its applications have already become quite popular in Western Europe and North America. Industrial *waste exchanges* are one aspect of industrial ecology that has been contributing significantly to pollution management. Waste exchanges connect waste generators with reusers and recyclers. Asian countries have been informally exchanging wastes for centuries, however, formalized waste exchanges are starting to gain momentum in many Asian countries such as the Philippines and Indonesia. A major question is still whether the industrial ecology concept, and waste exchanges specifically, can be successfully integrated into newly industrializing countries such as Vietnam.

Due to the large quantities of valuable wastes being produced in Vietnam and a relatively un-established network amongst industry, waste exchanges may contribute positively to both the environment as well as the economy.

Research Approach:

The methodology in my research consists of: 1) a literature search, 2) interviews with key informants, and 3) a corporate case study of companies in the pulp and paper - and food processing sectors in Ho Chi Minh City.

The corporate interviews have helped to identify motivations, practices and opportunities for improvement in industrial waste management in Ho Chi Minh City.

Key Findings:

Most companies are vaguely familiar with industrial ecology concepts and are quite interested in participating in innovative programs that will result in cost savings, while contributing to pollution management.

Although many companies expressed an interest in participating in a waste exchange, they also claimed that it is currently difficult in Vietnam due to relatively low levels of awareness and information about the process. Waste-Econ and the Ontario Centre for Environmental Technology Advancement (OCETA) could use their expertise and experience in this area by offering training workshops and related information about waste exchanges to a selection of industries located in Ho Chi Minh City.

Summary of Recommendations:

Waste Econ and the *Ontario Centre Environmental Technology Advancement* (OCETA) should help the industrial ecology concept gain momentum in Ho Chi Minh City by conducting a *Pilot Industrial Waste Exchange Program* in collaboration with the *Centre for Environmental Technology* (CEFINEA), the Vietnamese Partner involved this Project.

In order to effectively establish a formal waste exchange, a variety of issues must be considered. These include:

- Training of individual companies;
- Funding from various levels of government to ensure long-term sustainability;
- Appropriate infrastructure that is equipped to handle a waste exchange network;
- Policies supporting the operation of a waste exchange.

The recommendations provided in this report attempt to address the four broad issues stated above.

Relevance of Research:

This project may impact industrial development in Vietnam in a variety of ways. First, its findings may help to better plan the location of industrial establishments. Second, innovative policies and techniques such as waste exchange networks could be incorporated into the planning mechanisms of Ho Chi Minh City in order to reduce the amount of wastes being produced and disposed. Third, this project could affect the strategies currently being used by the government and the private sector in marketing industrial sites. Claiming to be “eco-industrial” to the public can be quite a valuable asset for a company’s reputation and its finances. Most importantly however, a waste exchange could lead the way to a more “ecological” industrial system in Ho Chi Minh City.

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1.0. VIETNAM: AN ECONOMY & ENVIRONMENT IN TRANSITION

In recent years, there has been rapid economic growth in many Southeast Asian countries.

Vietnam has been a major player in this region. The results of the social and economy-wide policy reforms that Vietnam has implemented over the past decade have been impressive and the benefits of these reforms to Vietnam's economy, society and its people have been significant, especially in the 1990's.

As the second-most populous country in South-East Asia (after Indonesia) and one of the most densely populated nations in the world, increased urbanisation is being experienced throughout Vietnam. Industrialization and therefore industrial waste generation is becoming a growing concern. The transition from a centralized, planned economy to *Doi Moi*, an economic form with elements of a market economy has posed serious challenges. Growth and development in Vietnam are coming to a crossroads. Policies associated with *Doi Moi* such as foreign investment and the promotion of exports are increasingly conflicting with concerns for the environment. Furthermore, the environmental movement in Vietnam is quite new and already lacks a strong lobby due to relatively low environmental administration (Ministry of Planning & Investment, 1997).

The situation is especially acute in Ho Chi Minh City, the economic engine of Vietnam. It is home to over 30,000 medium and large-scale industrial establishments and the numbers of both domestic and foreign investment are rapidly increasing (Hai, 2001). Although many of these industries provide employment opportunities and prosperity for members of the local community, their environmental practices are often poor and contribute significantly to urban pollution. Consequently, assessing the feasibility of introducing new and innovative alternatives into the planning mechanisms of Ho Chi Minh City needs to be explored.

The *Industrial Ecology* concept is one innovative alternative that is rapidly gaining recognition throughout the world. Its applications have already become quite popular in Western Europe and North America. This emerging framework attempts to move from a linear- to a closed materials loop system in all realms of human production and consumption (Lowe and Evans, 1995). This can presumably bring the world closer to an ecological model in its dynamics. Industrial *waste exchange* networks are one method by which the industrial ecology concept can be promoted in Ho Chi Minh City. Waste exchanges connect waste generators with reusers and recyclers (US EPA, 1994). Some of the benefits of waste exchanges include reduced disposal costs and quantities, reduced demand for natural resources, and a potential increase in the value of wastes.

1.1. Purpose and Objectives:

The overall objectives of this research are three-fold. These are:

- To provide an overall understanding of the planning or institutional structures that influence industrial waste management in Ho Chi Minh City;

- To identify the potential role of waste-exchanges as a tool for promoting the industrial ecology concept in Ho Chi Minh City;
- To explore various planning policies and forms of outside assistance that may be needed in order to promote waste exchanges in Ho Chi Minh City.

Industrial pollution is a growing concern in Ho Chi Minh City. Although the local government has tried to implement a variety of programs and policies to address problems associated with industrial waste, the results have been inadequate. This is due to a lack of incentives for companies to pay attention to environmental issues. Consequently, more incentive-based waste reduction options need to be explored.

Due to the large quantities of valuable wastes being produced in Vietnam and a relatively un-established network amongst industry, waste exchanges may contribute positively to both the environment as well as the economy. Waste Econ and the *Ontario Centre Environmental Technology Advancement* (OCETA) should help the industrial ecology concept gain momentum in Ho Chi Minh City by conducting a *Pilot Industrial Waste Exchange Program* in collaboration with the *Centre for Environmental Technology and Management* (CEFINEA); the Vietnamese Partner involved this Project.

2.0. RESEARCH APPROACH

I conducted my research in Ho Chi Minh City between May 2001 and August 2001 and returned again for a short period between December 2001 and January 2002. The methodology used in this research encompasses the following: 1) a literature search, 2) interviews with key informants, and 3) an analytical case study of Ho Chi Minh City's Black and Green Book Companies. Steps 2 and 3 were conducted solely in Ho Chi Minh City.

2.1. Literature Search:

The literature search provided the background information needed in order to set the context and to gain insight on the industrial ecology concept as well as industrial waste management in Ho Chi Minh City. The search began with a review of existing information in government reports, NGO reports, available data from private organizations, journals and periodicals, archives and the web.

2.2. Key Informant Interviews:

The research also consists of 22 semi-structured personal interviews with local and state government officials, waste-minimization experts (e.g. academics, consulting companies, international aid organizations) and non-governmental organizations (NGO's). I also interviewed 4 former waste pickers living near the *Hoc Mon* Landfill in order to gain a better understanding of the informal sector's role in managing industrial waste in Ho Chi Minh City and the potential impact that they may experience from the creation of a waste exchange.

2.3. Corporate Case Study:

Lastly, open-ended, corporate interviews with Black Book and Green Book companies in the pulp and paper and food processing sectors were conducted. The questions in both Black Book and Green Book Company questionnaires are quite similar in order to facilitate comparison in their environmental practices and attitudes towards the establishment of waste exchanges. These industrial sectors were chosen on the advice of my client, OCETA and also because they have been identified as highly polluting industrial sectors by Vietnamese government authorities as well as in a variety of literature. Identified as "champions," Green Book companies may be more receptive to adopting eco-industrial principles such as waste exchanges, thereby leading the way to a more "ecological" industrial system in Ho Chi Minh City.

The corporate interviews have helped to identify motivations, practices and opportunities for improvement in industrial waste management in Ho Chi Minh City. For example, the interviews investigate the reasons why certain companies have chosen to improve their environmental operations, the types of by-products that they produce, the percentage of by-products that are recycled or reused within their companies, and the environmental and economic benefits that they experience from doing so. Finally, the interviews help to uncover company attitudes and perceptions with regards to the opportunities for and barriers to establishing a formal waste exchange in Ho Chi Minh City. These responses have allowed me gauge how close they may be to embracing elements of the industrial ecology concept, namely waste exchanges.

All of the interviews were conducted with the aid of a translator who was fluent in both Vietnamese and English. The translator was a student as well as a part-time member of CEFINEA. Shortly after each interview, the responses were carefully translated from Vietnamese to English. Due to time constraints, the majority of corporate interviews were conducted in Vietnamese. Each interview took approximately 1 1/2 to 2 hours. Sample questionnaires are located in the *Appendix Section* of this report.

3.0. VIETNAM AT A GLANCE

3.1. Geographical Conditions:

Officially named the *Socialist Republic of Vietnam*, Vietnam is located along the southeast margin of the Indo-Chinese Peninsula with a total land area of over 31,104 million hectares and a coastline of about 3200 km (Asia Development Bank, 2000).

Vietnam is essentially a tropical country with a humid climate. The mean annual temperature is 23° in Hanoi, 25° in Hue City and 27° in Ho Chi Minh City. The average annual rainfall is 200mm and this precipitation falls mainly during the rainy season, which varies according to the specific geographic regions in the country (Mercker & Hoang, 1999).

3.2. Population Pressures:

Vietnam is currently the second most populous Country in Southeast Asia, after Indonesia. With a population of 78.5 million, it is one of the most densely populated nations in the world. The population density is 241.2 persons per square km. In 1999, the average life expectancy was 69 years (World Bank Source Book, 2001).

3.3. Economic Development:

The annual per capita income of Vietnam is estimated at U.S.\$290, making it one of the poorest countries in the world (World Bank, 2001). Emerging from the strong socialist influence of the Soviet Union through the 1980s, Vietnam has been changing from a centralized, largely controlled socialist economy to one that is primarily market driven. It is an economy in transition and is referred to as *Doi Moi*, or *economic renovation* policies. Institutional power and centralized enforcement systems of the past in Vietnam have been replaced with a greater emphasis on business growth and autonomy. The government has liberalized economic production and exchange; resource allocation has shifted toward market mechanisms, with the goal of increasing flexibility and efficiency, and tax reforms have transferred assets to, and strengthened the role of the private sector. Through the *Doi Moi*, GDP has grown at approximately 7% since 1989 and is currently at U.S.\$31 billion (World Bank, 2001).

At the same time however, Vietnam is being confronted with a number of very real tradeoffs in its development, particularly between growth and the environment. Serious environmental problems include: deforestation, degradation of land resources, the inefficient conservation of freshwater, threats to ecosystems and rise of environmental pollution, not to mention the long-

term impact of war (Quy, 1999).

3.4. Study Area: Ho Chi Minh City:

Ho Chi Minh City, formerly known as Saigon, is the largest city, the largest port, and the commercial and industrial centre of Vietnam. It is located on the right bank of the Saigon River, a tributary of the Dong Nai. The City covers over 2000 km² and is home to over 5 million people, constituting about 6.4 % of the national total (Hai, 2001).

Approximately 16,000 dwellings in Ho Chi Minh City are located along the canals with practically no sanitary facilities (Ha and Wong, 2001). As a result, liquid wastes are discharged directly into the water bodies. A similar case is true for the expanding industrial sector. Industrial effluents and garbage are being illegally discharged into water bodies and the air. While the government is trying to crack down on polluters by introducing new laws and policies, these efforts have had only a minor impact on the environment in Ho Chi Minh City.

