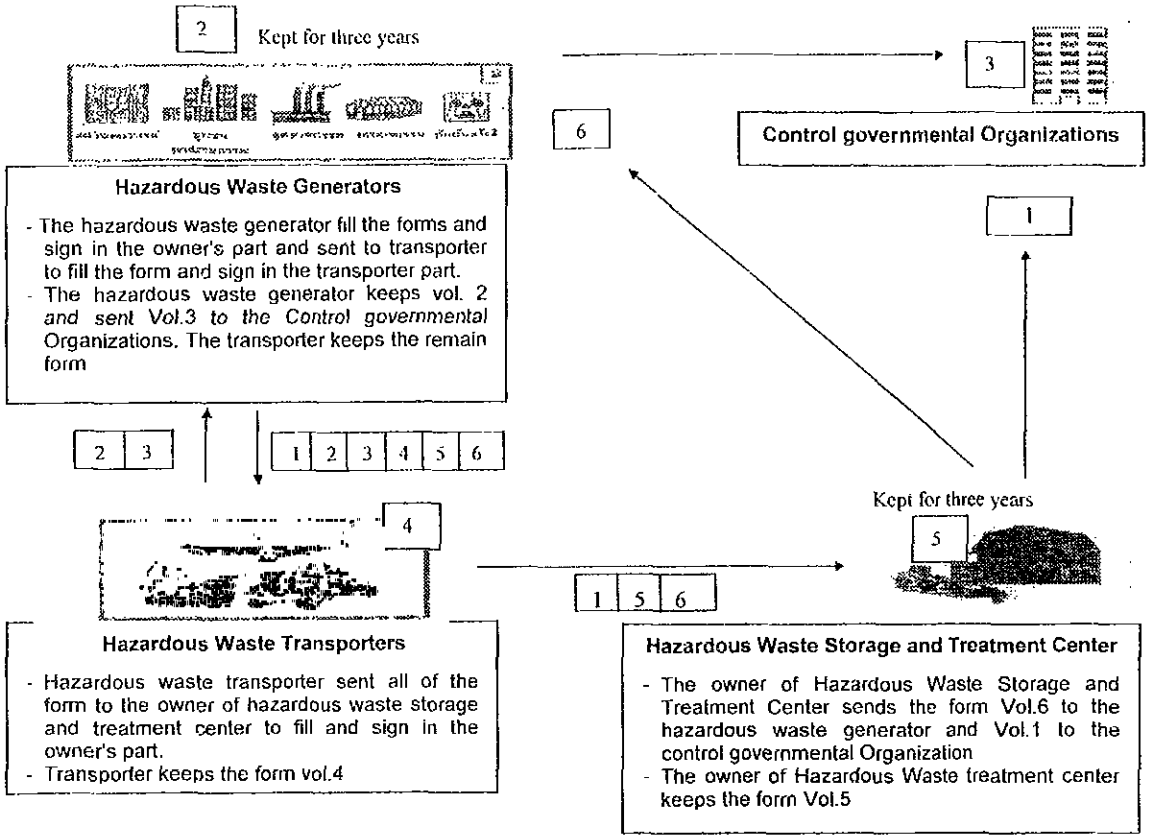


Figure 5-16: Manifest System Proposed by PCD

5.5 Administrative Procedures for IWM Enterprises

Enterprises engaged in IWM might be those who sort waste to select the reusable materials, stabilize waste for safe final disposal and utilize waste to produce the recycled material or new products. If they have the machinery of 5 horsepower or more or 7 workers or more, they are considered to be factories according to the definition of the Factory Act.

However, waste buyers or transporter are not factories by their nature. The Factory Act can not rule them at present. Department of Land Transport has an authority to issue the Transport License but this aims to control the transporters who do it as a business such as bus operators.

5.5.1 Factories engaged in IWM

a. Factory Registration and Operation License

Article 12 of the Factory Act prescribes that the factory owner must have a license from DIW prior to the construction and operation of the factory of group 3. Ministerial Regulation No. 5 (1992) shows the procedures to get licenses with a form of Ro Ngo 4. If in case of the group 2 factories, the article 11 of the Factory Act requires the factory owners to notify the DIW of construction and operation of the factory beforehand. Ministerial Regulation No. 4 (1992) presents a form of the notification.

The following figure illustrates the current flow of industrial waste utilization and disposal. In this figure, boxes in gray color, i.e. waste dischargers, treaters for final disposal, sorter for recycling, and recycling factories are to be considered as factories and subject to the control by the Factory Act.

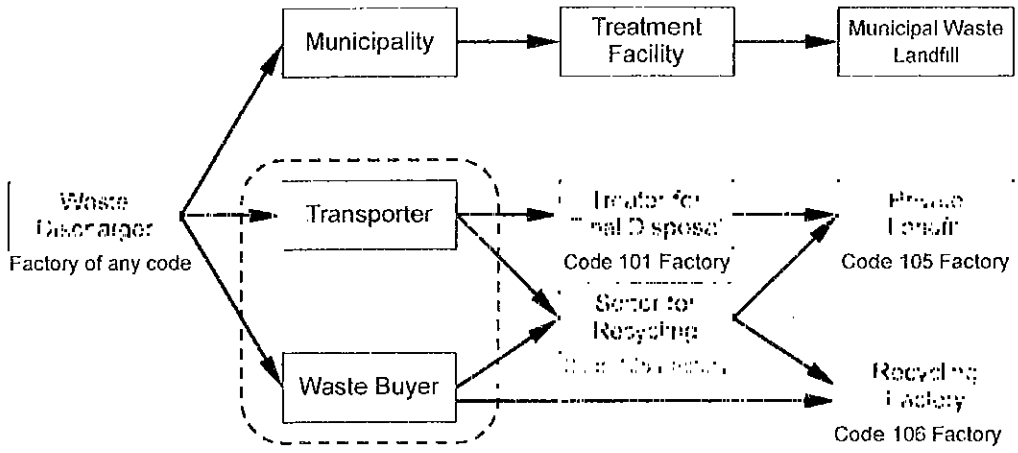


Figure 5-17: Actors involved in IWM

Private Landfill can also be controlled by the Factory Act, as it should be registered as a factory of Code 105 according to the new Ministerial Regulation No. 15 B.E. 2544 (2001).

The factory codes related to these actors involved in IWM are summarized below.

Table 5-7: Factory Categorization concerning the IWM

101	A Central Waste Treatment plant (treatment for the final disposal)
105	Factory engaged in sorting and landfilling of waste or unusable material of which the characteristics and properties defined in the Ministerial Regulation No.2 B.E. 2535 (1992) issued pursuant to the Factory Act B.E. 2535 (1992).
106	Factory engaged in making unused industrial products and factory waste into raw material or new products through an industrial process
Other code numbers	Factories of other sectors (waste dischargers)

The factories of the 101 are those who treat and detoxify waste or wastewater for final disposal. Most of the factories already licensed are wastewater treatment facilities or incinerators which serves themselves exclusively.

The factories of code 105 is those for waste sorting and landfilling. Those of code 106 recover raw material or produces products from unusable industrial products or factory waste. Before code 106 was established, they registered themselves to the relevant category of their business, no matter whether the factory uses the recycled

material or not. For example, the steel mill even using the scraped iron as material registered itself to code 59.

As code 106 was established, the factories using waste as raw material or fuel should register themselves to the 106, but in fact the number of factories that use waste as raw material or fuel is huge and it is not possible for DIW to immediately carry out the factory registration. DIW is therefore examining the reasonable registration procedure to be taken.

b. EIA for Construction of IWM Facilities

NEQA requires 19 types of projects and activities to evaluate the Environmental Impact. Currently, "Central waste treatment plant for waste and unusable material" is one of them. Cement industry is also required to undergo EIA. The National Environmental Committee is in charge of specifying the type of projects which require EIA.

The project owner prepares an EIA report and submits it to the OEPP of MOSTE to get the approval of the project.

In case of a governmental project, state enterprise project or project that is jointly owned by the public and private sectors, it must be approved by the Cabinet first. OEPP submit the EIA report to the Cabinet and after the approval of the Cabinet, OEPP will examine the EIA report.

In case of a private project, the Cabinet's approval is not needed and the OEPP examines the EIA report. In both cases, the OEPP sends the report to DIW.

5.5.2 Transporters and Waste Buyers

Transporters and waste buyers are not subject to the Factory Act. Department of Land Transportation, under the Ministry of Transport and Communications, controls transportation business through license to operators.

a. Department of Land Transport

Mission of the Department of Land Transport is defined as follows;

1. To enforce the laws concerning the Land Transport Law, Automobile Law and Wheeled Vehicle Law and other related laws
2. To improve, protect and promote land transport security
3. To coordinate and liaise with local and international organizations and agencies related to the land transport
4. Other duties as defined by law to be the Department's authorization or as assigned by the Ministry or Cabinet

b. Transport License

Transport License issued by the Department of Land Transport is to control the transport operators who transport passengers or freights by charging upon the passengers or on contract with customers. 4 categories of license are defined in the Article 27 of the Land Transportation Act B.E. 2522 (1979).

(1) License to operate fixed route transport

(2) License to operate non-fixed route transport

(3) License to operate transport by small vehicle

(4) License to operate private transport

License of the category (4) seems to be applied to the waste transporters, but not to the waste buyers. Once the Waste Buyer purchase the waste, it is his own goods, and it seems that the License is not required to carry his own goods.

However, if it is a large quantity, or dangerous in quality, the transporter may ruled by the Department of Land Transport.

An offender who violates to the mentioned articles in the Land Transportation Act B.E. 2522 (1979) is liable to be punished as follows:

- Violation of Article 23: No person shall operate transport, unless he has obtained license from the registrar may incur penalties of an imprisonment not exceeding 5 years or a fine not exceeding Baht 20,000 to 100,000 or both;
- Violation of Article 27: The transport operation licensees use wrong vehicles for the categories specified therein, may incur penalties of an imprisonment not exceeding 1 year or a fine not exceeding Baht 20,000 or both;
- Violation of Article 66: The transport operation licensees do not abide by the conditions prescribed in the license, may incur penalty of a fine not exceeding Baht 50,000.

5.5.3 Incentive for IWM Activities

a. Tax Exemption

There is no general system to give incentive to the IWM, but the exemption of the import tax on the pollution control equipment including the waste treatment and income tax on foreign experts who engage themselves in the installation of pollution control equipment. It is defined in the Article 94 of the National Environmental Quality Act (NEQA).

However, some special measures are taken case by case. For example, lead ingot which battery producers purchase as material is produced in two ways. One is that refined in the smelters as registered factories, and another is that made in an illegal way of incinerating the used batteries in drum cans. In latter case, environmental pollution occurs, as the batteries are not incinerated in a specified facility but in the field. In order to stop the illegal way of ingot producing and to promote purchase of ingot in a legal way, the Excise Department of Ministry of Finance exempts 5% at maximum from the excise tax when the battery producers purchase the legal ingot.

b. Environmental Fund

The NEQA also provides to found the Environmental Fund in the Ministry of Finance. The fund will be granted to the government agency, local administration or state enterprise to develop and operate waste disposal facilities. It also can be loaned to private sectors to install on-site treatment facilities as his duty, or private service

providers who are authorized or licensed. The uses of the Fund are stated in the Article 23 of the NEQA

> **Article 23:** Fund disbursement shall be made for the following activities and purposes:
>
> - As grants to a government agency or local administration for investment in and operation of the central wastewater treatment plant or central waste disposal facility, including the acquisition and procurement of land, materials, equipments, tools and appliances necessary for the operation and maintenance of such facility.
> - As loans to a local administration or state enterprise to establish air pollution control systems, wastewater treatment or waste disposal facilities to be used specifically in the activities of such local administration or state enterprise.
> - As loans to private person in case where the person has the legal duty to provide or install an on-site facility of his own for the treatment of polluted air, wastewater or waste disposal or any other equipments for the control, treatment or disposal of pollutants that are generated by his activities or business undertaking, or the person is licensed to undertake business as a Service Contractor to render services of wastewater treatment or waste disposal under this Act.
> - As aids or grants to support any activities concerning the promotion and conservation of environmental quality if considered appropriate by the Fund Committee and approved by the National Environment Board.
> - As expenditures for administering the Fund.

5.6 Public Participation

5.6.1 Public Awareness on IWM

Based on the result of Public Opinion Survey, public awareness on IWM is summarized as follows.

- Through the articles of newspaper and TV news on pollution problems caused by inappropriate IW such as illegal dumping, most people have often or sometimes heard IW and they have a negative image about IW. However, they do not know the detail of IW and IWM.
- More than 70% of respondents think that the existing IW treatment and disposal facilities are not operated properly and causing minor or serious environment problems. In particular, about half the respondents with a Bachelor degree or higher think that the operation of existing IW treatment and disposal facilities cause serious environment problems.
- Illegal IW dumping is also regarded as a cause of pollution, and they think that the government should tighten its control and increase penalty to prevent illegal dumping.