Rapid urbanization in Ho Chi Minh City created the need to clearly differentiate between residential, industrial and commercial areas. Consequently, in 1997, Ho Chi Minh City prepared a new Master Plan that attempts to guide future spatial development. Another objective of the Plan is to minimize negative environmental and social impacts on residents. While the Master Plan promotes economic development and industrial activity, it advocates that all industries should be established in new industrial zones located outside of the City Centre (Ha & Wong, 2000).

A map illustrating the land uses under the New Master Plan is shown in Figure 1. Note that *Existing Industrial Areas* (shown in pink) and *Developing Industrial Areas* (shown in purple) are mostly located outside of the central city.

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4.0. AN INDUSTRIAL ECOLOGY APPROACH

4.1. Conceptual Framework: Industrial Ecology:

Industrial waste management strategies should aim to be as systematic and holistic as

possible, consisting of technical, political, economic and socio-cultural dimensions. Traditionally, these dimensions have been viewed as separate systems from the environment, each operating independently of one another. The conceptual basis for my research is *industrial ecology*, a recently emerging concept that recognizes the interdependence of these systems and advocates strategies that both protect the environment while improving business performance.

Allenby (1999) defines industrial ecology as “the means by which humanity can deliberately and rationally approach and maintain a desirable carrying capacity, given continued economic, cultural, and technological evolution.” The concept requires that an industrial system be viewed not in isolation from its surrounding systems, but in concert with them.

A central goal of industrial ecology is to move from a linear- to closed-loop system in all realms of human production and consumption. It is similar to complex systems that are found in nature such as a rainforest (Ayres & Ayres, 1996).

4.2. Key Themes:

There are several distinct themes in industrial ecology. The first is that *industrial operations are natural systems that must function within the constraints of their local ecosystems and the biosphere* (Lowe & Evans, 1995). Natural and human systems are not separate; they are intimately co-evolved.

Another theme that is prevalent in the literature is that *the dynamics and principles of ecosystems offer a powerful source of guidance in the design and management of industrial systems. As nothing is wasted in nature, industrial products, processes, services and operations should produce residuals - not waste*. This means that every molecule that enters a specific manufacturing process should leave that process as part of a salable product. The manufacturing process should be designed not only to produce the primary product efficiently, but also residual streams, which can be reused or sold (Ayres & Ayres, 1996). Eco-industrial parks are one manifestation of the concept of industrial ecology that strongly mimics a natural ecosystem. The interactions among companies resemble the dynamics of natural ecosystems, where all materials are continually recycled and new firms emerge to take advantage of opportunities to process waste into valuable materials (Martin, Cushman, Weitz, Sharma & Lindrooth, 1998). In short, Industrial Ecology aims to shift from a conventional one-way industrial system to an interactive and circular industrial system.

The third emerging theme is that *achieving high energy and materials efficiencies in production, use, recycling and service will generate competitive advantage and economic benefits*. Ultimately, the source of economic value is the long-term viability of the planet and its local ecosystems without which present business success is meaningless (Lowe & Evans, 1995).

4.3. Application of Industrial Ecology: Industrial Waste Exchanges:

A major component of the eco-industrial concept is to design and develop efficient technologies and networks for recycling and reusing waste materials, so as to eliminate the need to extract 'virgin' materials that are extremely unsustainable over the long-term. One opportunity for such improved performance is in industrial waste exchanges (herein referred to as waste exchanges), where collections of companies achieve materials and energy efficiency through the exchange and reuse of by-products (or residuals). This process works on the notion that one person's waste is another's raw material' (Environment Canada, 2001).

The waste exchange process connects waste generators with waste reusers and recyclers. Some of the benefits of waste exchanges include: reduced disposal costs, reduced disposal quantities, reduced demand of natural resources, and a potential increase in the value of wastes (U.S. EPA, 1994). Waste exchanges are a vital component in the operation of a successful eco-industrial park, however, they can also be successfully operated at a broader scale such as the city, province/state or even at a national level (Graedel, 2000). Some categories of wastes available for exchange include: organic and inorganic chemicals, laboratory chemicals, paint, plastic, rubber, textile and leather, metal, oil and wax, wood and paper, glass, and construction debris, just to name a few (Ayres and Ayres, 1996).

4.3.1. How a Waste Exchange Works

Generally, there are five steps involved in a waste exchange (Bedfordshire, 2000):

Step 1:

Contact is established between the waste exchange facilitators and participating companies. This is to gauge the company's interest in matching its waste disposal or raw material needs with those of others.



Step 2:

Requires a response from interested participants, including contact details and the nature and quantities of materials they are interested in, or want to dispose of.



Step 3:

Details of companies' waste production and raw material needs are entered into a Waste Exchange database. In order to protect patent products or process design, many companies often choose not to reveal either their raw material input or the waste generated from their process (Environment Canada, 2001). Consequently, names of waste generating companies may be confidential, identified by only a code number.



Step 4:

Participants are issued a report, providing details of companies that are interested in their waste. At this stage, the role of the waste exchange ends. It is left to the companies themselves to see whether a transfer deal can be struck.



Step 5:

Although formal involvement of the waste exchange facilitators ends, participants are usually asked to inform the waste exchange whether a match or deal has been made in order to assess the success and sustainability of the waste exchange.

4.3.2. Waste Exchanges: The North American Experience

Over the last decade, the industrial ecology concept has become quite popular within North America and Europe. Although closing material loops by reusing and recycling wastes is a major part of industrial ecology, formal waste exchange services have been established as far back as during World War II in order to conserve resources and equipment. The earliest known waste exchange was established in Britain in 1942 and was titled the *National Industrial Waste Recovery Association* (US EPA, 1994).

However, the growing inventory of waste has become a major problem in virtually all industrial sectors throughout the world. Many North American and European nations, states and provinces have established formal waste exchange services. There are currently greater than

70 formal waste exchanges operating in major urban centers in North America such as New York, Chicago, and Toronto (CAC, 1999). In most cases, waste exchanges are provided as a free service to industries. Waste lists are published three to four times a year, some are updated monthly, and most exchanges have web sites on the Internet with links to other exchanges (Buggeln, 1998).

Through waste exchanges, companies save thousands of dollars in avoided disposal costs or in obtaining raw materials at reduced prices. According to Dr. Bob Laughlin, former director of the oldest waste exchange in North America, the Canadian Waste Materials Exchange, materials listed on the exchange have a 20 percent chance of becoming diverted for useful purposes. It is also clear that Internet exposure is helping to increase the exchange rates (World Bank, 2000)

In this section, North American waste exchanges are highlighted. An exploration of existing operations can draw important lessons before establishing future waste exchanges in an international context.

The Canadian Waste Materials Exchange (CWME) and Ontario Waste Exchange (OWME)

Ortech International, a Canadian provincial research organization, originally ran both the *Canadian Waste Materials Exchange (CWME)* and the *Ontario Waste Materials Exchange (OWME)*. Since its inception in 1978, the CWME listed over 28,000 items of waste in its bi-monthly bulletin and has been responsible for over 600 waste transfers per year (Environment Canada, 1996).

During its first two years, the CWME received all of its financial support from Environment Canada in order to guarantee its viability as a non-profit organization. After that time, 25% of its operating budget came from subscriber fees, which were set at \$50 (on a voluntary basis) and from waste listing fees of \$160. Four provincial governments provided the largest portion of its operating budget (Environment Canada, 1996). Ortech International controlled the CWME and OWME between 1984 and 1997. In 1997, the CWME was dissolved due to low levels of funding and industry interest. Responsibility for the OWME was transferred to OCETA.

The Ontario Waste Materials Exchange (OWME) is offered as a free service in order to facilitate the reuse and recycling of industrial waste materials. It is still in operation and creates a network that allows waste products or outputs of one industry to become the raw material inputs of another. Through the Exchange network, OCETA provides generators with access to reuse and recycling markets, and users with access to material supply sources.

Although the federal and provincial government no longer funds the OWME, funding is

secured from various sources. In the spring of 2001, OCETA received funding from the Volunteer Action On-line Program to strengthen its on-line capabilities and develop the infrastructure required to increase volunteer participation with the Exchange Network. Some of the improvements include and expanded network providing information and opportunities pertaining to the production and diversion of materials that would otherwise be diverted to a landfill. These new developments have allowed the Exchange to expand its traditional sole focus of tracking tonnes diverted from landfill, to become more of a well-rounded network providing information and opportunities pertaining to the production and diversion of materials traditionally destined for landfill.

Other sources of funding for the OWME include: *Automotive Parts Manufacturers' Association, Canadian Manufacturers' and Exporters, the Composting Council of Canada, Shell Environmental Fund, and the Toronto Environmental Alliance* (Sawler, 2002).

Some of the services that OCETA provides to interested participants are information on reuse and recycling, assistance with waste reduction and material substitution, and assistance with research and development projects (OCETA, 2002). Currently, OCETA has 200 registered users. OCETA does not play a major role in the waste exchange process due to the fact that the infrastructure is in place and industry networks are already established in Ontario.

National Materials Exchange Network (NMEN):

As a result of a Congressional appropriation in the early 1990s, the *United States Environmental Protection Agency* offered a grant of \$500 000 to two smaller-scale waste exchanges in order to develop a computerized *National Materials Exchange Network* (NMEN) (US EPA, 1994).

The rationale behind the establishment of the NMEN was to:

- § Exchange materials at both local and national levels;
- § Facilitate exchange of distinct waste materials in different geographic regions;
and
- § Diversify the market by identifying a greater number of wastes.

NMEN is an electronic system with listings from 42 participating exchanges. Listings are divided into 17 categories and can also be sorted by region, state and category.

Over 10,000 listings available to industrial and consumer users at no charge to immediately

list or search among thirty categories of available and wanted items such as scrap metal and surplus chemicals. The NMEN is still active and is a valuable tool for states or localities due to the fact that technical assistance programs that are interested in establishing waste exchanges in their locales do not need to devote a great amount of resources to its administration and operation. Moreover, NMEN reduces the start-up costs for an exchange by providing a nationwide system that can publicize listings generated by an exchange and can provide access to a large number of listings.

4.3.3. Status of Waste Exchanges in North America

The numbers of waste exchanges appeared to be expanding quite rapidly in North America, especially until the mid-1990s (US EPA, 1994). However, its popularity is declining. This decrease in popularity is due to a lack of funding from governments, low levels of marketing by waste exchange facilitators, and already-established industrial networks that no longer require participation in a waste exchange (Sawler, 2002). Although wastes are being exchanged informally in Asian countries, the amount of waste exchange activities is generally unknown.

Waste minimization methods and technologies in North America and Europe are also more developed amongst industry than in Asia. By establishing formal waste exchanges in newly industrializing countries of Asia, companies could significantly reduce the amount of wastes requiring disposal.

4.3.4. Waste Exchanges: The Southeast Asian Experience

Rapidly increasing industrialization is resulting in rapidly increasing industrial pollution in a majority of Asian countries. In many instances, overly ambitious pollution control measures make it impossible to enforce compliance with environmental regulations. Asian countries have been informally exchanging wastes for centuries. However, with the advent of computer and internet-based technologies, formalized waste exchanges are starting to gain momentum in Asia. This section provides examples of waste exchanges that are currently operating in two Southeast Asian countries: the Philippines and Indonesia.

Industrial Waste Exchange of the Philippines:

With assistance from the *International Development Research Council* (IDRC), the *Industrial Waste Exchange of the Philippines* was established as a pilot project in 1987. In 1993, responsibility was transferred to Philippine Business for the Environment Inc (PBE). PBE is a non-stock, non-profit organization formed to assist business firms in making their operations supportive of environmental protection efforts.

Almost three-quarters of the 15 000 industrial establishments in the Philippines are crowded into a single region: Metro Manila. Consequently, this area benefits greatly from a waste exchange. The exchange is the first in Southeast Asia.

The project has developed a database of materials available and materials wanted with corresponding specifications and contact details. A catalogue is published twice a year. It lists at least 600 industrial waste products of all kinds and over 130 products sought by industry. Each product is assigned a code to ensure that company identity, location and technologies used remain confidential. Currently, there are over 500 participating companies and many successful waste exchanges have occurred (IDRC, 2000).

The system reduces risks posed to the environment while stimulating the economy. For instance, calcium carbide sludge, which in the past would have been dumped, is now used as a neutralizer in wastewater treatment plants, waste pulp from a pineapple cannery finds a future as animal feed; gypsum waste is reused as a component in wall and cement finishes; acid is recycled into batteries (Sinclair & Gunningham, 2000).

Although the IWEP has been successful in attracting participants and developing an accessible listing of wastes available for exchange, the initiative needs time and personal follow-up.

There is a need for consolidators who will collect one particular type of waste from various companies to build up a sizeable inventory before another company will find it worthwhile to buy it. There are now signs of it becoming self-sustainable because of revenues derived from listing fees and advertising fees for the catalogue

Indonesia's Waste-to-Product Partnership Program:

Established in 1998, the *Waste-to-Product Partnership Program* identifies potential business partnerships between companies that want to dispose of waste materials and those that can either convert the waste into new products or better recycle it in Indonesia. This initiative is still in the research phase and is being managed by the *Indonesian Pollution Prevention Roundtable*. The objective of the *Waste-to-Product Partnership Program* is to develop a system that creates linkages between waste generators and enterprises that can use the waste to manufacture new products.

Four institutions have been selected as regional coordinators: *PT. Aspros* (West Java); *Business Partnership Foundation* (Central Java); *Centre for Agribusiness Community Empowerment Studies* (East Java); and *Indonesian Society for Environmental Engineers*

(Jakarta metropolitan area). Each of these institutions has pulled together consortiums of industry associations, local government, academia, and consultants to carry out the program. In addition, staff members have been recruited and trained for all locations (USAEP, 1999).

Since 1998, staff members have visited numerous factories to collect data and conduct preliminary field surveys. Based on these studies and on a strict set of criteria, 11 types of waste streams have been identified. These include plastic bottles, scrap PVC, worn tires, dry cell batteries, and waste generated from processing coconuts, tofu, and fish. For each of these waste streams, team members are identifying appropriate recycling and conversion technologies, types of new products, and product users/consumers (US-AEP, 1999).

4.4. Lessons Learnt From Existing Waste Exchange Operations:

The long-term sustainability of waste exchanges is impeded by three major factors: insufficient funding, liability and safety, and low levels of marketing.

Insufficient Funding:

Currently, government revenues, user and tipping fees fund most waste exchanges. An *Ortech International* survey found that North American waste exchanges usually operate with very small budgets.

Governments fund most of the budget, and only about five per cent of the budget is provided by fees and other revenues (US EPA, 1994).

The stability and sustainability of the budget is depends heavily on funding. Most exchanges contend that they are grossly under-funded. Furthermore, exchanges are usually run with fewer than 4 employees. Limited staff resources limit the quantity and quality of waste exchange services that can be provided (US EPA, 1994). It can also negatively affect the derivation of statistics, which provide important information about the success/failure of waste exchanges.

Liability and Safety:

Some companies are still apprehensive about participating in a waste exchange due to a potential for liability. Research suggests that more non-hazardous wastes are transferred than hazardous as a result of the liability risks involved. For example, a company may exchange hazardous material with another company but may be held accountable for any mishandling of that material by the receiving company (US EPA, 1994). As a result, many companies forgo the potential savings associated with exchanging hazardous wastes.

The safety of worker and community health is also an issue. The practices of concentrating

wastes and by-products, handling them and transporting them can increase the probability and magnitude of the risk of explosions, fires, and acute toxic episodes. Examples include the concentration of carcinogenic chromium (VI) compounds, volatile organic waste products, and unstable chemical mixtures in waste (Ashford, 1997).

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Marketing

Promoting the visibility of waste exchanges is also an important factor determining its success. Waste exchange information needs to be easily accessible and available to the business community in order to maximize its use. Once again, this point brings up the issue of funding. Without adequate funding, waste exchange operators cannot allocate many resources to the marketing of their services.

4.5. Can Waste Exchange Concepts be Applied in Asia?

In spite of the above-noted shortcomings, waste exchanges and hence industrial ecology concepts have contributed to pollution management. They have stimulated new ways of thinking and innovative design solutions in a growing number of companies, universities and governmental agencies throughout North America, Europe and, more recently in certain parts of Asia.

Nonetheless, a major question is still whether the industrial ecology concept, and waste exchanges specifically can be successfully integrated into newly industrializing countries such as Vietnam. To date, most work within the framework of industrial ecology has focused on North American and OECD economies. Yet the developing market economies of Asia are becoming and will continue to be the site of major investment. Asia's share of global output for instance, which was roughly 10% in 1950 and 30% in 1995, is expected to reach 55% by 2025 (Radelet and Sachs, 1997).

This remarkable industrial growth is undoubtedly having enormous environmental repercussions in Asia. Likewise, escalating urbanization and industrialization is rapidly increasing the generation of industrial waste in Vietnam. A study of the potential for waste exchanges to reduce the amount of waste requiring disposal is therefore timely.

However, web-based waste exchange services that are common in North America may not be appropriate in Vietnam because smaller companies often do not have access to computers or the Internet. Consequently, other company targeting and waste listing methods should also be considered. Some options include: holding information sessions for potentially interested companies, mailing monthly listings to companies, sending waste exchange staff to companies to attain waste information, setting up a phone service for companies to list wastes available for purchase or wastes needed. Taking cultural and technical constraints into

account could improve the participation rates in the waste exchange.

In the remainder of this report, I investigate the feasibility of establishing waste exchanges in Ho Chi Minh City. This is accomplished by reviewing critical issues associated with industrial waste management and also by exploring whether existing policies and infrastructure is adequate to manage an industrial waste exchange. I then discuss the findings of my corporate case study, which was conducted in order to shed light on some of the opportunities for- and barriers to establishing waste exchanges in Ho Chi Minh City.

5.0. A SNAPSHOT OF THE INDUSTRIAL POLLUTION SITUATION IN VIETNAM

The rapid industrial transformation currently taking place in Vietnam is having severe environmental repercussions. About 90% of industries in Vietnam have no wastewater treatment facilities. Groundwater has decreased in both quality and quantity and air pollution levels in major cities regularly exceed two to five times Vietnam's national standards (UNDP, 1999).

5.1. Vietnamese Government:

The Vietnamese government appears to be torn due to conflicting advice provided by the international community. On one hand, sustainable development and greater environmental awareness is advised, while on the other, the nation is encouraged to integrate into the world economy as quickly as possible without imposing barriers on already-struggling industries.

Unfortunately, policies aimed at promoting principles of sustainable development in Vietnam tend to be taking a backseat to economic development. While the Vietnamese government has passed environmental policies, they have tended to be a response to serious environmental situations as they arise rather than being a proactive and systematic effort to build environmental factors in the earliest stages of economic planning (Ministry of Planning and Investment, 1997). State responsibilities include standards setting, local inspections and seeking international cooperation (Sikor & O'Rourke, 1996). There is an umbrella *Environmental Protection Law* establishing broad responsibility and directions for environmental policy. The most recent macro-level project is the "National Environmental Action Plan." Within this plan, seven priority programs for the government have been defined. These are: solid and hazardous waste management, water management, forest management, environmental institution strengthening, education, and community

involvement. However, this progress has not kept pace with rapid industrialization. According to the *National Environmental Agency* (2001), less than two percent of the government's budget funds environmental projects, making environmental projects and plans severely under-resourced.

Evidently, the *Environmental Protection Law* (EPL) is much stronger in its mandate than in practice. Upon conducting industrial waste management research in Vietnam, I have realized that while there is a requirement that all industrial enterprises comply with specified environmental standards, the government does not have highly trained personnel to monitor or evaluate industrial operations, nor do they have an appropriate timeline for compliance or a standard methodology to respond to non-compliance.

Furthermore, the EPL has provisions for levying fines against polluters, but does not clearly explain how fines will be determined and who should be responsible for collecting them.

5.2. The Role of New Environmental Management Systems in Vietnam:

The *International Standards Organization 14000 (ISO 14000)* is one systematic approach by which the values of business are starting to embrace responsible environmental management. Increasingly, businesses are evolving their values and realizing that by developing and operating a harmonious environmental management system in combination with their existing system, they can abide by environmental laws while making a profit (World Conservation Union, 1999). However, the *ISO 14000* has not had a major impact in Vietnam in either its domestic or foreign companies. To date, only five companies (all foreign investment) and one brand-new industrial zone have implemented the *ISO 14000* into their operations (VPC, 2001).

It should be noted however, that the *ISO 14000* series is a Western concept and may not be feasible in a newly industrializing country context for two reasons. Firstly, its implementation involves high costs that smaller Vietnamese companies cannot afford and secondly, there is a lack of qualified human resources that can provide environmental training/education and technical support (Thi, 1997). Hence, international standards have not had a huge effect in changing business values towards the environment in Vietnam thus far. As such, only one foreign-owned company that participated in my corporate case study is listed in the Green Book as *ISO 14001* certified.

6.0. INDUSTRIAL WASTE MANAGEMENT IN HO CHI MINH CITY

Ho Chi Minh City is home to over 30,000 medium and large-scale industrial establishments (Hai, 2001). Although many of these industries have operated for years and provide employment opportunities for members of the local community, their environmental practices are often poor and contribute significantly to urban pollution. Waste treatment and collection has not kept up with demand. Due to the fact that Ho Chi Minh City does not have disposal facilities specifically for industrial wastes, liquid and solid wastes are often disposed illegally into canals, sewers, and other illegal dump sites (Hai, 2001).

The “State of the Environment Report for Ho Chi Minh City” (2000) provides estimates of average amounts of solid waste generated in Ho Chi Minh City per day:

- 4900 tons/day of domestic solid wastes
- 260 tons/day of industrial solid wastes (including 25 tons/day of hazardous solid wastes), and;
- 11 tons/day of hospital and sanitary wastes.

6.1. Black- and Green Books:

A number of programs and initiatives have been developed in Ho Chi Minh City to improve the existing industrial waste situation. One major program has been the “Industrial Environmental Pollution Survey in Ho Chi Minh City” which was undertaken in 1993. Using the results from this survey, the Ho Chi Minh City government embarked on a program in 1994, which places highly polluting industries in a “Black Book” and companies who have made exemplary environmental improvements in a “Green Book.”

Once a company is placed in the Black Book, it is required to take one of the three following actions: 1) relocate to an industrial zone located outside of the city, 2) remain at their current location but introduce “Cleaner Production (CP)^[1]”, or 3) shut down.

The Black and Green Books have only been updated twice. To date, 87 companies are listed in the Black Book (43 in the first and 44 in the second) and 16 companies are listed in the Green Book (ENERTEAM, 2001). Only one Black Book company has been shut down and two companies have relocated into industrial zones.

In conjunction with a local NGO, the Ho Chi Minh City *Department of Science Technology and Environment* (DoSTE) undertook a study exploring the rationale supporting the continued use of the Black Book (ENERTEAM, 2001). The focus of this study was to interview Black and Green Book companies in order to gauge their perceptions of being placed in the Book. Some of their conclusions are that:

- Black and Green Books are mainly an awareness tool.

- Companies are not greatly affected by being placed in the Black or Green Books either economically or socially.
- While it has pushed them to pay regard to industrial pollution to an extent, it is not a strong economic instrument for improving their environmental performance.

The majority of companies continue to be listed in the Black Book year after year because they do not have the financial wherewithal to purchase environmentally efficient equipment or pay extensive environmental consulting fees. Other companies simply cannot afford to change their production due to the potential loss of revenue.