- More than 60% of respondents think that it is urgent to construct new waste treatment/disposal facilities in Thailand, while 20% agree to construct them on condition that the government tighten its control over illegal dumping and operation of IW treatment/disposal facilities, and demand the transparency of the government policy.
- In addition, half of respondent required their participation in the planning process and careful selection of the site of IWM facilities as conditions for the acceptance of a construction plan in their district.

As a result, it can be said that it is necessary to win people's confidence by strengthening control on existing IW disposal facilities and illegal dumping, before asking local people for cooperation to pursue an IWM plan including construction of new IW disposal facilities.

As Thai people develop awareness of environment and basic rights, they demand their participation in the decision-making process of IWM plan. It is urgent for the government to establish a system to build a consensus with local people through their participation in the decision making process.

5.6.2 FTI (Federation of Thai Industry)

FTI was established in November 1967 and then reorganized in December 1987 by the enactment of the FTI Act which puts the FTI under the supervision of the Ministry of Industry. The Act stipulates the following 9 objectives which the FTI should pursue.

- To act as the sole representative of all industrial enterprises in Thailand in coordinating with the State in both the policy and operation matters.
- To promote and develop the industry
- To identify, analyze and solve problems and issues arising in the conduct of industrial enterprises
- To encourage, support the study, research training and disseminating technical knowledge and technology related to industries
- To conduct product test and issue certificate of origin and certificate of quality assurance
- To offer appropriate advice, recommendations to the Government for the overall benefits of the industrial circle
- To encourage industrialists and acts as a focal point for exchanging of views among industrialists for the mutual benefits of the entire industrial community
- To exert control and oversee the operation of all members to ensure the compliance to the respective laws relating to industrial enterprises
- To conduct any other business as the law may prescribe

The number of the members reaches more than 5,000 companies among which about 2,800 companies are the major ones. They belong either of 298 industrial club as follows.

- Thai Gas Manufacturers Industry Club
- Printing Industry Industry Club
- Granite and Marble Industry Club
- Thai Glass Manufacturers Industry Club

- Chemical Industry Club
- Industrial Machinery Industry Club
- Agricultural Machinery Manufacturers Industry Club
- Garments Industry Club
- Air-conditioning and Refrigeration Industry Club
- Auto Parts Industry Club
- Ceramic Industry Club
- Cement Industry Club
- Rubber Based Industry Club
- Plastic Industry Club
- Thai Furniture Industry Club
- Electricals Electronics and Allied Industry Club
- Thai Panel Product Industry Club
- Pharmaceuticals Industry Club
- Automotive Industry Club
- Pulp and Paper Industry Club
- Footwear Industry Club
- Petroleum Refining Industry Club
- Textile Industry Club
- Leather Based Industry Club
- Thailand Iron and Steel Industry Club
- Roofing and Accessories Industry Club
- Aluminium Industry Club
- Food Processing Industry Club

The FTI has local chambers in 46 provinces among 76 provinces. The Secretary office of the FTI where 157 fulltime staff works locates in the Queen Sirikit National Convention Center in Bangkok

The FTI started Industrial Environmental Management Program in March 1990 which was sponsored by the USAID for the first 5 years. A main objective of the program was to build the capacities of Thai industries concerning the work health and safety and the environmental management. IEM office was created in 1995 and then it was renamed to the Industrial Environmental Institute (IEI) of the FTI in 1998.
The mission of the IEI is

- To build consensus and capacity among Thai industrialists to advance policy options for addressing fundamental environmental and workers health and safety issues

- To promote private and public sector investments to demonstrate means of improving industrial environmental management.

The IEI gives technical assistance to the member companies. The assistance covers pollution control, Clean Technology (CT), Environmental Management Systems (EMS for environmental auditing), and EIA. The IEI has its own laboratory for environmental analysis which contributes to the assistance in a scientific sense. The IEI makes policy research on pollution control and industrial environment, and also presents seminars and training courses concerning the CT and the EMS.

Among these services, the IEI interested very much to introduce the CT to the actual industry. The IEI promoted the CT project for textile dyeing industry as a part of the IEM in 1995. The IEI also collaborates the Cleaner Technology Information Center set up in the Thailand Environment Institute for promotion of the CT.

The IEI is developing a data base of industrial waste as a basis of its Waste Exchange Projects but has no result yet as it has just started. The role of the IEI is expected more to promote the waste exchange in Thai industry.

5.6.3 Non-government Organization (NGO) and Local People

Thai NGOs have played an important role in the field of rural development and poverty alleviation. To promote public participation, NGOs are also playing decisive role along with local people.

a. Thai NGOs

Thailand is a Buddhist country with the long tradition of philanthropy. In addition, mutual support activities of Chinese immigrants and Christian Missionary's philanthropy existed since the 19th century. As a result, there are a large number of nonprofit organizations in Thailand, and they are diversified from foundations and associations with cultural and social purposes to cremation associations and commercial associations. On the other hand, various public interest or development oriented non-government organizations were established since the 1960s to respond to problems caused by rapid economic development.

These Thai NGOs have also contributed a lot in the democratization process of the Thai society, as well as to solve social problems such as poverty issues. Regarding people's participation, they played various roles ranging from promoting community development, disseminating information and networking local people and NGOs, to coordinating various projects with the government and providing advice to some government organizations. This report reviews the roles and problems to be solved of NGO in the filed of public participation, paying an attention to NGOs which are actively working in the field of social development and environment.

a.1 Features of Thai NGO and Its role

Thai NGOs can be divided roughly into two groups. The first type of NGOs, so called a network type NGO, were established by professionals such as university teachers, government officials, lawyers, monks, journalists, and so on, and located in Bangkok. They focus on a specific area, mainly the same as the founder's area of their NGOs, and emphasize advocacy and have a network with local people. The second type was founded, administered, and staffed by field workers with past experience in larger PINGOs. These NGOs tend to work in specific rural communities with village leaders and to provide consultation[2].

The founder or board member of a NGO is often a board member of another NGO. Many of NGOs are closely linked each other, but it can be said that the Thai NGOs are still managed by a small number of people and not penetrated into ordinal Thai people yet.

[2] Amara Pongsapich and Nitaya Kataleeradabhan, "Thailand Nonprofit Sector and Social Development", Churalongkorn University Press (1997)

Umbrella organizations such as NGO Coordinating Committee on Rural Development (NGO-CORD), which was established to organize NGOs and coordinate cooperation with the government, play an important role and they contributed a lot to strengthen the influence of NGOs on some of government organizations. In some fields such as rural development and the prevention of AIDS, NGOs have already established its influence on the formation of government basic policies.

One of problems Thai NGOs are facing is financial reliance on foreign assistance: international NGOs, donor countries, and international organizations. Even though Thai NGOs capture people's confidence as shown in the result of POS, due to the limited penetration to the Thai society, it is still very difficult to establish the financial base based on the membership fee. It is one of current issues for the Thai society to construct a civil society based on voluntary will and financial support of ordinal people.

a.2 NGOs which are involved in IW issues

In the case of environment oriented NGOs, they are very diverse in character, ranging from pure conservationists to those who are interested in the social impacts of economic development. There is no single organization functioning as a coordinating body among NGOs working on environmental issues, but they have formed coalitions and wide networks.

Since there is not enough information on IW, there are only a limited number of NGOs, which are involved in IW management issues: Campaign for Alternative Industry Network (CAIN) and Greenpeace Southeast Asia as advocate groups and Thailand Environment Institute (TEI) and Good Governance for Social Development and the Environment Institute (GSEI) as research institutes.

Environment NGOs strengthen the relations with some of the government organizations, such as the Office of the National Economic and Social Development Board (NESDB) and Ministry of Science, Technology and Environment (MOSTE) in the 1990s, and are entrusted various projects by these organizations. In addition, there are a lot of examples in which NGOs play a leading role to conserve local environment in cooperation with government organizations and local people. However, it is still difficult for them to make a contact with other government organizations, which are in charge of many of public work projects, and to participate in the decision making process of development projects.

b. Local People and its community

Local people are main player in the public participation, but the level and form of participation vary due to the organizing ability of local community.

There is a great difference in the structure of local community among regions in Thailand. In the north or northeast region, where there were abundant land and people could clear land and formed new villages relatively freely until the middle of the last century, villages with sense of unity have developed. However, in the central region, where the study area is located, houses are located along the canal or road in a small number of group or isolated in each property, and villages with sense of unity has not developed. It is said that the Thai society was traditionally based on the personal relationship between the two people. As the market economy penetrated into the local

community and social classes were differentiated, this traditional relationship was weakened, and new types of social system such as cremation association and saving cooperative was created and play an important role to unite the community[3].

On the other hand, administrative villages were established in the second half of the 19th century as an implementing organization in the centralized administrative system. From the start, the chief of village and tambol were elected by local people. In the north and northeast region, these administrative villages were established based on the naturally grown villages, but in the central region, where houses are dispersed, boundaries were decided based on the canal, taking no account of local communities[4].

The function of administrative villages was originally to transfer resources from the central government to local people as the smallest unit of the administrative organization until the end of 1970s, in which the Thai government recognized the self-governing ability of local community and changed its basic policy from top-down system to encouraging local people to initiate their own projects on the level of village. Since then, the government actively invests in local projects on the village level such as establishment of rice bank and sanitary projects. Thai NGOs also support local people to organize their community to enhance their abilities to solve problems by themselves.

As a result, a lot of local communities throughout Thailand, in particular north and northeast region, organize groups to manage common resources in their communities. In addition, local people in various places, who are against development projects in their own regions, make a network such as the Forum of the Poor, and support each other. However, in the central region, the development of organizations is not so active as in the north and northeast region, except low-income residential areas where NGOs are actively involves in various projects to solve problems such as poverty.

5.6.4 Other Organization Relating to the Public Participation

There are several government organizations, which recognize the importance of public participation in government projects. On the other hand, as decentralization process progresses, the role of the local governments is becoming bigger and more crucial.

a. Government Agencies

The Office of the National Economic and Social Development Board (NESDB) made efforts to establish relations with development oriented NGOs and prepared the 5th NESDP in 1981, in cooperation with NGOs. NESDB also supported the establishment of NGO-CORD in 1985, and staated the important role of NGOs in rural development and public participation in the 6th NESDP (1987-1991).

Urban Community Development Office (UCDO) is an umbrella organization of NGOs, supporting slum dwellers and urban poor, but it is also a government body. UCDO was established under the National Housing Authority in 1990 based on the result of a research on the formation of an "Urban Poor Development Fund" by NESDB. UCDO aims at strengthen the capacity of slum dwellers and the urban poor

[3] Shinichi Shigetomi, "Rural Development and Local Community in Thailand", Institute of Developing Economy (1996)
[4] ibid

through process of credit provision. In addition, it promotes public participation to improve environment and living conditions in their communities.

Ministry of Science, Technology, and Environment (MOSTE) is one of government organizations that recognize the importance of partnership with NGOs and local people and promote public participation, based on the 1992 Enhancement and Conservation of National Environmental Quality Act. Office of Environment Policy and Planning (OEPP) encourages municipalities and newly created tambol administrative organizations (TAO) to formulate the environment basic plan, but most of TAOs do not have enough human resources and experience to draw up it by themselves. Department of Environmental Quality Promotion (DEQP) conducted various project to support local government to enhance their environment management capabilities, including a pilot project to formulate an action plan for healthy and sustainable city through workshop in Nakhon Ratchasima.

On the other hand, it is necessary for people to broaden and deepen knowledge to be actively involved in environment issues. It is very difficult for ordinal people to evaluated EIA report, and they need support from experts. DEQP makes a list of environment experts and registered environment NGOs and open it on the web site as a green data. However, it is necessary to improve the supporting system, making it possible for people to get necessary information and exchange information with others.

b. Local Governments

The Thai government promotes decentralization of administrative organizations since it promulgated Tambol Council and Tambol Administrative Organization Act in 1994. Municipalities and TAOs need to strengthen their capabilities in order to formulate their policies reflecting people's opinion on the level of municipality or tambol. It is preferable to expand support program to local government by DEQP.

5.6.5 Public Participation in the Decision Making Process

In the 1990s, protest movements against development projects, which might cause serious environment deterioration, frequently occurred throughout Thailand and became serious social problems. Environment activists and local people who participate in such movements regard public participation in the decision making process as one of effective solutions to theses disputes. In this article, the situation of public participation in the decision making process in Thailand is summarized.

a. Historical Background and Current situations

NGOs have played a leading role to promote public participation. At first, the evolution of public participation in Thailand is reviewed historically, paying attention to the role of NGOs.

The role and activities of Thai NGOs have been considerably influenced by the government policies. The Thai government tries to control NGOs strictly due to the threat of communism since the constitutional monarchy started in 1932, and required all NGOs to register. On the other hand, since the first national development plan was initiated in 1961, problems such as income disparity caused by rapid economic development became visible and caused a great concern of some students and urban middle class people. After the student coup d'etat in 1973, a lot of NGOs which were

concerning social issues were established, but the following military coup depressed the activities of NGOs and many activists and villagers were fled into the jungle to join the Communist party.