DoSTE has proposed that the Government assist enterprises with preferential bank loans and tax incentives, and factories that have to be relocated should also be compensated fairly for their property. For instance, companies wishing to relocate to an industrial zone outside of the City are provided with numerous incentives, including: interest-free loans; lease of land where relocated companies used to exist to other interested; and tax free status for the first 2 to 3 years of any new business venture (Lam, 2001).

New environmental directives stipulate that the adoption of Cleaner Production must be encouraged through taxation and credit policies and that the funding of environmental protection should almost become 'institutionalized' (UNEP, 2001). Nonetheless, these incentives have not had a major impact on industrial pollution management in Ho Chi Minh City, namely due to the fact that loans and tax reductions are not substantial enough for companies to reduce or abate their pollution levels (Triet, 2001).

6.2. Highly Polluting Industrial Sectors in Ho Chi Minh City:

Although industrial activity in Ho Chi Minh City has contributed significantly to the country's GNP, it has also contributed to environmental pollution and degradation. According to the Ho Chi Minh City's DoSTE, food processing and pulp and paper industries are amongst the highest polluting sectors due to the presence of high volumes of untreated organic wastewater (DoSTE, 1999).

6.2.1. Food Processing Sector

In Vietnam, the food processing sector discharges the highest organic waste loads to the environment. In the Black Book set up by DoSTE, alcohol production, food and seafood processing companies were identified as the leading sources of pollution.

Under the case study component of my research, I interviewed 4 seafood-processing companies (2 in Black Book and 2 in Green Book). Seafood processing generally involves eviscerating, defrosting, cleaning and can washing the seafood (Nguyen, Visvanathan & Nguyen, 2001). These processes consume a large amount of water. The *Vietnam Ministry of*

Fisheries (1998) reports that the average amount wastewater produced is 15 cubic metres per ton of processed product.

Wastewater from food processing industries is seldom treated and contains high levels of chemicals and nutrients such as nitrogen and phosphorous. Their presence may cause abnormal growth of algae in receiving waters. This process is known as *eutrophication*, and often results in a lack of oxygen for aquatic species and algal toxicity (Nguyen *et al*, 2001). Not only does wastewater contribute significantly to organic pollution, high salt content is also a major concern. Useful byproducts in food processing companies include hydrogen peroxide. Food-processing companies also produce a substantial amount of solid wastes such as discharged fish and animal solids, fruit and vegetable peels, and eggshells (DoSTE, 1999).

6.2.2. Pulp and Paper Sector

Pulp and paper production companies generally undertake two main steps: 1) pulping, and 2) paper-making. During the pulping step, the raw materials are separated from the fibre. Raw materials usually consist of wood pulp, reused paper and cardboard, cotton or wool.

After the raw materials are separated, the pulp is beaten in a Hollander during which time the bleach (hydrogen peroxide) and other chemicals are added (Hai, 2001). Paper is produced by diluting the pulp stock and putting it through equipment that removes larger particles. It is then rolled, cut and packaged for sale.

The paper production process produces a large amount of wastewater, solid wastes such as scrap paper, and air pollution. Elementary chlorine and hydrogen peroxide are amongst the bleaching chemicals that often enter the environment without treatment. High-suspended solids of fibre and impurities from raw materials also characterize wastewater (Beukering and Bouman, 2001).

6.3. Informal Sector's Role in Industrial Waste Management:

In Ho Chi Minh City, the informal waste recovery and recycling system contributes extensively to waste management. Over the years, it has responded to the demand for secondary raw materials in various industrial sectors where virgin raw materials were in short supply or costly (Preceup Research Action, 1999). Years of war, economic deprivation and isolation may also be factors contributing to this thriving sector.

6.4. Need for More Proactive Pollution Solutions:

Due to the fact that the Black and Green Books have not been very successful in decreasing industrial pollution levels, innovative alternatives must be explored in Ho Chi Minh City. One potential solution is to introduce formal waste exchange networks as a tool for promoting eco-industrial behaviour. The following section explores the various aspects of industrial waste management that may determine the feasibility of a waste exchange in Ho Chi Minh City.

7.0. WASTE PICKING AT THE *HOC MON* LANDFILL

The Hoc Mon landfill is one of the largest in Ho Chi Minh City and is located in the Hoc Mon District. Over 4000 tonnes of waste per day is transported to this 43-hectare landfill.

At one time, over 500 waste pickers worked at the Landfill site. Since 2001, the government passed a law prohibiting waste pickers to enter the landfill property. The objective of this law is to deter rural dwellers from migrating to the City and to also improve the health and safety of waste pickers (DoSTE, 2001).

I had the opportunity to speak with four former waste pickers who lived near the landfill. Three pickers were female and one was male. All of the waste pickers downplayed health problems that arose as a result of waste picking. They claimed to have made a good living at the Landfill and would like to be allowed to pick again.

7.1. *Industrial Wastes at the Hoc Mon Landfill:*

All of the former pickers reported collecting and sorting industrial wastes, which included: metal and plastic scrap, paper, cardboard, rubber and glass.

An engineer who is employed at the Hoc Mon Landfill believes that although companies should be sorting and treating their own wastes, many types of industrial waste still end up in the landfill. He also feels that when informal waste pickers were allowed to enter the landfill, they played a very important role in industrial waste management by sorting and separating industrial wastes. Unfortunately, these activities have also had severe health repercussions, which is of greater priority (Interview, 2001).

Since the potential establishment of waste exchanges could further formalize industrial waste management, it is likely that the amount of recyclable material available for collection by the informal sector will be reduced.

However, informal workers carry out most recycling activities in Vietnam and this sector can play a major role in closing the materials loop. Details of this sector's role in the establishment of waste exchanges are discussed in *Section 8* of this report.



Figure 2: Over 4000 tonnes of garbage is transported to the *Hoc Mon* Landfill daily.

8.0. CORPORATE CASE STUDY RESULTS

Under the case study component of my research, I conducted 9 in-depth, corporate interviews with Black Book Companies. Of these 9 companies, 5 are in the food-processing sector and 4 are in the pulp and paper sector. The names of companies that cooperated in my research are stated in the Appendix section of this report. These sectors have been chosen because they are identified as highly polluting by Vietnamese government authorities as well as in a variety of literature.

During my second field visit, I conducted 6 in-depth, corporate interviews with companies listed in the Green Book. All companies are in the food processing sectors, and their names are located in the *Appendix Section*.

Corporate interviews were conducted for two main reasons: 1) to trace the types and amounts of waste being produced, treated (if at all) and disposed, and 2) to determine if these companies were in a position to successfully participate in a waste exchange.

8.1. Key Findings:

The corporate questionnaire that was conducted is divided into four major categories:

1. Waste generation and treatment of companies;

2. Government monitoring practices;
3. Environmental actions (if any) taken by Black and Green Book Companies;
4. Company's views and opinions toward establishing waste exchanges.

8.1.1. Waste Generation and Treatment

In order to gauge the feasibility of establishing a waste exchange in Ho Chi Minh City, it is important to have information on the types and amounts of wastes that are produced in company operations. The questionnaires focused predominantly on solid and liquid wastes. Perhaps not surprisingly, when questioned about the amounts of solid wastes produced, most of the Black Book and Green Book companies were either unwilling to provide that information or were unaware of the amounts. The quantity of wastes generated and treated is based on the findings of the questionnaires alone.

Waste Water Generation:

Wastewater produced in the interviewed-companies generally contains the following types of substances:

- Alkali and Acid
- Inorganic Chemicals
- Organic Chemicals and Wastes
- Solvents
- Laboratory Chemicals

Some of the sources of wastewater are: industrial sanitation processes (i.e. cleaning equipment and machinery), bleaching and dyeing, washing raw materials, and finally blood and fecal matter (in seafood processing and slaughter factories).

On average, Black Book companies produced 350m³ of wastewater per day, with the highest being 2200m³ at a paper company *Vinh Hue Paper Company* and the lowest being 40m³ (*Table 1*) at the *Khanh Loi Fish Processing Company*.

The average amount of wastewater being produced by Green Book companies is 145 m³, with the highest being 250m³ at the *Tan Thuan Food Processing Company* and the lowest amount being 15m³ at the *SAFACO Food Processing Company* (*Table 1*). The *Binh Dong Company* did not provide wastewater information.

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Table 1: Waste Water Generation of Black Book and Green Book Companies

Black Book Company	Amount (m³/day)	Green Book Company	Amount (m³/day)
Kanh Loi Fish Processing Company	40	SAFACO Food Processing Company	15
Trung Son Seafood Factory	120	Nam Phong Foodstuffs Company	150
Thien Houg Food Stuffs Company	41	Wall's Vietnam Ice Cream Company	30
My Lan Paper Company	144	Tan Thau Food Processing Company	250
Vinh Hue Paper Company	2,200	Binh Dong Wheatflour Company	N/A
Vien Dong Paper J.S. Stock Company	350	Seaspimex Import-Export Company	280
Lesaffre-Cattoung J.V. Company	120		
Nam Duong Soya Sauce Company	80		
Binh Tay Noodle Factory	70		
Average	350	Average	145

Wastewater Treatment & Disposal:

In Vietnam, wastewater discharge standards are divided into 3 levels – A, B, and C. Level A standards require the most extensive and sophisticated wastewater treatment, whereas Level C standards require minimal treatment. At present, industrial waste treatment facilities are expected treat wastewater to at least Level B standards. In order to achieve economies of scale, it makes sense for companies to share a common wastewater treatment facility. However, the majority of companies in Ho Chi Minh City are not operating in industrial zones and of the 15 companies that were interviewed, only 4 are located in an industrial zone.

As it is very costly for companies to treat their production wastewater, most companies discharge wastewater directly into the municipal drain or local canals without treatment. The effluent discharged by these companies contains very high levels of *Chemical Oxygen Demand* (COD) and *Biochemical Oxygen Demand* (BOD), suspended solids and other organic and inorganic chemicals. BOD refers to the amount of oxygen that a chemical solution or effluent consumes through biological degradation. COD refers to the amount of chemicals that the effluent consumes through breakdown. High concentrations of BOD and COD can severely disturb natural ecology (Draper, 2001). For instance, it can kill certain types of plants, lead to the growth of different plants on land and thereby lead to starvation for the indigenous populations of animals, birds, and insects.

According to the interview results, only 1 Black Book Company undertakes in some wastewater treatment (much below Level C Standards). Furthermore, 2 Black Book companies that are located in an industrial zone are still waiting for a common wastewater treatment facility to be built.



Figure 3: Waste Water of this Black Book Company is discharged directly into municipal drain without treatment.



Figure 4: Wastewater treatment facility in one food processing company that is listed in the Green Book.

In contrast, 5 of the 6 Green Book companies operate their own wastewater treatment facility.

Most companies are listed in the Green Book because they treat their wastewater to Level *B* standards or higher

Solid Waste Generation:

The interviewed companies produce many types of solid wastes, including:

- Plastics and Rubber
- Metal Scrap
- Cardboard and Paper
- Glass
- Organics (ex. fish solids)

Only 1 company listed in the Black Book was able to estimate the amount of solid wastes produced. This food processing company produces approximately 150 to 200 kg of solid wastes per day. Surprisingly, none of the Green Book companies were able to provide data on the amounts of solid wastes being produced.

Solid Waste Disposal:

In Ho Chi Minh City, solid waste management systems are characterized by the simultaneous existence of both the formal sector (conventional collection, transportation and disposal) and the informal sector.

8.1.2. Reused and Recycled Wastes

Waste exchanges work on the premise that one industry's wastes can be reused or recycled for another industry's operations. *Reused* materials are those that are reused directly, either for its original purpose or for a new purpose. *Recycled* materials are those that undergo a physical, chemical or biological process and are transformed into secondary resources for the manufacturing of new products (International Environmental Technology Centre, 1996). Obtaining information on reuse and recycling activities amongst the participating companies can be very useful in determining their levels of interest and involvement in a formal waste exchange.

The interviews found that 2 Black Book companies reuse their wastewater in the production process. Similarly, 2 Green Book companies reuse their solid wastes, while 1 company reuses its wastewater to water the company's grass.

It is not always feasible for companies to recycle waste materials on their own premises. The interview results show that only 1 Black Book company recycles waste paper for pulp. None of the Green Book companies reported recycling wastes.

With regard to recycling policies, only 1 out of 9 Black Book companies has a formal procedure for separating wastes into recyclables and non-recyclables. Likewise, 1 out of 6 Green Book companies has a formal recycling policy.

The Informal Sector:

The informal sector could potentially play a major role in the operation of a waste exchange, and thus their recycling activities within the interviewed companies are highlighted.

Of the 9 Black Book Companies interviewed, 7 allow informal sector workers to enter their company premises to sort and collect wastes. On the other hand, no Green Book Companies permit informal workers to enter the premises. When asked why, most companies cited liability concerns. Another respondent at a food processing company stated,

"We don't allow informal waste collectors to take our wastes because we want to ensure that the wastes leaving company premises are used, treated or disposed of

in an environmentally-appropriate manner.” (Dec. 19th, 2001)

All 15 companies reported sending their non-reusable wastes to either public- or private companies. The *Urban Environment Committee* (URENCO) is responsible for collecting and transporting landfillable waste to landfills or treatment plants. URENCO generally charges disposal fees of \$25CAD per cubic metre of hazardous wastes, \$3 to \$5CAD per cubic metre of industrial wastes from *State-Owned Enterprises*, and \$8 to \$10CAD per cubic metre for *Joint Ventures* and *Foreign Investments* (Palladino, 2001). In Vietnam, legislation such as landfill tipping fees make disposal of wastes a significant cost for companies, thereby making waste exchanges a desirable option.

Some private companies purchase waste for reuse in their own operations, while others are small cooperatives that either sort and recycle the wastes or sell it to other enterprises. Six out of 9 Black Book companies, however, claim that to their knowledge, their wastes are sent directly to the landfill without sorting. Only 1 Green Book Company believes that its waste goes directly to the landfill (Table 2).

Table 2: Recycling and Waste Disposal Activities of Interviewed Companies

Black Book Companies	Total #	Green Book Companies	Total #
Formal Recycling Policy	1	Formal Recycling Policy	1
Informal Sector Workers Permitted	7	Informal Sector Workers Permitted	0
Waste Sent to Public Co.	1	Waste Sent to Public Co.	3
Waste Sent to Private Co.	2	Waste Sent to Private Co.	2
Waste Sent Directly to Landfill	6	Waste Sent to Directly Landfill	1

* Some respondents chose more than one option.

8.1.3. Monitoring

The *Ministry of Science, Technology and Environment* (MOSTE) is responsible for implementing environmental laws and regulations, environmental quality control and inspection, and conducting environmental impact assessments. MOSTE’s provincial affiliates are responsible for the technical aspects of its enforcement at the local level.

Industrial enterprises in Ho Chi Minh City are under the jurisdiction of the *Department of Science, Technology, and Environment* (DoSTE), which is responsible for enforcing/ monitoring environmental standards set out by MOSTE, licence issuing, and addressing public concerns and complaints.

The level and frequency at which industrial enterprises are monitored and the amount of waste-related information that DoSTE retains about each enterprise are very important in assessing the government's ability to manage a waste exchange network.

Six Black Book companies reported being visited by DoSTE inspectors at least once a year. Inspectors visited two companies 3 to 5 times per year, while only one was visited 6-8 times per year. Wastewater and air pollution levels are the primary focus of the visits. Four Green Book companies reported being visited by DoSTE inspectors 1 to 2 times per year and two companies are visited 3 to 5 times per year.

These numbers indicate that DoSTE pays field visits to industrial establishments quite frequently and has a large *quantity* of information about Black and Green Book companies. However according to DoSTE, this industrial pollution information is confidential and cannot be released. As a result, the *quality* of the information remains in question. Furthermore, the extent to which non-listed companies are visited by DoSTE inspectors is also unknown.

8.1.4. Steps Taken to Treat and Reduce Wastes

The results show that 6 Black Book companies have introduced *Cleaner Production* concepts into their operations, 2 Black Book companies have opted to relocate to an industrial zone, and 1 Black Book company has done nothing to treat and reduce wastes to-date.

All companies listed in the Green Book have introduced Cleaner Production technologies and measures into their operations. One food processing company claims to have moved into an industrial zone in an effort to decrease production costs while protecting and enhancing the environment.

Specific waste treatment and minimization activities for each company are beyond the scope of this study. However, some steps that both Black and Green Book Companies have taken are:

- § Installation of energy-efficient and fuel efficient machinery
- § Reduced consumption of raw materials
- § Tree planting around the factory
- § Specialized wastewater and air quality tests
- § Higher smoke stacks
- § Wastewater treatment facilities
- § Environmental training of staff and employees

Green Book companies have invested a much greater amount of money, staff, and time to reduce wastes at source. Upon visiting these companies, I found that almost all Green Book

companies have installed energy efficient equipment (eg. boiler systems, wastewater treatment facilities) and have a greater level of waste minimization training and experience.

More detailed waste treatment and minimization responses to the questions are included in the *Appendix Section* of this report.

8.1.5. Waste Exchanges

The final section of the corporate questionnaire investigates company perceptions and attitudes towards the establishment of a formal waste exchange in Ho Chi Minh City^[2]. Furthermore, the type(s) of outside assistance that is/are needed to promote waste exchanges in Ho Chi Minh City was also explored.

Respondents were asked to evaluate the feasibility of establishing a formal waste exchange network in Ho Chi Minh City. An overwhelming majority of Black Book companies feel that it is difficult at this time. The most commonly stated reason is a lack of knowledge about eco-industrial concepts such as waste exchanges. Other reasons that companies feel that waste exchanges are difficult to implement are that there is very little networking amongst companies and the government is prioritizing economic growth, not environmental protection, at this time. An individual at one company cited,

“Waste exchanges likely wouldn’t work in Vietnam. It is a very recent concept even in the West. I don’t think this idea can be effectively implemented due to Vietnam’s economic and political climate as well as the lack of environmental awareness amongst industry.” (June 22nd, 2001)

Green Book company respondents seem to be much more receptive to the idea of waste exchanges. Most respondents felt that waste exchanges would be quite feasible in Ho Chi Minh City for three primary reasons: 1) waste exchanges have been informally occurring in Vietnam for centuries, 2) companies already sell wastes to other companies, and 3) the government is committed to environmental protection. Moreover, all but 1 Green Book Company expressed an interest in participating in an industrial waste exchange pilot project, if it were to take place. Although some companies sell their wastes to private companies, they would also be interested in purchasing reused materials for their own operations in order to decrease their costs of production and pressures on the environment.

Government Actions Needed to Promote Waste Exchanges in Ho Chi Minh City:

Green Book Respondents were asked to broadly identify the actions needed in order to promote waste exchanges in Ho Chi Minh City. The most common responses were new

policies supporting its implementation, government campaigns and training for companies. Many companies also feel that the government needs a more complete inventory of the types of wastes that are created and disposed of by individual companies. Two companies expressed a need for a permanent government body to oversee and manage waste exchange operations. One company felt that by strengthening waste disposal laws, companies would explore more innovative and cost-effective methods of removing wastes from their premises.

Forms of Outside Assistance Required:

The vast majority of Black and Green Book companies feel that in order to improve environmental standards by establishing a formal waste exchange, outside assistance would be imperative. The most frequent responses were financial assistance and environmental education.

Although most companies are interested in participating in a waste exchange, they also voiced concern over financing. Many companies claim that in order to refine and prepare wastes for exchange, a greater amount of money and expertise would be required. Due to the prohibitive costs associated with more complex waste management systems, the levying of user fees needed to operate the exchange becomes an issue of concern.

Table 3: Forms of Outside Assistance Needed to Promote Waste Exchanges in Ho Chi Minh City

Black Book Companies	Total #	Green Book Companies	Total #
Financial Assistance	6	Financial Assistance	5
Environmental Education	9	Environmental Education	6
Do not Need Outside Assistance	0	Do not Need Outside Assistance	0
Other	1	Other	0

* Note: Companies could choose more than one option

With regard to the desired medium of environmental education, most Black Book company respondents prefer training workshops with other companies as well as one-on-one intensive training. Green Book companies place a greater importance on the latter. Very few

respondents in both groups feel that self-learning materials or the Internet would be a useful environmental education tool at this stage.

8.2. Findings Summary:

Although the findings are based on a limited sample size, they do provide an indication of waste generation, treatment and disposal conditions and attitudes towards the potential establishment of a waste exchange within Ho Chi Minh City.

A large majority of companies that participated in the research generate a high quantity of wastewater that is discharged into the municipal drain without treatment. Very few reuse their liquid and solid wastes and are unaware of how the waste is handled or disposed of once it leaves the company premises. However, Green Book company responses are more promising relative to Black Book companies in terms of their waste treatment (namely wastewater) systems as well as their levels of environmental awareness.

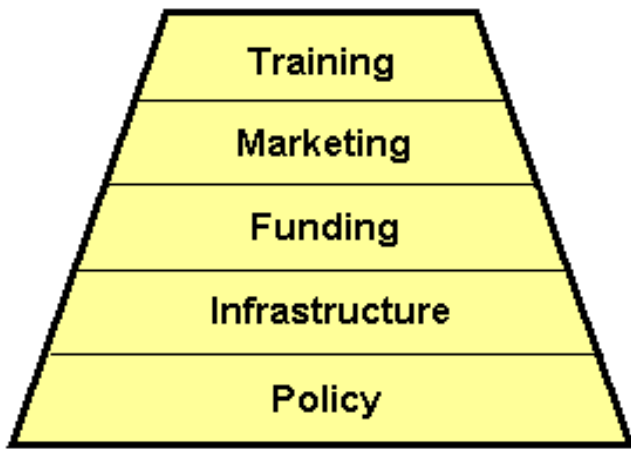
With regard to establishing elements of eco-industrial behaviour such as waste exchanges in Ho Chi Minh City, all Black Book companies feel that it is currently difficult to apply. The most commonly expressed reason is that there is a lack of information in Vietnam about how to operate and maintain waste exchanges. Meanwhile, almost all Green Book companies feel that the waste exchange concept is in fact quite feasible. These results suggest that Green Book companies are more familiar with the waste exchange concept and may be open to new and innovative approaches to waste management.

In the following section, the findings of the corporate case study are combined with the key informant interviews as well as background information in order to investigate the potential opportunities for waste exchanges in Ho Chi Minh City.

9.0. OPPORTUNITIES FOR WASTE EXCHANGES IN HO CHI MINH CITY

Through my literature review and interviews with key informants and a variety of companies, I have determined that industrial pollution is a growing concern in Ho Chi Minh City. Although the local government has tried to implement a variety of programs and policies such as the *Black and Green Books* to alleviate problems associated with industrial waste, the results have been inadequate. Consequently, more innovative, voluntary-based policies waste reduction policy options need to be explored.

In order to effectively support a waste exchange, the following aspects should be considered:



Using this framework, the opportunities for and barriers to establishing waste exchanges in Ho Chi Minh City are considered. The steps needed to identify some of the identified barriers are also proposed.

9.1. Industrial Waste Exchange Pilot Project:

Recommendation: Waste Econ and OCETA should help the industrial ecology concept gain momentum in Ho Chi Minh City by conducting a Pilot Industrial Waste Exchange Program in collaboration with CEFINEA, the Vietnamese Partner involved in this Project.