In 1980, the Prem government changed its policy toward NGOs. The government offered amnesty to those who had fled to join the Communist party, and liberated the activities of NGOs. Many organizations working at the grass-roots level resumed their activities in such field as rural development and advocacy. NGO members who used to live in jungle in the late 1970s knew the situations of rural areas well, and they succeeded in showing their abilities in many projects to organize and support local people to improve their living conditions by themselves. Some of the government organizations, such as the Royal Forest Department, gradually realized the role and ability of NGOs and local people, and expected them to play a complementary role such as community development and environment conservation in rural areas. In addition, umbrella organizations of NGO such NGO-CORD were established to organize and coordinate NGOs. They also contributed to strengthen relations between NGOs and the government.

The government officially recognized the role of NGOs in the field of social development in the 6th NESDP (1987-1991), and there were a lot of cases in which NGOs and local people succeeded in environment conservation in their community in cooperation with the government organizations.

On the other hand, in the second half of the 1980s, the government economic policy shifted its emphasis from the greater Bangkok to other regions, and various development project plans such as dam and power plant construction were established throughout Thailand. As democratization process made progress and people became more aware of environment issues and basic human rights, increasing number of protest movements against development projects from the environmental point of view occurred in the 1990s, and some of them were escalated to serious conflicts between local people and the government. Protest movements often took an advantage of environment issues to show the justice of their movement and to receive support from the public. Protest movements are classified into 3 groups: (1) mob-type, (2) civil movement type, and (3) mixed type[5]. The main players of mob-type protests are farmers, many of who were left behind the economic development, while NGOs play an important role in the civil movement type protests. The main factor of mob-type protests was attributed to their strong desire of relief to the government, and they often chose direct negotiation with politicians[6]. However, both NGOs and local people require the government to allow them to participate in the decision making process of the project, which could affect their lives and environment. Even though the government promotes public participation and there are a lot of successful cases in which the local people conserve environment in their communities in cooperation with government organizations, the government does not yet have a method and a mechanism well capable of responding to these requirements. The Thai government took efforts to introduce new systems such as the public hearing to deal with protest movements, but inappropriate procedures of new systems often intensified people's distrust toward the government. The Thai government is now

[5] Teruyo Funatsu, "Environment conflicts in the first half of 1990s in Thailand –Urban and Rural Movements and their theory" in Environment Awareness in Developing Countries: Case Study in China and Thailand, Institute of Developing Economies (1997)
[6] ibid

preparing for Act on Public Hearing to modify the current Prime Minister Office's Regulation Concerning Access to Public Opinion through Public Hearings. On the other hand, OEPP made a guideline of public participation in EIA and tried to incorporate public participation process in the EIA procedure, even though this guideline is not legally authorized yet. It is still in the process of trial and error to find an appropriate public participation process in EIA, but OEPP has a plan to make the public participation authorized by The Enhancement and Conservation of National Environmental Quality Act, which is now in the process of revision.

In the case of the construction of industrial waste disposal facilities, different parties have different interests and people distrust the government, so it can be said that promoting cooperation between the local people and the government is not enough. First of all, the government need to take an effort to restore the confidence of people, by enforcing pollution control related laws and regulations and securing the due process of law (procedural justice).

b. Legal framework

In the 1990s, the government took an effort to arrange the legal framework related to public participation to solve environment problems. Major laws which guarantee the right of a people to participate in environment conservation activities, including decision-making process, are shown as follows.

b.1 The Constitution

The most important law to secure public participation is the new Constitution, promulgated in 1997. The overall objective of the constitution is to promote further development of a democratic society focusing on the people, the rule of law, transparency and accountability.

It states various types of right of a person, which pave the way to public participation in the decision-making process, shown below.

Article 46: It refers to the commercial right to environmental management.

> Local communities which have traditionally, been formed by individuals shall have the rights to conserve or rehabilitate customs, indigenous knowledge, local as well as national arts and culture, and to participate in the management, maintenance and balanced and sustainable use of natural resources and the environment.

Article 56: It states the right to participate in environment conservation activities, the necessity of environment impact assessment, along with the right to sue to the government organizations, if a government project seriously affect the quality of life and any measures are not taken to prevent further environment deterioration.

> The right of a person to give to the State and communities participation in the preservation and exploitation of natural resources and biological diversity and in the protection, promotion and preservation of the quality of the environment for usual and consistent survival in the environment which is not hazardous to his or her health and sanitary condition, welfare or quality of life, shall be protected, as provided by law.

> Any project or activity which may seriously affect the quality of the environment shall not be permitted, unless its impacts on the quality of the environment have been studied and evaluated and opinions of an independent organization, consisting of representatives from private environmental organizations and from higher education institutions providing studies in the environmental field, have been obtained prior to the operation of such project or activity, as provided by law.
>
> The right of a person to sue a State agency, State enterprise, local government organization or other State authority to perform the duties as provided by law under paragraph one and paragraph two shall be protected.

Article 58: It deals specifically with the right to information. It mentioned as follows:

> A person shall have the right to get access to public information in possession of a State agency, State enterprise or local government organization, unless the disclosure of such information shall affect the security of the State, public safety or interests of other persons which shall be protected as provided by law.

Article 59: It provides for the right to public hearings as follows:

> A person is entitled to information, explanation and reasons to be given by state and governmental agencies, public enterprises or local authorities prior to an approval or implementation of projects or activities which may have adverse impacts on the environment, health, life quality and other significant interests of him or has or local communities. They shall also have the right to express their views in the matter through a public hearing process as provided by the relevant law.

Article 60: It state the right to participate in the decision making process.

> A person shall have the right to participate in the decision-making process of State officials in the performance of administrative functions which affect or may affect his or her rights and liberties, as provided by law.

The constitution also stipulates the obligations of the government to promote public participation. In addition, the right of local authorities in the management, maintenance and use of natural resources is emphasized.

Article 76:

> The State shall promote and encourage public participation in laying down policies, making decision on political issues, preparing economic, social and political development plans, and inspecting the exercise of State power at all levels.

Article 79:

> The State shall promote and encourage public participation in the preservation, maintenance and balanced exploitation of natural resources and biological diversity and in the promotion, maintenance and protection of the quality of the environment in accordance with the persistent development principle as well as the control and elimination of pollution affecting public health, sanitary conditions, welfare and quality of life.

Article 290

For the purpose of promoting and maintaining the quality of the environment, a local government organization has powers and duties as provided by law.

The law under paragraph one shall at least contain the following matters as its substance:

1) the management, preservation and exploitation of the natural resources and environment in the area of the locality;

2) the participation in the preservation of natural resources and environment outside the area of the locality only in the case where the living of the inhabitants in the area may be affected;

3) the participation in considering the initiation of any project or activity outside the area of the locality which may affect the quality of the environment, health or sanitary conditions of the inhabitant in the area.

b.2 Other Major Legislation

It can be said that the Constitution illustrates the principles. Other major legislations, which regulate individual issues and show some procedures concerning public participation, are summarized below.

Administrative laws such as the Administrative Procedure Act and the Information Act aim at securing procedural justice and transparency of administrative procedure, and promoting public participation in the whole process of administrative procedure, including environment issues, and they are regarded as indispensable laws for civil society based on the democracy. These administrative laws have been well developed since the 1990s in Thailand and some are introduced below. It is becoming important for NGOs and the general public to understand them and make the best use of them for the advancement of the civil activities.

b.2.1 The 1992 Enhancement and Conservation of National Environmental Quality Act (NEQA)

The 1992 NEQA is the comprehensive legislation on environmental protection. This Act empowers citizens to participate in the national and local environmental decision-making process (Article 6) and recognizes the important role of NGO (Article 7). Article 6 provides as follows:

For the purpose of public participation in the enhancement and conservation of national environmental quality, the following rights and duties may be accorded to individual person as provided by this Act or governing law related thereto:

1) To be informed and obtain information and data from the government service in matters concerning the enhancement and conservation of environmental quality, except the information or data that are officially, classified and secret intelligence pertaining to the right to privacy, property, rights, or the rights in trade or business of any person which are duly, protected by law;

2) To be remedied or compensated by the State in case dangers or injury is sustained as consequence of dangers arisen from contamination by pollutants

or spread of pollution, and such incident is caused by any activity or project initiated, supported or undertaken by government agency or state enterprise;

3) To petition or lodge complaint against the offender of being a witness to any act committed in violation or infringement of the laws relating to pollution or conservation of natural resources;

4) To co-operate and assist government officials in the performance of duty relating to the enhancement and conservation of environmental quality; and

5) To strictly observe the provisions of this Act or other laws concerning the enhancement and conservation of environmental quality.

The Act also regulates the Environment Impact Assessment procedure in the Part 4, through Article 46 to 51. Base on the Act, OEPP of MOSTE issued technical guideline by sector.

b.2.2 Prime Minister Office's Regulation Concerning Access to Public Opinion through Public Hearings, 1996

This is a regulation established by an Advisory Committee on Public Hearings chaired by the Permanent Secretary of the Prime Minister Office. A public hearing focuses on a public project, which may cause adverse impacts on environment, the life of local people, culture, and so on. Under the current regulation, a ministry in charge of the public can decide to open a public hearing or not. As mentioned before, public hearing often intensify the conflict, the bill of Public Hearing Act is now being drawn up to make the public hearing obligatory.

b.2.3 Administrative Procedure Act, B.E.2540 (1997)

As a part of the democratization process defined by the Constitution, the Administrative Procedure Act was promulgated in 1997 to enhance transparency and accountability of the administrative system. Even though the Act was formulated referring to the German administrative act, it excludes the planning formation process and does not define the public participation in the decision-making process.

b.2.4 Official Information Act, B.E. 2540 (1997)

To guarantee the right to information, referred in the article 58 of the Constitution, Official Information Act was promulgated in 1997.

b.2.5 Act on Establishment of Administrative Court and Administrative Court Procedure, B.E. 2542 (1999)

The Constitution states the right of a people to sue the government organizations, in case that they are affected by a government project and the government organization which is in charge of the project accomplish its duty to prevent further environment deterioration. This Act guarantees the right and established the procedure.

c. Public Participation in EIA process

OEPP made a guideline of public participation in the EIA study, though it is not legally authorized yet. The flow of public participation in the EIA study is summarized in Figure 5-18.

According to the guideline, OEPP defines all the stakeholders as participants in EIA, and encourage public to participate in the early stage of EIA procedure, TOR draft. Projects subject to EIA are divided into 3 groups, considering the degree of environmental and social impact of the project. If the OEPP thinks the project has a considerable impact on neighboring areas, a coordinator or a coordinating team is appointed by OEPP due to the degree of its impact to arrange public participation in EIA study (all the cost is bored by the project owner). The coordinator or coordinating team is in charge of various tasks from opening necessary information to public, organizing public hearing to gathering public opinion and submitting a report on public participation to the EIA committee.

As mentioned before, public participation in EIA is not legally authorized yet and is not obligatory for the project owner. OEPP has not had enough experience nor a clear image of public participation process yet. It seems that the Thai government tend to rely on the public hearing as a tool of public participation, but the public hearing arranged at the final stage of EIA often provoked antipathy of local people. Without a clear process to reflect people's opinion in the project planning, the public hearing system does not work. It is important to establish the public participation process in the early stage of EIA, TOR draft, which designs the whole EIA study. The revision of the Enhancement and Conservation of National Environmental Quality Act could improve the procedure of EIA.

On the other hand, environmental activist often criticize the quality of EIA report. The public participation in the stage of TOR draft could improve the quality of the report. However, since there are only the limited number of people who understand EIA well, it is crucial to increase the level of people's knowledge on EIA in order to improve both EIA procedure and EIA report.