Most government authorities, companies and other key informants that were interviewed are familiar with the Cleaner Production concept and believe that it has the potential to reduce industrial pollution substantially in Vietnam. While this is true to an extent, Cleaner Production alone cannot be considered sufficient to reduce wastes for a variety of reasons. Firstly, it is concerned primarily with remediation and compliance as oppose to more preventative approaches. Secondly, it is somewhat of a reactionary, end-of-pipe approach; and thirdly, Cleaner Production does not view industries as operating in a *system*, where many different components affect one another (Wallner, 1998).

In recent years, the *Vietnam Cleaner Production Centre* has been successfully establishing pollution prevention and waste minimization programs to industries throughout Vietnam. Thus, Cleaner Production is a good starting point for industrial ecology.

Much has been written about how eco-industrial parks that have been successfully established in developed countries. However, industrial firms within the developing world do not face the same regulatory or economic regimes as those in higher income countries. Although eco-industrial parks in Vietnam seem unlikely to gain popularity in Vietnam in the near future, there does seem to be a potential to apply specific elements of industrial ecology.

Due to the large quantities of valuable wastes being produced in Vietnam, waste exchanges may contribute positively to both the environment as well as the economy.

Upon investigating waste exchange opportunities in Ho Chi Minh City, I found that the majority of government officials, NGOs and companies are very interested in participating in a waste exchange project. However, a unanimous response has also been that training and awareness would be the first step towards a more “ecological” industrial system. As such, Waste Econ and OCETA should play a major role in the promotion of waste exchanges in Ho Chi Minh City through greater training and information and dissemination.

9.1.1. Co-ordinating Body

Recommendation: DoSTE should be responsible for coordinating waste exchange activities in Ho Chi Minh City. A small number of permanent staff members should also be hired to facilitate its establishment and operation. Consequently, Waste Econ and OCETA should work closely with DoSTE to help develop a waste exchange program.

According to all contacted government officials and environmental experts, DoSTE should be the co-ordinating body for a waste exchange program. DoSTE contains a wealth of information on waste streams, has legislation and policy to support its projects and most importantly, has the political support of the People’s Committee (Interview, 2001).

DoSTE also has skilled staff that could oversee a waste exchange program. While technical institutes such as CEFINEA can provide additional expertise and advice, the primary coordinating body for an industrial waste exchange project should be DoSTE (Interview, 2002).

9.2. Industry and Government Education:

Recommendation: Waste Econ and OCETA should give first priority to simply following up with the corporate case study participants. Almost all of these companies have requested additional information about waste exchanges and quite a few are also interested taking part in an industrial waste pilot project.

In Ho Chi Minh City as well as the rest of Vietnam, there is definitely a lack of information and awareness about industrial ecology concepts. Industrial ecology concepts are relatively new and have not gained too much momentum thus far. Accordingly, before a waste exchange is organized, an *information* exchange must be arranged. Waste Econ and OCETA should

disseminate information to both government and industry in Ho Chi Minh City.

9.2.1. Training and Education

Recommendation: Waste Econ and OCETA should organize training workshops in Ho Chi Minh City for participating companies as well as government. Training topics should include eco-efficiency, industrial ecology concepts and waste exchange opportunities and experiences. OCETA's considerable expertise, especially with eco-efficiency in the food-processing sector may be beneficial in this regard

All companies that participated in the corporate case study expressed a need for more information about waste exchanges and industrial ecology concepts in general. Training workshops with other companies seem to be the most desirable mode to present this information.

These training sessions could also solicit industry output. Interviewed companies that are buying and selling wastes were eager to share their expertise in exchanging wastes, recycling and other waste minimization efforts. It could also encourage industrial networking in Ho Chi Minh City, which is a vital component of a successful waste exchange program.

Also, information sessions could address barriers towards waste exchanges as perceived by government officials, environmental experts and industry in Ho Chi Minh City. Some concerns that were raised in the interviews have been that:

§ Reused or recycled materials are of lower quality than raw materials and do not meet quality requirements;

§ The cost of purchasing raw material is cheaper than using reused or recycled inputs;

§ The costs and time commitments associated with participating in a waste exchange are too high.

Waste Econ and OCETA should investigate these concerns further and discuss them with workshop attendants.

9.3. Marketing:

Recommendation: Ho Chi Minh City's DoSTE should actively publicize waste exchanges and the steps involved to set up and maintain them. Local advertising brochures and

newsletters can be mailed. These could also be combined with a promotional campaign that targets companies operating in Ho Chi Minh City.

Another important requirement of waste exchanges is publicity. The majority of businesses in the corporate case study have never participated in any type of waste exchange. In fact, many respondents did not even know what the term “waste exchange” means. As a result, before companies participate in a waste exchange, they must understand what it is and how it works.

9.4. Funding Mechanisms:

Before an *Industrial Waste Exchange Pilot program* is in operation, funding mechanisms must be carefully considered in order to ensure its long-term viability. Waste exchanges in North America depend heavily on public-sector support. Consequently, funding in Ho Chi Minh City should be secured from various levels of government.

9.4.1. Company Incentives

Recommendation: As part of its environmental improvement action plan, DoSTE should consider providing companies that wish to take part in a waste exchange with financial incentives, at least in the initial phases. These incentives could include interest-free loans for environmental improvement or tax reductions for participating companies.

Understandably, many companies within the corporate case study stated that they would be apprehensive about investing too much money into a waste exchange project initially, in case it does not deliver positive economic results for their company.

Once the waste exchange is operating with a larger company base, the government could consider levying modest user fees on companies. Some options are to charge a fee for *listing* wastes in the publication/database or upon a successful *transfer* between two companies.

9.4.2. Role of the Informal Sector in Waste Exchanges:

Recommendation: There must be further qualitative and quantitative analysis of the informal sector’s role in managing industrial wastes. This research should also investigate industrial waste streams that the informal sector is involved in.

In Ho Chi Minh City as well as the rest of Vietnam, informal sector workers collect wastes predominantly from households. The chain of collection is loosely organized and consists of

waste pickers (door-to-door collectors, street sweepers, scavengers), door-to-door waste buyers, and junk shopkeepers. While there is a wealth of information about informal waste collection of domestic or commercial wastes, information about the informal sector's role in managing industrial wastes is definitely lacking in Ho Chi Minh City. This is one area that Waste Econ could investigate further.

Most companies that participated in the corporate case study do not allow informal waste collectors to enter their company premises. As stated, due to a new government law, waste pickers are not allowed to pick in landfills any longer and consequently have lost their source of income. Since the establishment of waste exchanges further formalizes industrial waste management, it is likely that the amount of recyclable material available for collection by the informal sector will be reduced. However, informal workers carry out most recycling activities and this sector can play a major role in closing the materials loop.

Recommendation: Before an industrial waste exchange project begins, the financial capacity and role of informal sector workers should be strengthened through specialized training or education. Potential training opportunities are in the recycling or refining of wastes for exchange or the transfer of wastes from one company to another. The informal sector could also be responsible for taking inventories of the types of wastes or customers that are available. By doing so, they could assist the government in locating potential markets for valuable wastes.

9.6. Existing Infrastructure:

Recommendation: There should be further investigation of the existing *Relocation Program* in Ho Chi Minh City to determine if it can operate in conjunction with a Waste Exchange project. Planning new industrial zones according to principles of industrial ecology can greatly facilitate the establishment of formal waste exchange networks.

Waste exchanges operate very well within an industrial park that has been planned according to principles of industrial ecology. One prospect for such improved performance is in eco-industrial parks, where collections of companies achieve materials and energy efficiency through the exchange and reuse of by-products (waste exchanges) and the sharing of services and infrastructure

Over the last decade, eco-industrial parks have become quite popular within North America

and Europe. The concept has already been proven successful in a commercial district in Kalundborg, Denmark (Graedel, 2000). Other Western eco-industrial parks include the Fairfield Ecological Industrial Park in Fairfield, Maryland, the Port of Cape Charles Sustainable Technologies Industrial Park, Virginia, and the Brownsville-Matamoros Eco-Industrial Park, in Texas (Dwortzan, 1998).

Some of the benefits of waste exchanges within eco-industrial parks include: reduced disposal costs, reduced disposal quantities, reduced demand of natural resources, and a potential increase in the value of wastes. Ho Chi Minh City has 17 industrial zones and export processing zones. Very little environmental and land use planning is taking place with regard to where industries locate within these zones. All interviewed companies that relocated to industrial zones cited that they are able to choose which industrial zone they locate to and decide on vacant land with very little guidance from the *Industrial Zone Management Board*.

According to an individual employed at the *Industrial Zone Management Board* of the *Tan Tao Industrial Zone*, investors are encouraged to purchase land that is at a distance from companies that are producing similar products, for competitive reasons. The types of infrastructure required by the company also come into account. However, when recommending which space to locate a company, environmental protection is not a major consideration (Interview, 2001).

Many of these industrial zones are quite new and contain vacant space that could be filled according to principles of industrial ecology (Phuong, 2001). In the *Tan Tao Industrial Zone* for example, 30% of the land is still available for leasing.

Moreover in 1999, the People's Committee of Ho Chi Minh City passed a resolution on Environmental Health and Protection, which states, "*It is necessary to speed up the construction of centralized industrial zones to enable the relocation of industry...*" (DoSTE, 1999).

9.7. Policies that Support the Establishment of a Waste Exchange:

9.7.1. Environmental Protection Law

As stated, the *Environmental Protection Law* (1994) guides environmental policy implementation in Vietnam. Chapter 11 of this *Law* states,

"The government encourages individuals and organizations to use and exploit natural resources reasonably, to apply advanced technologies, clean technologies, reuse wastes and save materials in scientific research, production and consumption." (Phung, 2001, pp. 101)

Chapter 11 forms the legal basis for the establishment of waste exchanges in Ho Chi Minh City. It is evident that the government is committed to environmental protection at least in its

policy mandates; especially waste minimization, reuse and recycling activities.

9.7.2. Environmental Safety and Liability Policies

Recommendation: Waste Econ and OCETA should work with CEFINEA and DoSTE to help develop standards for a formal policy that stipulates the types of hazardous wastes that can be transferred via waste exchanges. This policy should clearly outline liability in the event that a sending or receiving company has mishandled the hazardous wastes in any way.

Aside from lack of familiarity with the waste exchange concept, some companies in the corporate case study stated that they would be reluctant to participate in a waste exchange due to liability and safety issues associated with exchanging hazardous wastes.

The government enacted the *National Regulation on Hazardous Waste Management* in 1999 (Palladino, 2001). This regulation stipulates that hazardous wastes are to be: classified at the point of discharge, isolated from non-hazardous wastes at the point of storage, collection and disposal. Moreover, the discharge of hazardous wastes into the environment is prohibited under the *Regulation*. Nevertheless, liability in the event of a spill during the transfer of exchanged hazardous wastes has not been explicitly stated within this policy.

9.7.3. Ho Chi Minh City Master Plan

Ho Chi Minh City has recently implemented a revised Master Plan that aims to provide a legitimate and institutional framework to guide its future spatial development. Some objectives of the Master Plan are to generate employment, meet the basic needs of its population, and preserve the natural environment.

While the Plan actively promotes new industrial investment in Ho Chi Minh City, it has also projected a large-scale expansion of the city to an additional 650 square kilometres. (Ha & Wong, 2000). Much of this expansion will accommodate new industrial zones. This provides a great opportunity for industrial zones to be planned according to eco-industrial principles, thereby facilitating waste exchanges.

CONCLUSIONS: NEXT STEPS & SUMMARY OF RECOMMENDATIONS

This report has provided a base for the establishment of an *Industrial Waste Pilot Project* in Ho Chi Minh City. Due to the large quantities of valuable wastes being produced in Vietnam and a relatively un-established network amongst industry, waste exchanges may contribute positively to both the environment as well as the economy.

Although the popularity of waste exchanges in North America seems to be decreasing partly due to existing networks amongst exchanging companies, these networks are not highly established in many Asian countries. Moreover, industrial waste minimization methods and technologies are more developed amongst industry in North America and Europe than in Asia. By establishing formal waste exchanges in newly industrializing countries of Asia, industries could significantly reduce the amounts of wastes requiring disposal. The next step is to provide information to industry and government through training and education.

The summary of recommendations is divided into two sections. The first section outlines the more immediate steps that must be taken in order to introduce a waste exchange project in Ho Chi Minh City. The second section summarizes long-range research and policy/planning development that should occur to maintain a successful waste exchange in the future.

I. Next Steps:

- 1. Waste Econ and OCETA should give first priority to following up with the corporate case study participants in this research.**
- 2. Waste Econ and OCETA should organize training workshops in Ho Chi Minh City for companies as well as government.**
- 3. Waste Econ and OCETA should work with DoSTE to actively publicize waste exchanges and the steps involved to set up and maintain them in Vietnam.**
- 4. There must be further qualitative and quantitative analysis of the informal sector's role in managing industrial wastes. This research should also investigate industrial waste streams that the informal sector is involved in.**
- 5. Before an industrial waste exchange project begins, the financial capacity and role of informal sector workers should be strengthened through specialized training or education.**

II. Actions Needed to Support Long-term Sustainability of Waste Exchanges

- 6. DoSTE should be responsible for coordinating waste exchange activities in Ho Chi Minh City. A small number of permanent staff members should also be hired to facilitate its establishment and operation.**
- 7. Waste exchanges programs are heavily dependent on the public sector and therefore on-going funding should be secured from various levels of government in Vietnam. Private donor funding opportunities could also be investigated.**
- 8. As part of its environmental improvement action plan, Ho Chi Minh City's DoSTE should consider providing companies that wish to take part in a waste exchange with financial incentives, at least in its initial phases.**
- 9. There should be further investigation of the existing *Relocation Program* in Ho Chi Minh City to determine if it can operate in conjunction with a Waste**

Exchange project.

10. **Waste Econ and OCETA should work with CEFINEA and DoSTE to help develop standards for a formal policy that stipulates the types of hazardous wastes that can be transferred via waste exchanges.**

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11.1. Key Informant Communications:

February 13th, 2002.

Ontario Centre for Environmental Technology Advancement

Interviewee: Viive Sawler, Marketing Manager.

2nd Research Trip

Dec. 18, 2001

DoSTE

Interviewee: Mr. Lam Nguyen, Environmental Expert

Jan. 10, 2002.

CEFINEA

Interviewee: Mai Tuan Anh.

Jan. 10th, 2002

CEFINEA

Interviewee: Dr. Lam Minh Triet

Dec. 21st, 2001

Cu Chi Industrial Zone Management Board

Interviewee: Environmental Expert.

1st Research Trip:

May 22, 2001

National Environmental Agency, Hanoi

Interviewee: Mr. Dzung, Environmental Officer

June 5th, 2001

Consulate General of Canada,

- Interviewee: Mr. Huynh Trung Nhan, Commercial and Trades Officer.

June 8, 2001, 9:00am

Financing for SMEs” at Mekong Development Facility (MPDF):

- Interviewee: Ms. Tran Thi Hong Nhien, Environmental Specialist

June 12th, 2001

Department of Science, Technology and Environment (DoSTE)

Interviewee: Mr. Tue, Environmental Expert, Environmental Management Division

June 7th, 2001

DoSTE

Interviewee: Ms. Hong, Assistant Environmental Management Expert

June 11th, 2001:

Centre for Environmental Technology and Management (CENTEMA)

Interviewee: Dr. Viet, Director and Professor

June 19th, 2001

Energy Conservation Research & Development Centre (NGO)

Interviewee, Dr. Tran Quang Cu, Energy and Environmental Technology Specialist

June 20th, 2001

REFINE Project (Dutch Project)

Ms. Mathilde Kuper, REFINE Representative and Air Quality in Industrial Zones Expert

Jun 19th, 2001.

ENDA

Interviewee Mr. Doan Van Khai

Friday, June 29th, 2001

Japanese International Cooperation Agency

Interviewee: Ms. Yuko Ito, Project Formulation Advisor

July 5th, 2001

Hoc Mon Landfill

Interviewee: Mr. Bui Huu Thien, Environmental Engineer

July 5th, 2001.

Spoke with 4 former waste pickers who worked at the Hoc Mon Landfill.

July 5th, 2001

Ho Chi Minh City Department of Planning and Investment:

Interviewee: Mr. Nhan, Industrial Zones Officer and F.D.I. Promotions Planner

July 6, 2001

Tan Tao Industrial Zone

Interviewee: Ms. Pham Thi Ngoc Phoung and Mr. Son, IZ Business Division

July 8th, 2001

Official Development Assistance Partnership for Ho Chi Minh City

Interviewee : Mr. Anh, ODAP Facilitator

July 25th, 2001

Tropical Technology Centre,

Interviewee: Mr. Sy

July 27th, 2001

Ho Chi Minh City Export Processing and Industrial Zones Authority (HEPZA)

Interviewee: Mr. Ho Trung Hieu, Environmental Management Expert

Friday, August 3rd, 2001

Department of Industry

Interviewee: Mr. Hai, Chief of Project Management

12.0. APPENDIX

I. Corporate Case Study: Names of Interviewed Companies

Black Book Companies:

1. Khanh Loi Fish Processing Factory
2. Trung Son Seafood Factory
3. Thien Houg Foodstuffs Factory
4. Mai Lan Pulp and Paper Company
5. Vin Hue Paper Company
6. Vien Dong Paper Joint Stock Company
7. Lessafre-Cattuong J.V. Company
8. Nam Duong Soya Sauce Company
9. Binh Tay Instant Noodle Factory

Green Book Companies:

1. SAFACO Food Company: Spaghetti Factory
2. Nam Phung Food Stuff Factory.
3. Wall's Vietnam Ice-Cream Company
4. Tan Thuan Food Processing and Export Company
5. Binh Dong Wheatflour Company
7. Seapimex Special Aquatic Products Import-Export Company

II. QUESTIONNAIRE FOR BLACK BOOK COMPANIES IN HO CHI MINH CITY

Date:

I: Company Background:

1. Company Name:
Company Address:
Telephone Number:
2. Names and title of interviewee:
3. When was this company constructed?
4. Is it family-owned and operated?
5. How many workers are employed at this company?
6. What types of products does this company produce?
7. Does this company have a formal environmental policy? If so, what is its mandate?

II: Waste Generation and Treatment:

8. What types of raw materials are utilized?
9. What types of wastes (solid, liquid, hazardous) are being produced?
10. How much of each type of wastes is being produced daily or annually?
11. How is each type of waste treated or disposed of?
12. What is the cost of this disposal/treatment method?
13. Are any wastes re-used at this company? If so, what are they?
14. Are any wastes sold to other companies in the Industrial Zone?
15. Are any recycling procedures put into place at this company?
16. Are informal waste collectors permitted to enter your company?

III: Monitoring:

17. How often does DoSTE or District Environmental Bureau monitor your company?
18. What aspects of your company are monitored?
19. Has your company been identified as a highly polluting industry and placed on a 'Black List?' If so, when?
20. Could monitoring methods of the government be improved or changed? If so, how?

IV: Black Book Companies:

[The following questions apply to those companies who have been identified as highly polluting industries and have been placed in a 'Black Book']:

21. Since being placed in the Black Book, which of the following options has your company selected (or will select in future)?

- a) Treat and reduce wastes (using “Cleaner Production” concepts)
- b) Relocate to a specified industrial zone
- c) Shut down

22. If you answered *a* to question #21 (treat and reduce wastes), what steps have been taken by your company to improve environmental standards (i.e. waste minimization using source reduction strategies, recycling, improved treatment or disposal of wastes) since being placed on the ‘Black List’?

23. If you answered *b* to question #21, do you feel that environmental standards at your company have improved since relocating to an industrial zone? If so, how?

24. What environmental benefits (if any) have been achieved as a result of applying one of the options stated in question #21? Are these significant for your company?

V: Waste Exchanges:

25. Do you think that it is feasible to undertake in eco-industrial behaviour (such as setting up formal waste exchanges with companies located within a certain radius)*?

26. Which of the following forms of outside assistance would be most beneficial to your company in terms of achieving higher environmental standards (establishing waste exchanges)?

- a) Financial assistance
- b) Environmental education
- c) We do not need outside assistance
- d) Other (please specify) _____

27. If you answered *b* to question #25, which form of environmental education would be most beneficial for your company?

- a) Training Workshop with other companies
- b) One-on-one intensive training
- c) Self-learning books, manuals
- d) C.D ROM, Internet or other computer-based training
- e) Other (please specify) _____

VI: Constraints and Barriers

28. Do you feel that the options available to your company are fair? Why or why not?

29. If you have already undertaken in one of the above noted options, what have been some of the implications (please describe both positive and negative implications – i.e. economic, environmental, political or social)?

30. Please provide any further information that you feel may be useful to this study.

Thank you for your time.

* *Note: although not explicitly stated in the interview questionnaire, question #27 focused specifically on waste exchanges as an aspect of eco-industrial behaviour. The industrial ecology concept was introduced to the participants with a detailed description of waste exchanges.*

III. QUESTIONNAIRE FOR GREEN BOOK COMPANIES IN HO CHI MINH CITY

Date:

I: Company Background:

1. Company Name:
Company Address:
Telephone Number:
2. Names and title of interviewee:
3. When was this company constructed?
4. Is it family-owned and operated?
5. How many workers are employed at this company?
6. What types of products does this company produce?
7. Does this company have a formal environmental policy? If so, what is its mandate?

II: Waste Generation and Treatment:

8. What types of raw materials are utilized?
9. What types of wastes (solid, liquid, hazardous) are being produced?
10. How much of each type of wastes is being produced daily or annually?
11. How is each type of waste treated or disposed of?
12. What is the cost of this disposal/treatment method?
13. Are any wastes re-used at this company? If so, what are they?
14. Are any wastes sold to other companies?

15. Are any recycling procedures put into place at this company?
16. Are informal waste collectors permitted to enter your company?

III: Monitoring:

17. How often does DoSTE or District Environmental Bureau monitor your company?
18. What aspects of your company are monitored?
19. Has your company ever been identified as a highly polluting industry and placed in the 'Black Book?' If so, when?
20. Has your company been listed in the Green Book? If so, when?
21. Could monitoring methods of the government be improved or changed? If so, how?

IV: Green Book Companies:

[The following questions apply to those companies who have been placed in the Green Book]

22. Why has your company been placed in the Green Book?
23. Which of the following environmental improvement option(s) have your company selected (or will select in the near future)?
 - d) Treat and reduce wastes (using "Cleaner Production" concepts)
 - e) Relocate to a specified industrial zone
 - f) Shut down
24. If you answered *a* to question #23 (treat and reduce wastes), what steps have been taken by your company to improve environmental standards (i.e. waste minimization using source reduction strategies, recycling, improved treatment or disposal of wastes, waste-exchanging)?
25. If you answered *b* to question #23, do you feel that environmental standards at your company have improved since relocating to an industrial zone? If so, how?
26. What environmental benefits (if any) have been achieved as a result of applying one of the options stated in question #23? Are these significant for your company?

V: Waste Exchanges:

27. Do you think that it is feasible to undertake in eco-industrial behaviour (specifically, setting up formal waste exchanges with companies located within a certain radius)?
28. Would your company be interested in establishing formal waste exchanges with

neighbouring companies? Why or why not?

29. What is needed in Ho Chi Minh City in order to promote waste exchanges? (New policies, outside assistance)

30. Which of the following forms of outside assistance would be most beneficial to waste exchanges)?

- e) Financial assistance
- f) Environmental education
- g) We do not need outside assistance
- h) Other (please specify)_____

31. If you answered *b* to question #31, which forms of environmental education would be most beneficial for your company?