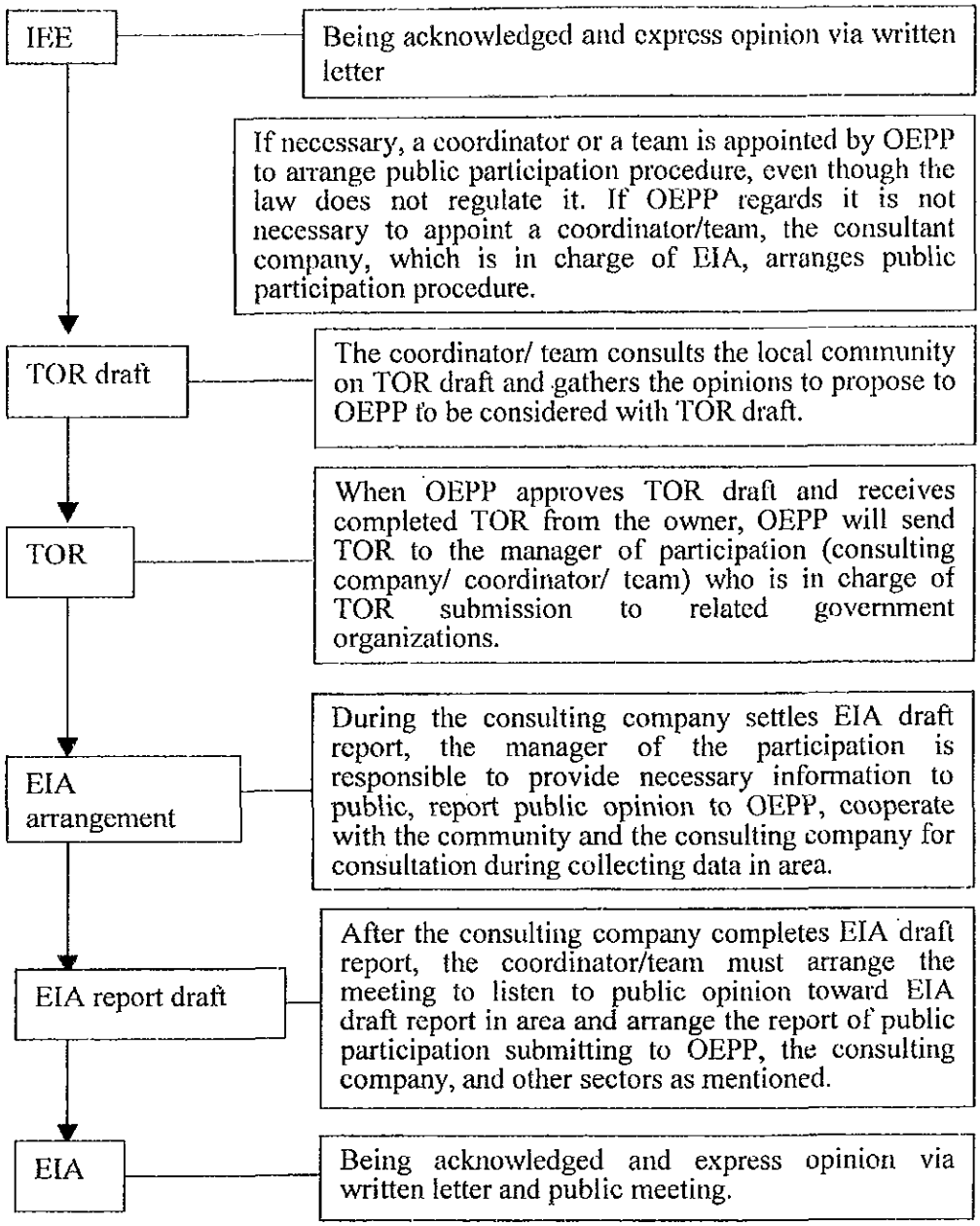


Figure 5-18: Flow of Public Participation in EIA

Chapter 6

Database Development

6 Database Development

6.1 Current Database

6.1.1 Current Database (DB) of DIW

The DIW has already developed an advanced computer system, interconnected in a network shown in Figure 6-1. This whole network system is administered in the IT Center, located on the 3rd floor of the DIW building. Most of the PCs of each department is connected to this network and can share data and printers and to Internet through a Web server.

Regarding the current DB, DIW has two important DB: one is the factory registration DB and the other is the GIS industrial location DB as shown in Figure 6-2.

a. Factory Registration DB

a.1 DB Structure

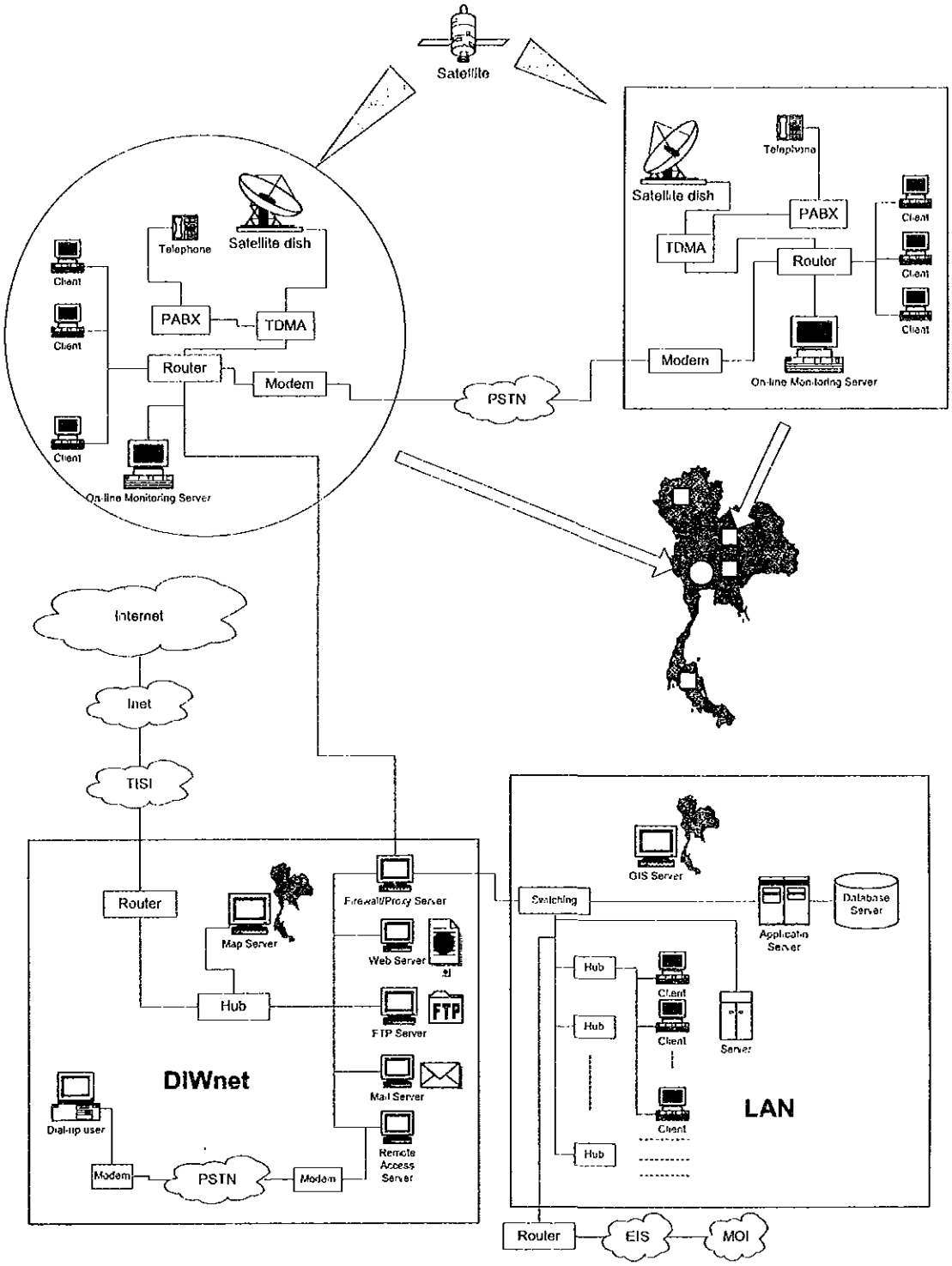
The Factory Registration DB contains the data of all the registered factories in the whole country. The number of the factories is approximately 121,231. The database is located in the central DB server in the IT Center. The field names of the DB are as shown in Table 6-1. Some of them are accessible by the public through Internet.

Table 6-1: Factory Registration Database Fields

Field-Name	Description	Key	Type	Size
facreg	Registration Factory Number	pk	Text	14
facreq	Requisition Number to Establish the Factory		Text	22
fflag	Factory Status	0=No Operation, 1=Operating,2=Shut Down	Text	1
expseq	Factory Expansion Number	0=establishment, 1=First expansion	Text	2
fname	Factory Name		Text	80
faddr	Factory Address		Text	40
fmoo	Moo		Text	3
soi	Soi		Text	40
road	Road		Text	40
prov	Province	fk	Decimal	16
amp	District	fk	Decimal	16
tumbol	Sub-district	fk	Decimal	16
tel	Tel.		Text	15
telext	Extention Number		Text	4
canal	Canal		Text	30
river	River		Text	30
object	Details of Permitted Operation		Text	160
hp	Horse Power		Decimal	16

Field-Name	Description	Key	Type	Size
hp2	Horse Power		Decimal	16
oldreg	Old Registion Number		Text	14
rule	Rule of Permission		Text	1
expdate_c	Expired Date of Operation Licence		Text	10
exdate	Expired Date of Operation Licence		Date/Time	8
build_type	Building Type	1=Row Building, 1=Non Row building	Text	1
barea	Building Area, Sq.m.		Decimal	16
farea	Factory Area, Sq.m.		Decimal	16
concode	*	unused in app. System	Text	1
caplan	Land Capital		Decimal	16
capbuild	Building Capital		Decimal	16
capmach	Machine Capital		Decimal	16
capwork	Work Capital		Decimal	16
mansk	Skilled Worker (Men)		Decimal	16
manonsk	Unskilled Worker (Men)		Decimal	16
womsk	Skilled Worker (Women)		Decimal	16
womnonsk	Unskilled Worker (Women)		Decimal	16
expert	Foreign Expert		Decimal	16
tech	Foreign Technician		Decimal	16
officed	Office Address	1=Owner's address, 2=Factory address	Text	1
archived	Date of File		Date/Time	8
archived_c	Date of File		Text	10
class	Industrial Type	fk of TCLASS.class	Text	5
factype	Factory Type	2=Type 2,3=Type 3	Text	1
flag	Submit for Construction or Operation	0=Establish/Expansion, 1=Operation/Expansion Operation	Text	1
last_user	Update Info. Person		Text	10
last_update	Update Time		Date/Time	8

Note: *1 Primary key
*2 Foreign key



Notes
EIS: Executive Information System, Network that developed by OIE (Office of Industrial Economics)
TISI: Thai Industrial Standards Institute
Inet: Internet Thailand (Internet Service Provider)
PSTN: Public Switching Telephone Network

Figure 6-1: Existing Network System in DIW

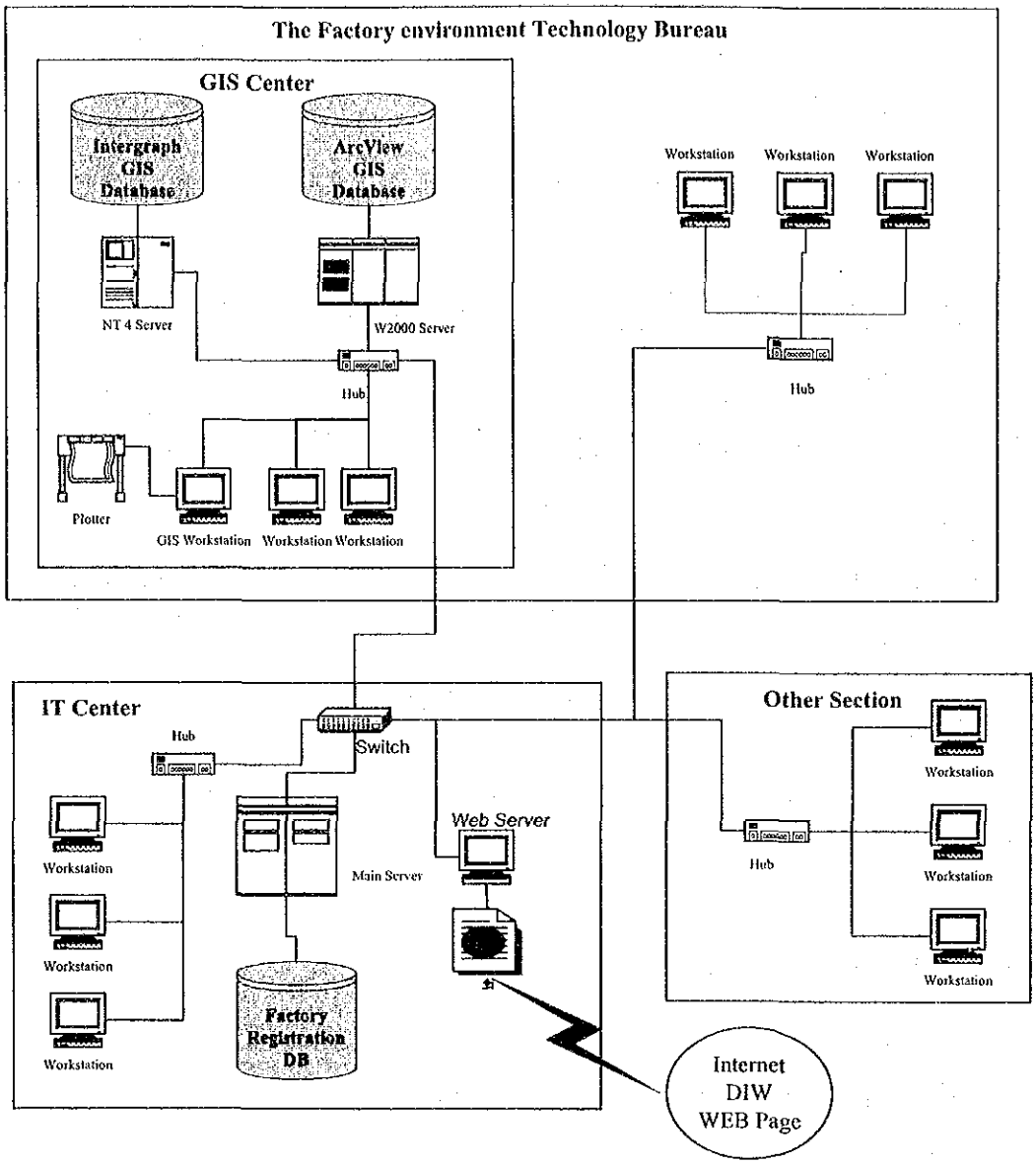


Figure 6-2: Current DB of DIW

The tables of industrial category and sub-category, shown in Table 6-2, can be also obtained through Internet.