- f) Training Workshop with other companies
- g) One-on-one intensive training
- h) Self-learning books, manuals
- i) C.D ROM, Internet or other computer-based training
- e) Other (please specify)_____

VI: Constraints and Barriers:

32. Do you feel that the government's options (noted in question #23) that are available to your company are fair? Why or why not?

33. What have been some of the implications of undertaking in environmental improvement activities (please describe both positive and negative implications – i.e. economic, environmental, political or social)?

34. Please provide any further information that you feel may be useful to this study.

Thank you for your time***

IV. Black Book Company Synthesized Results:

I: Company Background:

Environmental Policy	# of Companies
Yes	3
No	6

Type of Ownership	# of Companies
State-Owned	3

Joint Venture	4
Private	2
Foreign Investment	0

II: Waste Generation & Treatment

Sources of Waste Water	#	Sources of Solid Waste	#
<i>Cleaning Machines</i>	2	<i>Discarded Raw Materials</i>	2
<i>Bleaching</i>	3	<i>Packaging and Paper</i>	5
<i>Beating Paper</i>	3	<i>Scrap Materials</i>	2
<i>Industrial Sanitation Processes</i>	5	<i>Data Not Available</i>	1

Waste Water Treatment Method	#	Solid Waste Treatment Method	#
<i>Waste Water Treatment Facility</i>	1	<i>None</i>	9
<i>Common Waste Water Treatment</i>	0		
<i>No Treatment</i>	8		

Wastewater Disposal Method	#	Solid Waste Disposal Method	#
<i>Discharged into Municipal Drain</i>	7	<i>Sold to Private Company</i>	2
<i>Discharged into Local</i>	2	<i>Sent to Public Company</i>	1
		<i>Landfill</i>	6

Reused Wastes	#	Wastes Sold	#
<i>Only Waste Water</i>	1	<i>Only Waste Water</i>	0
<i>Only Solid Wastes</i>	0	<i>Only Solid Wastes</i>	6
<i>Waste Water and Solid Wastes</i>	2	<i>Waste Water and Solid Wastes</i>	0
<i>None</i>	6	<i>None</i>	3

Formal Recycling Procedures	#	Informal Sector Workers Permitted	#
Yes	1	Yes	7
No	8	No	2

III: Monitoring

Frequency of DoSTE Monitoring	#
0-2 times per year	6
3-5 times per year	2
6-8 times per year	1
Greater than 8 times per year	0

Aspects of DoSTE Monitoring	#
Waste Water Only	1
Solid Wastes Only	0
Air Emissions	0
Two of the Above	5
All of the Above	3

Is Company's Name in Black Book?	#
Yes	5
Yes. However, will be removed	3
No	0
No. However, we will appear in next Book	1

Can monitoring Methods be Improved?	#	How Can Monitoring Methods Be Improved?	#
Yes	3	<i>Greater Enforcement</i>	1
No	4	<i>Advance Notification of Black Book</i>	2
No Comment	2	<i>Less Strict Environmental Standards</i>	1
		<i>Abandon "Complaint System"</i>	1

IV: Companies in Black Book:

Option(s) Selected by Company	#
Treat and Reduce Wastes	6
Relocate to Industrial Zone	2
Shutdown	0
Do nothing	0

Step(s) Taken to Treat and Reduce Wastes	#
More Environmentally Friendly and Efficient Machinery	5
Reduced Consumption of Raw Materials and Hazardous Products	5
Tree Planting around Factory	1
Specialized Tests	1
Retrofitted Drainage System	1
Higher Smoke Stacks	2
Waste Water Treatment Facility to be installed	2
Environmental Training of Staff and Employees	1
No steps taken yet	2

Environmental Benefit(s) Achieved As A Result of Treating/Reducing Waste	#
Reduced Tax Expenditures	1
Improved Health Standards of Local Residents	0
Reduction in organic pollution	2
Improved Public Image	4

Increased Knowledge of Workers	2
Reduced Long-term Costs	3
No Known Benefits Achieved Yet	2
Not Applicable	2
Assistance Needed to Help Achieve Higher Environmental Standards	#
Financial Assistance	6
Environmental Education	9
We Do Not Need Outside Assistance	0
Other	1

Feasibility of Establishing Eco-industrial Behaviour in Ho Chi Minh City	#
Feasible	0
Difficult because both government and industry prioritize economic growth	1
Difficult due to lack of networking amongst companies	2
Difficult due to lack of knowledge about eco-industrial concepts	5
Difficult because our clients will not want us to exchange and reuse our raw materials	1

Most Suitable Form(s) of Environmental Education	#
Training Workshops with Other Companies	7
One-on-One Intensive Training	7
Self Learning Books/Manuals	1
C.D.ROM, Internet, or other Computer-Based Training	1
Other	0

V. Green Book Company Synthesized Results:

I: Background:

Environmental Policy	# of Companies
Yes	3
No	3

Type of Ownership	# of Companies
State-Owned	4
Joint Venture	1
Private	0
Foreign Investment	1

II: Waste Generation & Treatment

Sources of Waste Water	#	Sources of Solid Waste	#
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Cleaning Machines	6	Discarded Raw Materials	2
Bleaching	1	Discarded Animal/Seafood Solids	3
Industrial Sanitation Processes	0	Scrap Materials	5
Blood/Fecal Matter	1	Packaging and Paper	5

Waste Water Treatment Method	#	Solid Waste Treatment Method	#
Waste Water Treatment Facility	4	None	6
Shared Waste Water Treatment	0		
No Treatment	2		

Wastewater Disposal Method	#	Solid Waste Disposal Method	#
Discharged into Municipal Drain	6	Sold to Private Company	3
Discharged into Local Canal	0	Sent to Public Company	2
		Landfill	1

Reused Wastes	#	Wastes Sold	#
Only Waste Water	0	Only Waste Water	0
Only Solid Wastes	1	Only Solid Wastes	4
Waste Water and Solid Wastes	1	Waste Water and Solid Wastes	0
None	4	None	2

Formal Recycling Procedures	#	Informal Sector Workers Permitted	#
Yes	1	Yes	0
No	5	No	6

III: Monitoring

Frequency of DoSTE Monitoring	#
0-2 times per year	4
3-5 times per year	2
6-8 times per year	0
Greater than 8 times per year	0

Aspects of DoSTE Monitoring	#
Waste Water	5
Solid Wastes	0
Air Emissions	4
All of the Above	0

Is Company's Name in Green Book?	#
Yes	5
Yes. However, we have now been removed	0
No	0
No. However, we will appear in next Book	1

Can monitoring Methods be Improved?	#	How Can Monitoring Methods Be Improved?	#
Yes	2	Greater Enforcement	1
No	3	Less Corruption in Licensing Operations	1
No Comment	1	Less Strict Environmental Standards	0
		Abandon "Complaint System"	0

IV: Companies in Green Book

Option(s) Selected by Company	#
Treat and Reduce Wastes	6
Relocate to Industrial Zone	1
Shutdown	0
Do nothing	0

Step(s) Taken to Treat and Reduce Wastes	#
More Environmentally Friendly and Efficient Machinery	4
Reduced Consumption of Raw Materials and Hazardous Products	2
Tree Planting around Factory	0
Retrofitted Drainage System	0
Higher Smoke Stacks	0
Waste Water Treatment Facility installed	4
Environmental Training of Staff and Employees	3
Micro organism Compost	1
No steps taken yet	0

Environmental Benefit(s) Achieved As A Result of Treating/Reducing Waste	#
Improved Health Standards of Local Residents	1
Reduction in Wastes	4
Water and Energy Conservation	1
Increased Knowledge of Workers	0
Better Relations with Government Authorities	2
No Known Benefits Achieved Yet	0
Not Applicable	0

Feasibility of Establishing Waste Exchanges in Ho Chi Minh City	#
Feasible	2
Feasible because many companies exchange wastes informally	1
Feasible because we already exchange wastes with other companies	1

Feasible because the government wants to reduce wastes in Vietnam	1
Difficult because both government and industry prioritize economic growth	0
Difficult due to lack of networking amongst companies	0
Difficult due to lack of knowledge about eco-industrial parks planning	1
Difficult because our clients will not want us to exchange and reuse our raw materials	0
Company's Interest in Participating in a Waste Exchange	#
Yes	5
No	1
Maybe	0
I Don't Know	0
Government Actions Needed to Promote Waste Exchanges in Ho Chi Minh City	#
Financial/Tax Incentives	3
New Policies that Support Waste Exchanges	5
Education and Training Campaign	4
Complete Inventory of Existing Waste Generation Rates	2
Permanent Body that Manages Waste Exchanges	2
Stricter Waste Disposal Laws and Regulations	1

Assistance Needed to Promote Waste Exchanges in Ho Chi Minh City	#
Financial Assistance	5
Environmental Education	6
We Do Not Need Outside Assistance	0
Other	0

Most Suitable Form(s) of Environmental Education	#
Training Workshops with Other Companies	5
One-on-One Intensive Training	1
Self Learning Books/Manuals	0
C.D.ROM, Internet, or other Computer-Based Training	0
Other	0

Black Book Corporate Case Study:

Table I: Company Background

Company Name	Year	Ownership Structure	# Of Workers	Product Type	Environmental Policy
Khanh Loi Fish Processing Company	2000	Private	40	Fish Processing for Export	None
Trung Son Seafood Factory	1993	Joint Venture	400	Seafood Processing: shrimp, octopus, fish	Company follows Industrial Park's Environmental Policy: common waste water treatment
Thien Hung Foodstuffs Factory	1975	State	1200	Instant Rice Products: noodles, soup additive powder, snack cakes	Participating in Cleaner Production Program since 1998
My Lan Paper Company	1969	State	173	Paper Products: tissue & toilet paper, sanitary napkins.	None
Vinh Hue Paper Company	1967	State	620	Pulp & Paper Products: worship paper, carton packaging paper, tissue & toilet paper	Participating in Cleaner Production Program since 1999
Vien Dong Paper J. S. Company	1975	State	170	Paper Products: sanitary, printer/photocopy, tissue & toilet	None
Lesaffre-Cattoung J. V. Company	1991	Joint Venture	100	Fermentation Yeast for Bread & Other Food Products	None
Nam Duong Soya Sauce Company	1951	State	79	Variety of Sauces	None
Binh Tay Noodle Factory	1970	Private	225	Instant Food: noodles, gruel	Participating in Cleaner Production Program.

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Green Book Corporate Case Study:

Table 2: Company Background

Company Name	Year of Construction	Ownership Structure	# Of Workers	Product Type	Environmental Policy
SAFACO Food Processing Company	1980	State Owned	400	Spaghetti, Noodles	None
Nam Phong Food Stuffs Factory	1983	State-Owned	44	Slaughterhouse, Meat Products	CP Program
Wall's Vietnam Ice-Cream Company	1996	Foreign Investment	170	Ice Cream, Green Tea	Safety, Health, Environment Program (SHE), ISO 14001
Tan Thuan Food Processing & Export Company	1988	State-Owned	750	Frozen Aquatic Products	None
Binh Dong Wheatflour Company	1969	Joint-Venture	400	Wheatflour	None
Seaspimex Import-Export Company	1983	State-Owned	1000	Frozen, Canned Aquatic & Meat Products	CP Program

[1]

The Goal of Cleaner Production is to reduce the adverse amounts of wastes produced, use energy and resources efficiently, and produce environmentally sound products that will result in less waste. Many of the improvements result from simple "good housekeeping" changes at existing operations, implementing ideas from workers themselves (UNEP, 2001).

[2]

Note: Due to the fact that I modified my original research questions, I placed a greater focus on waste exchanges in the Green Book Company questionnaires during my second field research trip.