Table 6-2: Field of Industrial Category

Field	Description
Category	Main Industrial Category (104)
Subcategory	Sub-category (approximately 360)

At the Web page of DIW as shown in Figure 6-3 and Figure 6-4, where information about the registered factories are available, the lists of all the factories classified by type and location can be downloaded by anybody. Furthermore, factories can be searched for by computer.

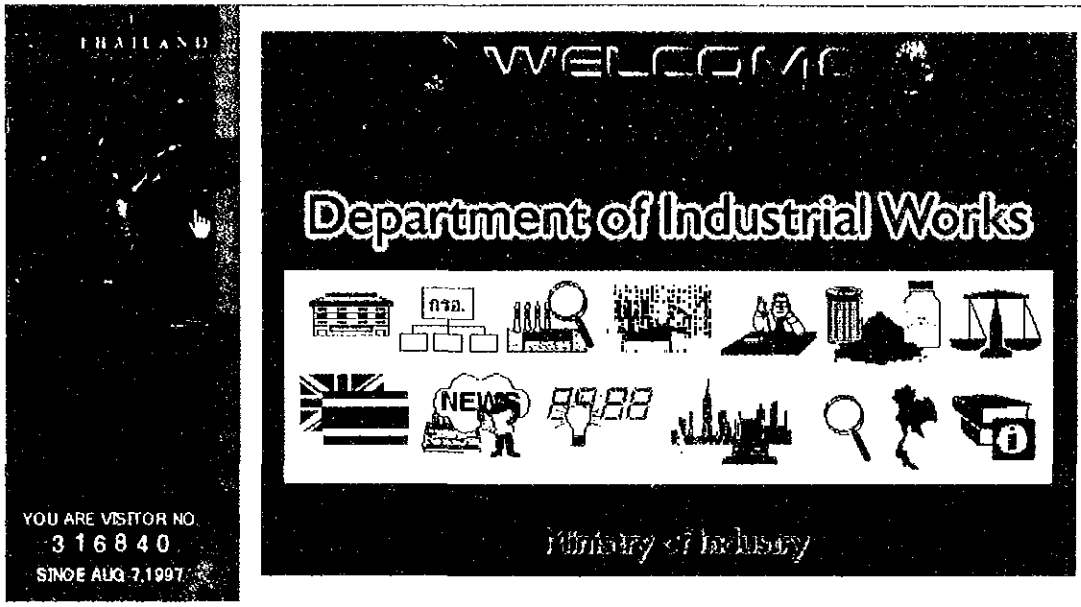


Figure 6-3: Main Web Page related to Industrial Information

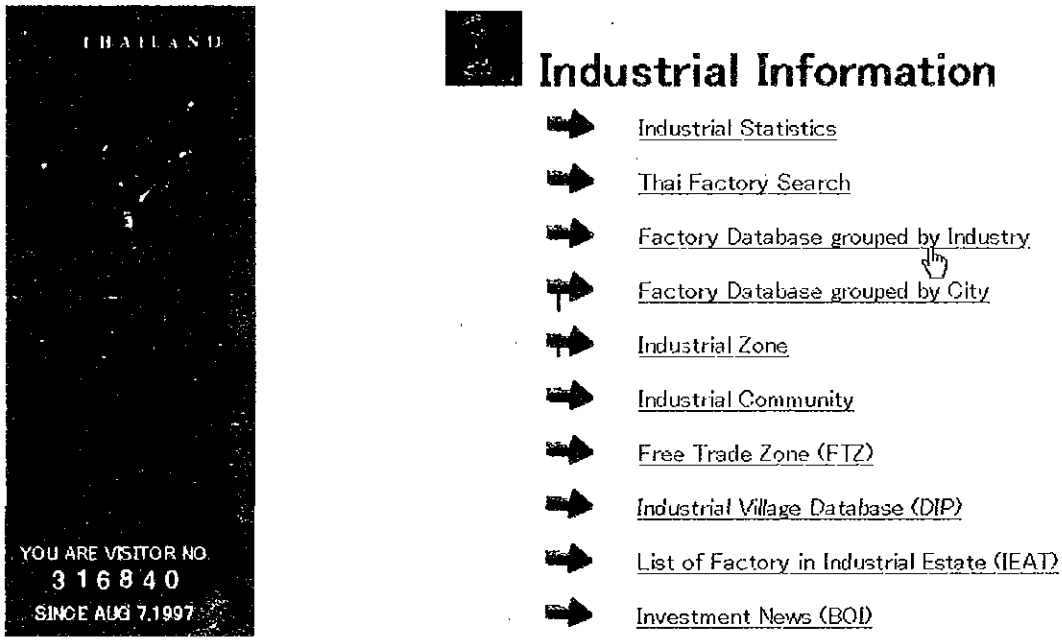


Figure 6-4: Web page related to industrial information

a.2 Problem of DB Update

The analysis of the Factory registration DB has detected a serious problem of data update. In this study the Team has been carried out several surveys in which general information of the industries such as name, type of operation, address, telephone number, and number of employees etc. in the DB were used. Consequently the following problems were detected.

- Wrong addresses and telephone number: many factories were found to have already moved and they have different addresses.

- Some factories have a new registration number but their registration numbers in the DB are still old ones.
- Factories that registered recently and already have a registration number are not added to the DB.
- The number of employees of most of the surveyed factories is different from data in the DB.

DIW should take an urgent action to solve the problem of not updated DB, otherwise this DB will not be useful even as a reference of the general and principal information of the factory. The information of this DB is essential because it is the starting point for any study, analysis and control of the factories and therefore it should be updated and to have truthful information.

Data input to the factory registration DB started approximately in the year 1989 and mostly finished in the year 1997. Since then DIW only carries out the update of 3 items:

- Name of factory
- Address
- Operation status (in operation, closed, etc.)

Until now, however, they could update approximately 30% of the total of the factories.

Database update is expected in such occasions as:

- When the factory pays the annual fee.
- When the factory wants to enlarge their production and requests a new permission.
- When the factory is inspected by the DIW inspectors.

But latest information is not always available in these occasions because some factories do not cooperate DIW and refuse information disclosure. It is usually DIW regional offices that acquire latest information, but even if they can do so, data is sent to the DIW headquarters not in a digital form but in a written from because the database system used at the regional offices is different from that of the headquarters and data can not be transferred from one to the other. Consequently, documents put together from 74 regional offices over the country to the headquarters have been left untouched and piled up.

With regard to IT equipment to update the DB, DIW has enough capacity. The 4 Factory and Inspection Bureaus have approximately 100 workstations and 400 employees that are designated for the control of the industries, and at least one terminal workstation in each provincial office.

In addition, IT Center that is responsible of all activity related to computer equipment and management of DIW DB has the following humans resources.

- 1 General administrator
- 7 Programmers
- 3 Hardware technician
- 10 DB management and supports
- 6 administration assistance
- 6 DB assistance

With those staff the IT Center supports all software and hardware and the proper DBMS.

DIW will have to solve this problem of DB update with a good plan and coordinated work by effectively using the great physical and human resources

b. GIS Industrial Location DB

The GIS Industrial Location DB contains the location data of 121,231 factories in the whole country, on which the exact location of the factories can be shown. An example of the GIS map with location of factories in Bangkok is shown in Figure 6-5.

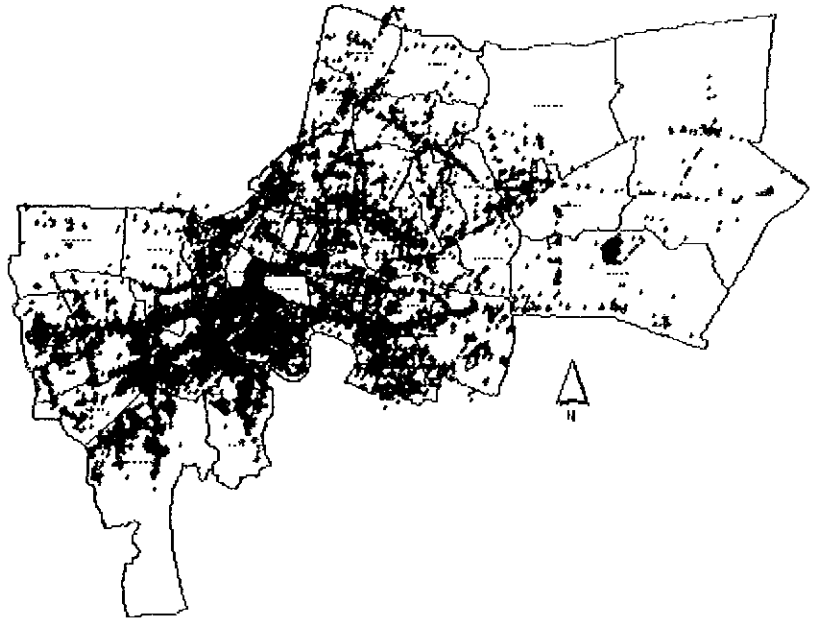


Figure 6-5: GIS Map with Location of factories in Bangkok

6.1.2 Current Database on IWM

At present the DIW has one DB related to IWM. This DB contains the registration record of factories that generate HW only in Samut Prakarn province. The DB is developed under the project promoted by Thai-German Technical Cooperation Program, "Preparation of Register on Hazardous Waste Generation & GIS Application for the Province Samut Prakarn" in the year 1999.

A general study on HW was carried out as part of the project, and the DB system was developed using the technology of GIS to locate all the industries. The DB is located in the server of GIS Data Center of the factory environmental technology bureau, and contains data of HW of approximately 640 factories. The detail of this DB is shown in Figure 6-6.

The development of this DB was initiated with the idea to improve of an appropriate management of HW by DIW, to increase the efficiency of obtaining data, and to use the technology of GIS to manage geographical information about the location of the factories that should cooperate for appropriate management of HW.

In this study the consultant team carried out calculations of generation rates of HW for the different categories of factories, which is in the DB. At the present time these coefficients are used for the calculation of HW generation when required by the staff of DIW and other institutions and organizations.

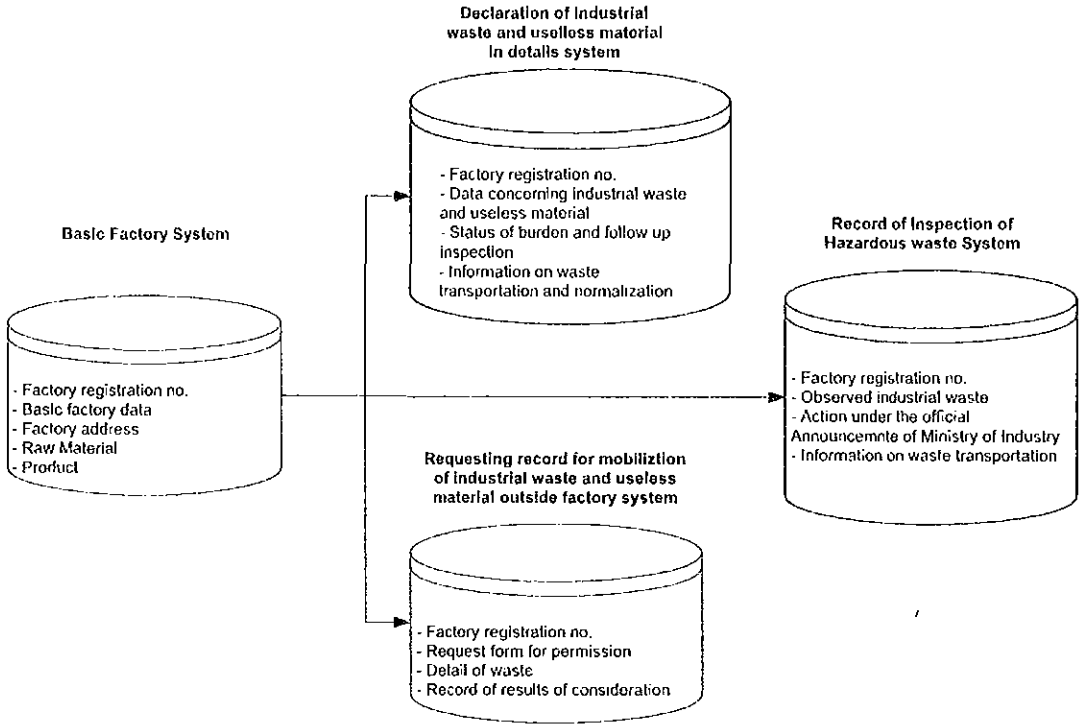


Figure 6-6: Description of HW DB

At the beginning, the database management system (DBMS) of this DB and the DBMS of the main server of IT Center had an inconvenience to be interconnected due to different operating systems. The GTZ used Microsoft Access to develop the HWDB, because it is one of the most popular database softwares and is convenient to develop DB and easy to use, while the main server of DIW is running on the Unix operating system and the DBMS uses Oracle. To fix this problem of compatibility of these two systems, GTZ assigned an engineer who developed a program for the interconnection of the two DBs. Accordingly at the present time the databases are interconnected and the HWDB of GIS Data Center can draw the general information of factories from the main factory registration DB, as shown in the Figure 6-7.

Now the other sections of DIW, if authorized and installed with an accessing program by GIS Data Center, can access the information of this HWDB on-line.

But here also exists a problem that has to be solved as soon as possible by DIW. The factory registrations DB is not updated periodically and in this situation many types of report will be emitted with false data.

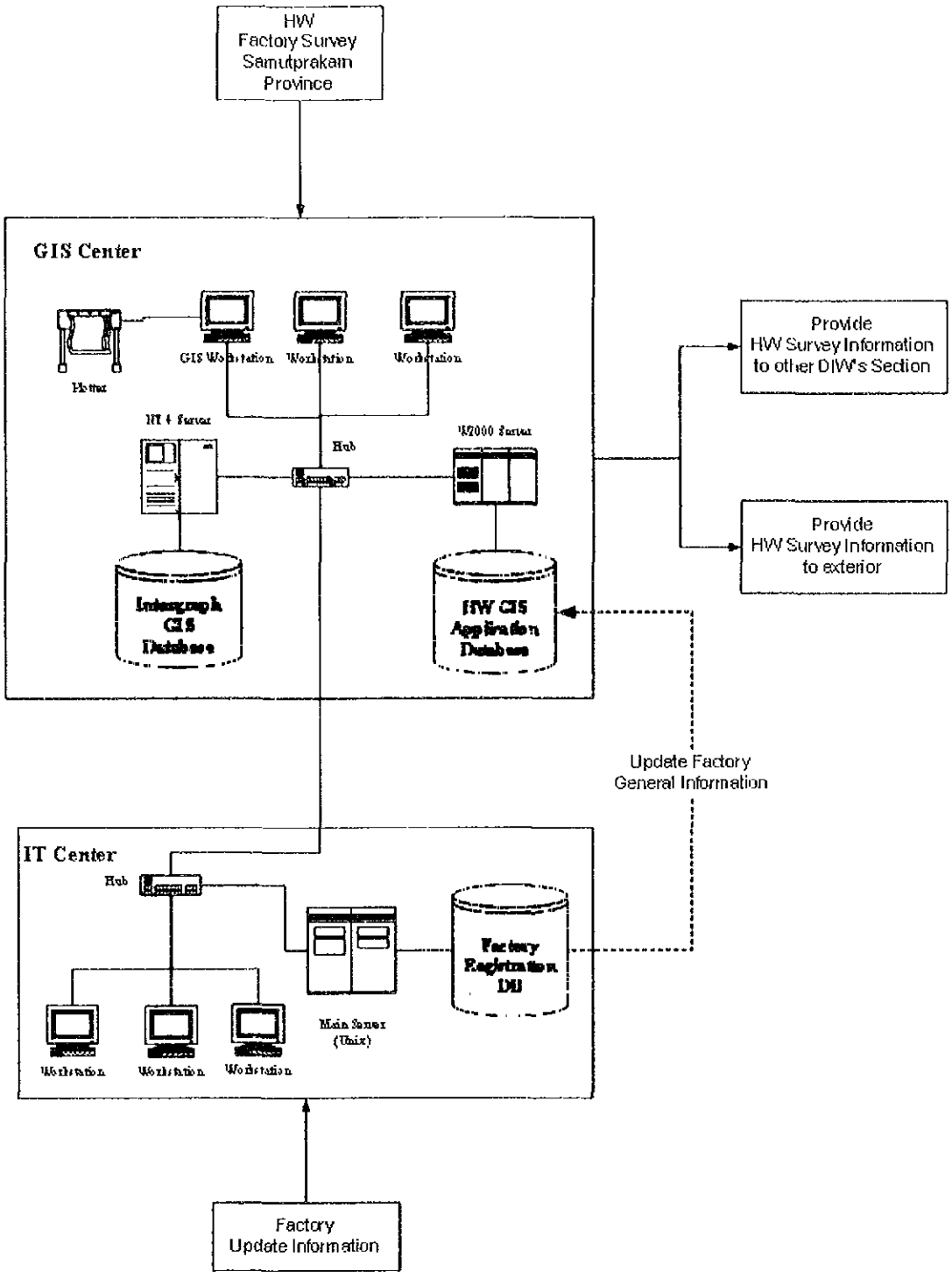


Figure 6-7: GIS Data Center HWDB scheme

6.2 Development Plan

6.2.1 Development Plan for New Database

At the end of the first study work in Thailand, DIW and the team signed minutes of meetings on the progress report (2) and agreed that the team would develop the following three databases and applications to manage them.

- Non-Hazardous Waste Database (Non-HW DB)
- Manifest System Database (MS DB)
- Waste Utilization Dababase

Waste Utilization Database will be described in Chapter 13.

The applications were developed using *Developer 2000*, which presents menus and data input pages for the end users, and *Oracle Database Management System (DBMS)*, which controls data in the database. After completion, these applications were installed in the main server of IT Center.

For DB management, three personal computers, two printers and accessories have been installed in the Bureau of Industrial Environment Technology, of DIW. As shown in the Figure 6-8, these computers are connected directly to the main server with a fiber optic cable for good performance and fast access to the databases.

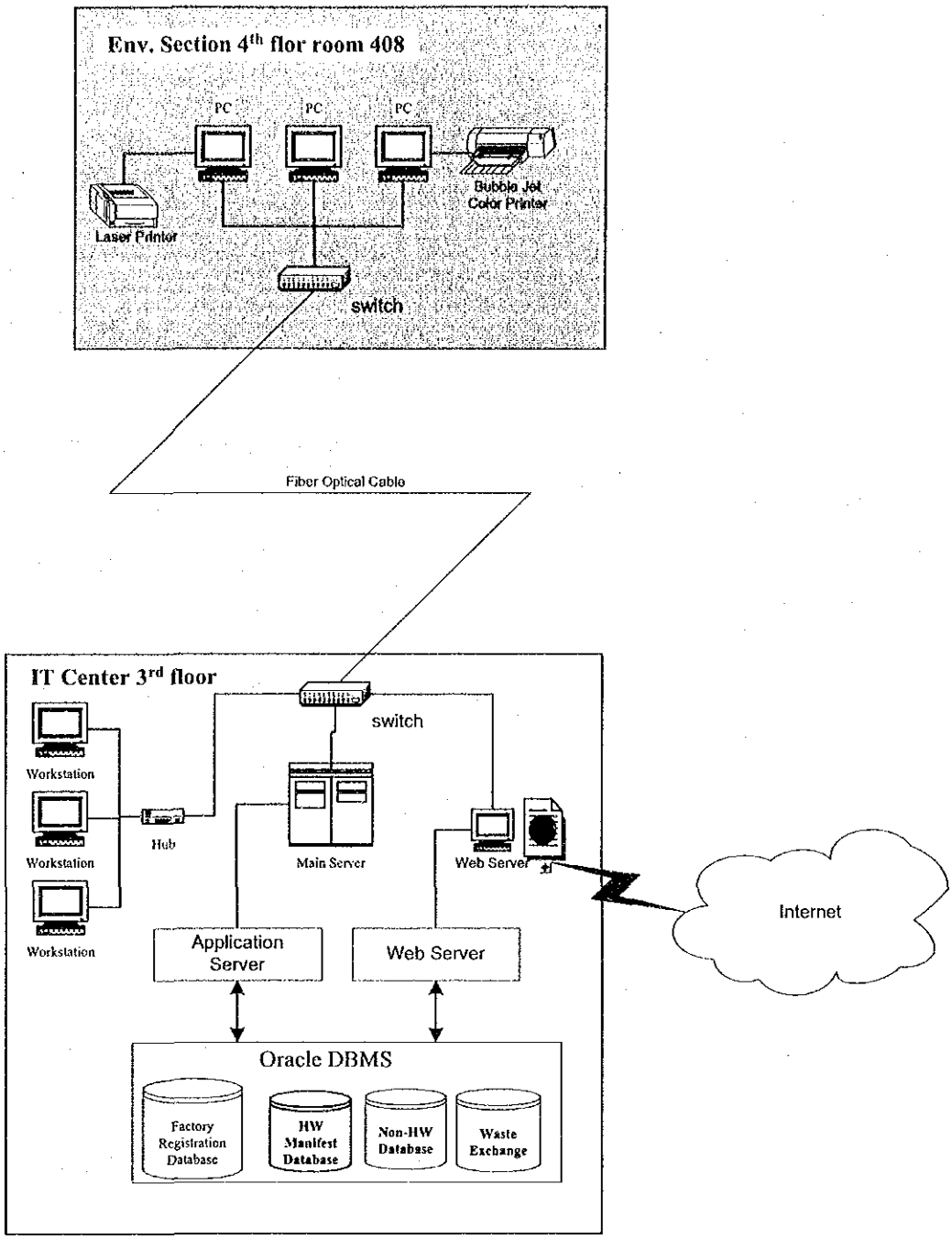


Figure 6-8: New DB Management Scheme

a. Schedule for DB Management Application Development

The development of the DB management applications was scheduled as follows.

ID	Task Name	Start	End	Duration
1	PC Instalation&Network	2001/07/09	2001/07/23	13d
2	Database Development	2001/07/09	2002/02/27	201d
3	*DB Development(1)*	2001/07/09	2001/07/27	17d
	DB Development(2)	2001/07/27	2001/10/15	69d
	Data Input&Test&Tuning	2001/10/16	2001/12/20	57d
	Final Test & Tuning	2002/02/11	2002/02/22	11d

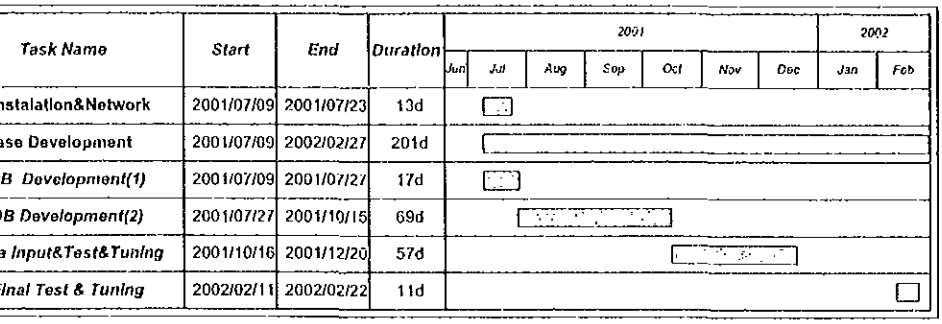


Figure 6-9: Schedule for DB application development

b. User Interface for DB Management

To secure the safety of the system and to ensure that only authorized people have access to view, change, and delete data, the application system will manage the user permission. The permission for the access to the system will be managed for one administrator, who will give permission to the other local users as follows.

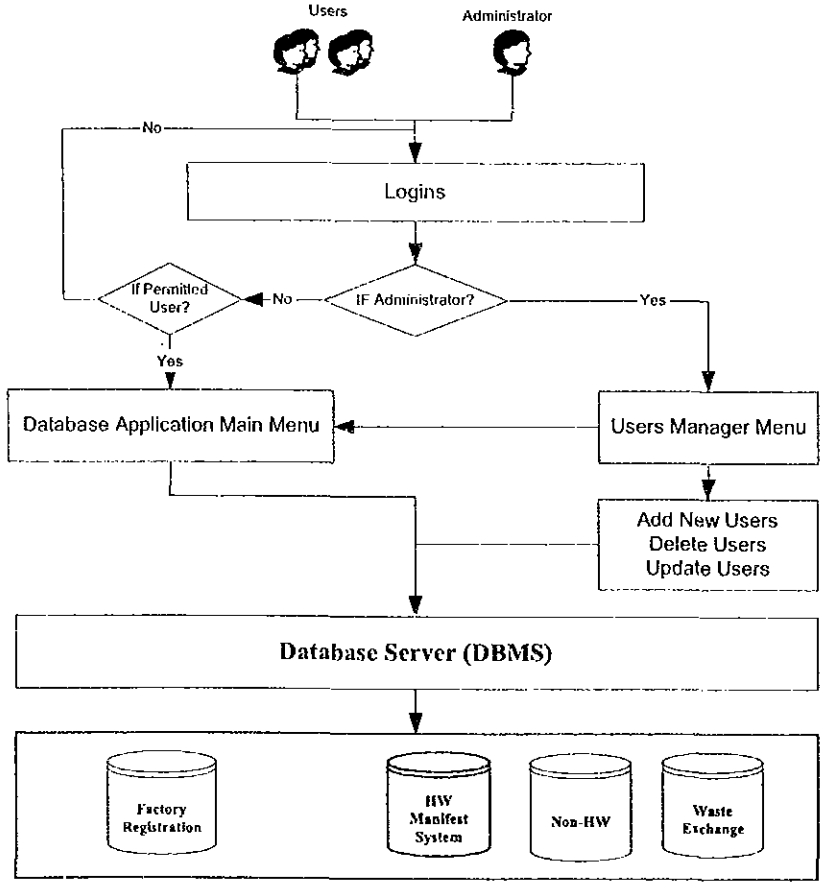


Figure 6-10: User interface

6.2.2 Development of Non-HW Database

a. Background

Since there was no database of non-HW, it was decided to establish its basis. Data on non-HW obtained by the factory survey were entered to the database.

b. Non-HW DB Development Process

Non-HW DB was developed by the process illustrated below.

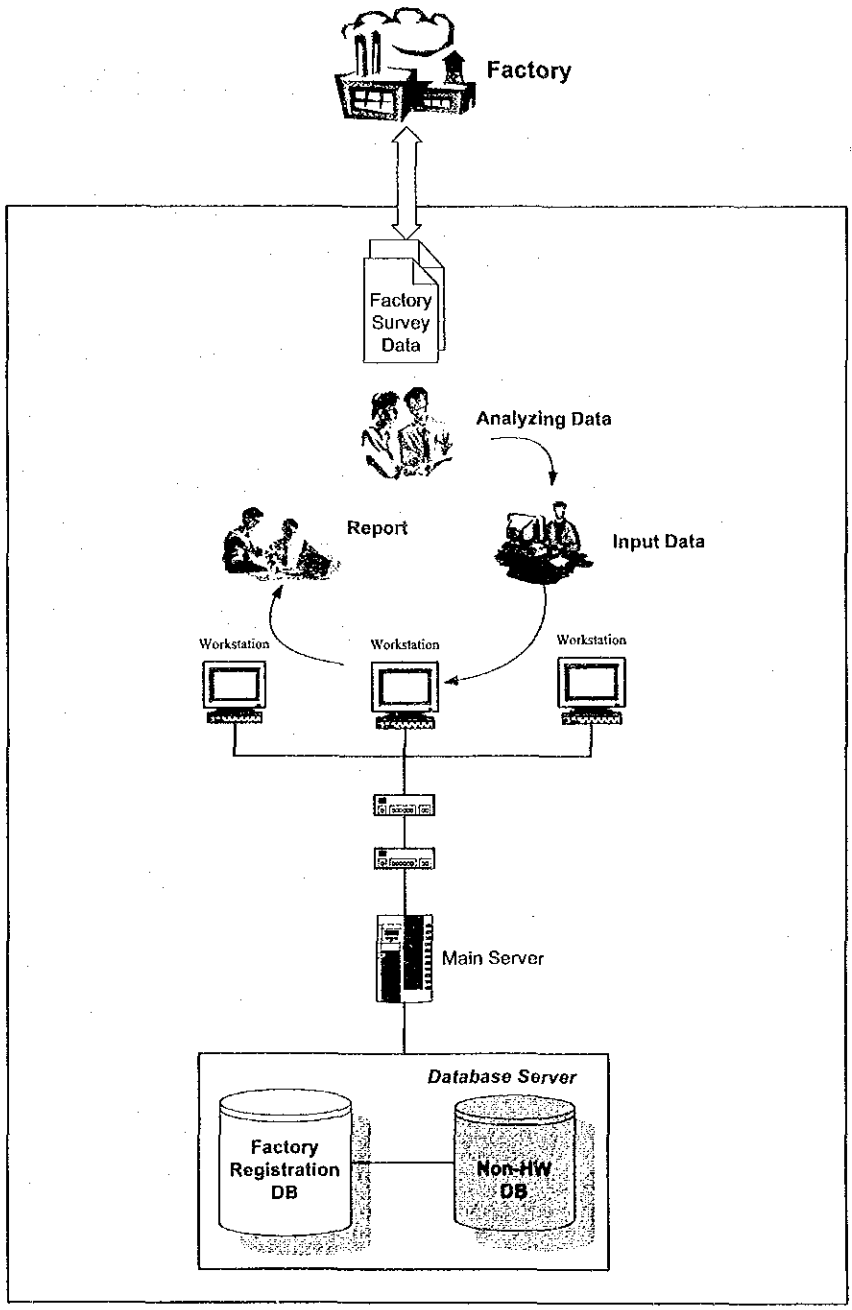


Figure 6-11: Non-HW DB Scheme

c. Non-HW Data Input Sheet

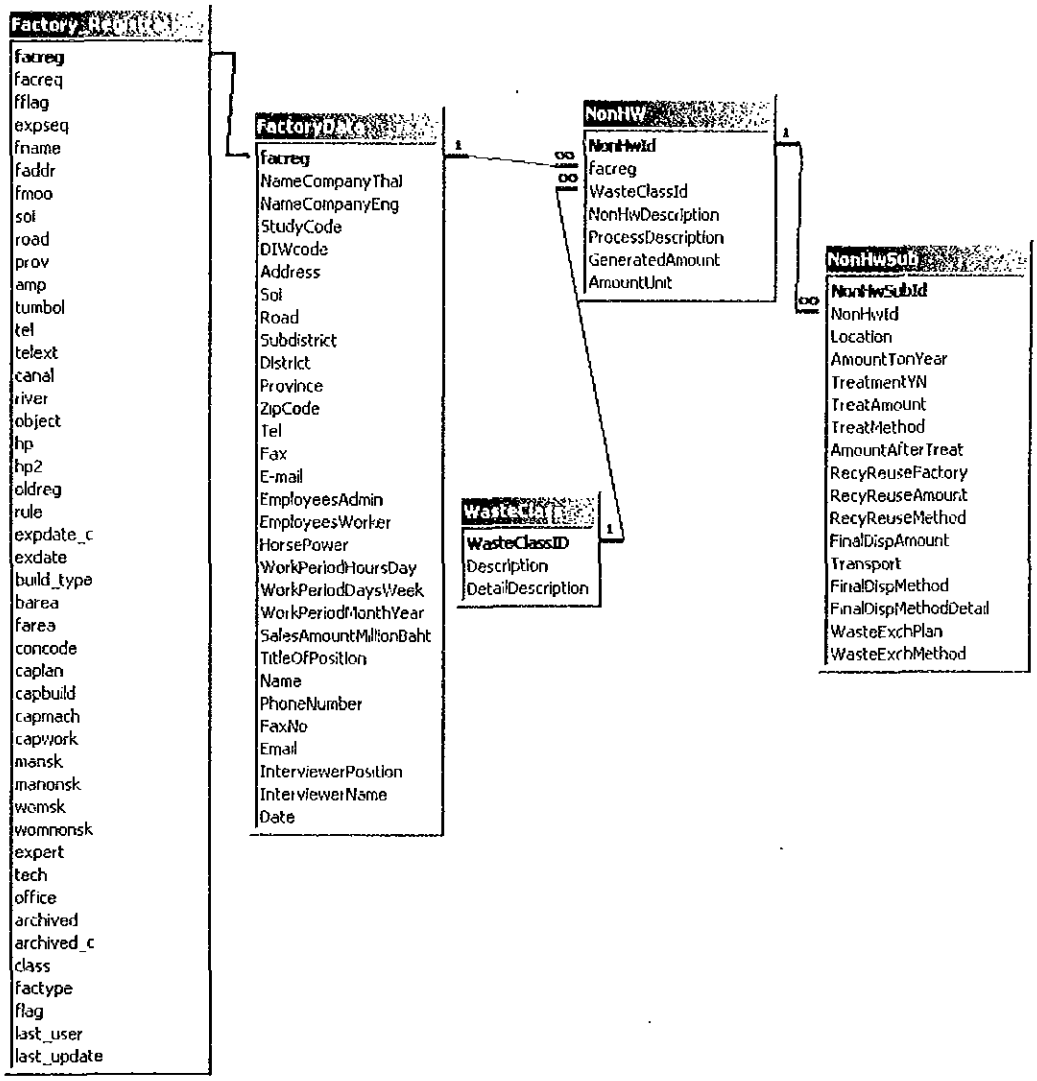
Data were entered in such a table as below.

IW Code	Type & Description	Specify the Name of the process	Generated Amount (ton/year)
C01-01	Waste from tree such as root		100

On-off site	Amount	Treatment			Reuse/Recycling		Transporter	Disposal		
		Amount	Method applied	Amount after treatment	Amount	Method applied	Responsible/ Detail	Amount	Method applied	Responsible/ Detail
On-site	50				20	Method 1		30	Method 1	
Off-site	50				50	Method 2				

d. Non-HW DB Table Relationships

Non-HW DB consists of several tables which are interlinked together as shown below.



e. Database Fields

Database fields are as below.

Name	WasteClass		
Description	Waste classification		
Fields			
Name	**Type**	**Size**	**Description**
WasteClassId	Text	1	PK
Description	Text	40	
DetailDescription	Text	180	

Name	FactoryData		
Description	General information of the factory from factory survey		
Fields			
Name	**Type**	**Size**	**Description**
facreg	Text	20	**PK**
NameCompanyThai	Text	100	
NameCompanyEng	Text	100	
StudyCode	Text	5	
DIWcode	Text	5	
Address	Text	150	
Soi	Text	30	
Road	Text	50	
Subdistrict	Long Integer	4	
District	Long Integer	4	
Province	Long Integer	4	
ZipCode	Long Integer	4	
Tel	Text	25	
Fax	Text	25	
E-mail	Text	50	
EmployeesAdmin	Long Integer	4	
EmployeesWorker	Long Integer	4	
HorsePower	Long Integer	4	
WorkPeriodHoursDay	Long Integer	4	
WorkPeriodDaysWeek	Long Integer	4	
WorkPeriodMonthYear	Long Integer	4	
SalesAmountMillionBaht	Long Integer	4	
TitleOfPosition	Text	50	
Name	Text	50	
PhoneNumber	Text	25	
FaxNo	Text	25	
Email	Text	50	
InterviewerPosition	Text	50	
InterviewerName	Text	50	
Date	Date/Time	4	

Name	NonHW		
Description	General detail of generation of waste from factories		
Fields			
Name	**Type**	**Size**	**Description**
NonHwId	Long Integer	4	**PK**
facreg	Text	20	Factory Registration ID
WasteClassId	Text	6	**FK**
NonHwDescription	Text	60	Description of waste
ProcessDescription	Text	60	
GeneratedAmount	Long Integer	4	
AmountUnit	Text	10	

Name	NonHW_Sub		
Description	Detail of treatment/recycling/disposal of each waste of NonHW table		
Fields			
Name	**Type**	**Size**	**Description**
NonHwSubId	Long Integer	4	**PK**
NonHwId	Long Integer	4	**FK**
Location	Text	10	Treatment location
AmountTonYear	Long Integer	4	
TreatmentYN	Text	1	
TreatAmount	Long Integer	4	
TreatMethod	Text	50	
AmountAfterTreat	Long Integer	4	
RecyReuseFactory	Text	1	
RecyReuseAmount	Long Integer	4	
RecyReuseMethod	Text	50	
FinalDispAmount	Long Integer	4	
Transport	Text	50	
FinalDispMethod	Text	50	
FinalDispMethodDetail	Text	50	
WasteExchPlan	Text	10	
WasteExchMethod	Text	50	

f. Outcome of the Non-HW DB and Future Usage

The establishment of the database enabled the team to check, integrate and analyze the data. As a result, the team could calculate the waste generation rate of each type of waste and of each category of industry, by which the team further could estimate the total waste generation amount in the whole study area in 2001 and 2010. Moreover, the analysis of the database could produce the waste flow. The waste flow explains the reality of IWM by describing how much waste is reused/recycled, treated, or disposed of on-site or off-site.

In this manner, this database is useful to investigate the non-HW management system and identify the issues to be improved.

g. Future Use and Institutional System of Non-HW DB

For the continuous use of this database, it is necessary to repeat the factory survey, as done by the team in the present project, every a few years and to update the data. It is recommended to have a legislative measure to obligate factories to disclose data of their waste management to DIW.

If the data is updated, the total non-HW generation amount and waste flow can be estimated periodically, and it is also possible to monitor non-HW management with the progress of the M/P, and to review the non-HW management policies.

Because the non-HW DB is a new database, DIW does not have an institutional system to operate or maintain it. The daily O&M work is, however, minimal and data updating will be well done using human resources outside as it is an event only once in a few years.

To facilitate the O&M of non-HW DB, the team prepared an operational manual, as shown in Annex 6.1.

h. Improvement of Non-HW DB

The problem of update of the factory registration DB should be sorted out in order for the non-HW DB to be useful. The team arranged the non-HW DB so that its data can be exported to the DIW factory registration DB. In this manner, data from factory surveys that are recommended to be carried out periodically, should be utilized not only for the non-HW DB but also for the factory registration DB.

6.2.3 Development of Manifest System Database

a. Background

At present, DIW intends to enforce the manifest system shown in Figure 6-12, but it is not fully operated. The form has six copies, but only Copy 1, which comes from the Samae Dam Treatment Center, is available at DIW, but the copies are simply filed without being digitised. Consequently, the team and C/P agreed to develop a Manifest System DB (MS DB) to which the data of Copy 1 would be entered.

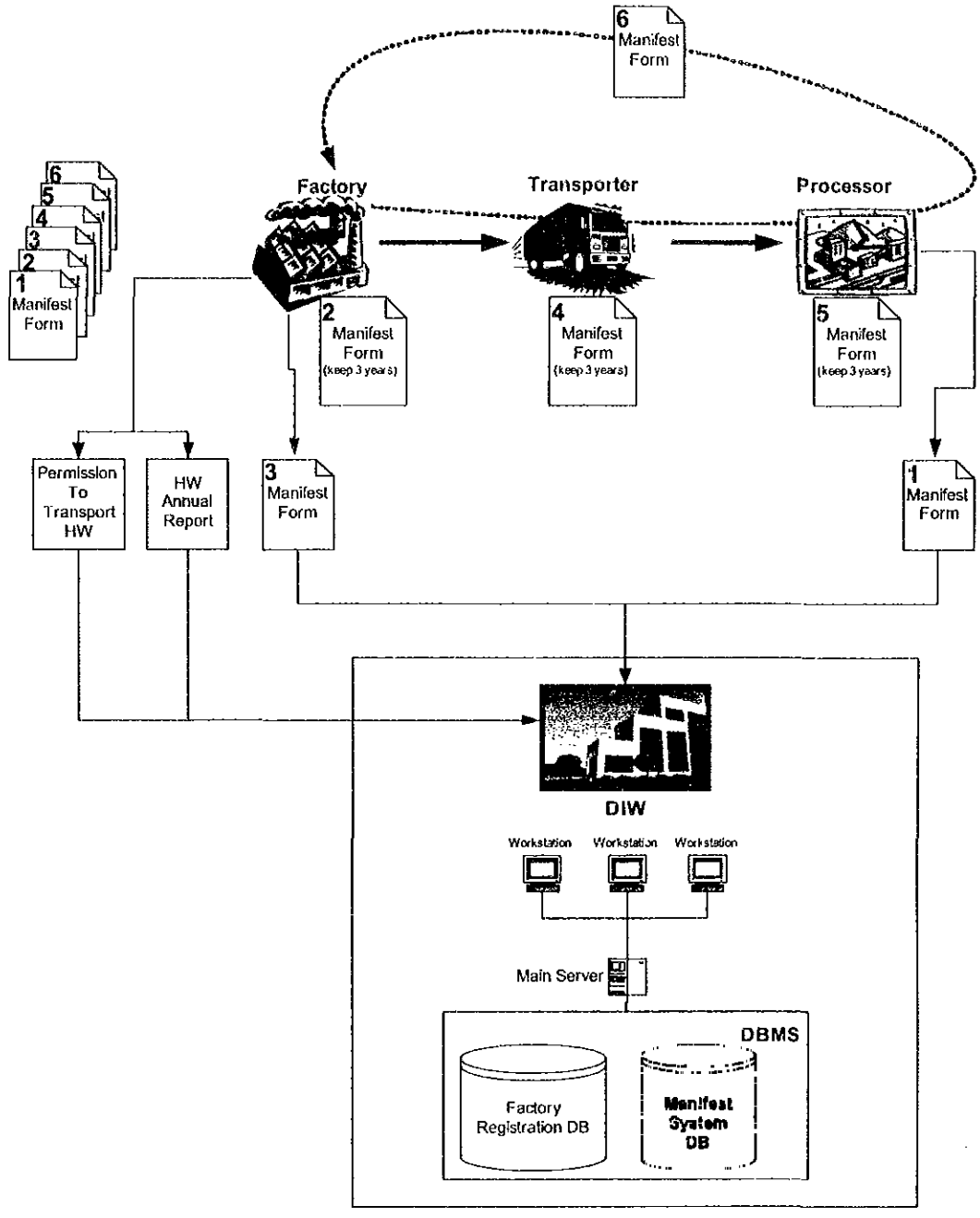


Figure 6-12: Manifest System Scheme

b. Manifest Data from Samae Dam

Finally DIW obtained the manifest data as in Figure 6-13 from Samae Dam Treatment Center in digital format and provided them to the team..

Field	Data
manifest_no	066456
cust_no	201134
plant_code	201135
wast_number	01134-02
container_type	001
container_volumn	
container_type2	
container_volumn2	
container_type3	
container_volumn3	
total_quantity	8500
unit_of	019
advice_desc	
manifest_date	02/01/2000 08:26:54
date	02/01/2000
transport_code	บริษัทแอดวานส์ จำกัด
transport_date	02/01/2000 08:26:54
process_code	
waste_quantity	8440
process_date	
rej_wast_type	
rej_quantity	
rej_process	
rej_date	
waste_code	
recipe_code	

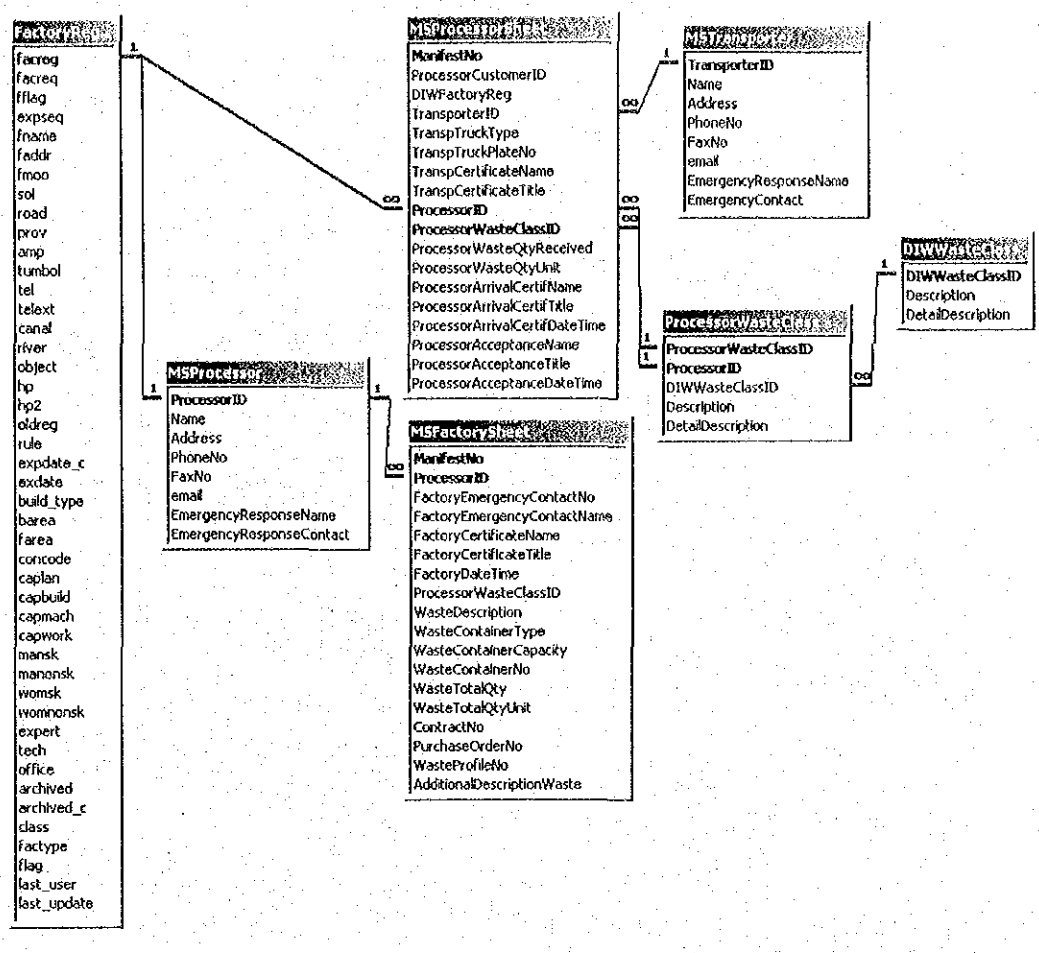
Field	Data
cust_code	200002
plant_tname	ทการไทย
industry_name	Textile

Field	Data
cust_code	200007
waste_number	00007-01
waste_code	1000000071
waste_name	กัดกรดใช้แล้ว

Figure 6-13: Detail of Manifest data from Samae Dam

c. Manifest System DB Tables Relationships

MS DB tables have mutual relationships as shown below.



d. Data Fields

Fields of data in tables are as shown below.

Name	**MSFactorySheet**		
Description	Table to input details of Manifest data came from factory		
Fields			
Name	**Type**	**Size**	**Property**
ManifestNo	Text	10	PK
ProcessorID	Text	20	DIW registration of the processor
FactoryEmergencyContactNo	Text	30	
FactoryEmergencyContactName	Text	30	
FactoryCertificateName	Text	30	
FactoryCertificateTitle	Text	30	
FactoryDateTime	Date/Time	8	
ProcessorWasteClassID	Text	10	Waste classification ID of the processor waste classification
WasteDescription	Text	50	
WasteContainerType	Text	50	
WasteContainerCapacity	Text	20	
WasteContainerNo	Long Integer	4	
WasteTotalQty	Long Integer	4	
WasteTotalQtyUnit	Text	10	Ton/c.u.m.

ContractNo	Text	20	
PurchaseOrderNo	Text	20	
WasteProfileNo	Text	20	
AdditionalDescriptionWaste	Text	50	

Name	**MSProcessorSheet**		
Description	Table to input detail of Manifest data came from processors		
Fields			
Name	**Type**	**Size**	**Descriptions**
ManifestNo	Text	15	**PK**
ProcessorCustomerID	Text	20	Customer ID use in the processor database
DIWFactoryReg	Text	20	DIW registration of the factory (customer of the processor)
TransporterID	Text	15	**FK** (Transporter ID to link to the MS Transporter table)
TranspTruckType	Text	30	
TranspTruckPlateNo	Text	15	
TranspCertificateName	Text	30	
TranspCertificateTitle	Text	30	
ProcessorID	Text	20	**PK/ FK** (DIW registration of the processor)
ProcessorWasteClassID	Text	10	**PK/ FK** (Waste classification ID of the processor waste classification)
ProcessorWasteQtyReceived	Long Integer	4	
ProcessorWasteQtyUnit	Text	10	
ProcessorArrivalCertifName	Text	30	
ProcessorArrivalCertifTitle	Text	30	
ProcessorArrivalCertifDateTime	Date/Time	8	
ProcessorAcceptanceName	Text	30	
ProcessorAcceptanceTitle	Text	30	
ProcessorAcceptanceDateTime	Date/Time	8	

Name	**MSProcesor**		
Description	General Information of Processor		
Fields			
Name	**Type**	**Size**	**Property**
ProcessorID	Text	20	**PK** (DIW registration of the processor)
Name	Text	50	
Address	Text	50	
PhoneNo	Text	30	
FaxNo	Text	30	
Email	Text	30	
EmergencyResponseName	Text	50	
EmergencyResponseContact	Text	50	

Name	MSTransporter		
Description	General information of transporter		
Fields			
Name	Type	Size	Descriptions
TransporterID	Text	15	PK
Name	Text	50	
Address	Text	50	
PhoneNo	Text	30	
FaxNo	Text	30	
email	Text	30	
EmergencyResponseName	Text	50	
EmergencyResponseContact	Text	30	

Name	DIWWasteClass		
Description	Detail of the waste classification of DIW		
Fields			
Name	Type	Size	Descriptions
DIWWasteClassID	Text	10	PK
Description	Text	40	
DetailDescription	Text	180	

Name	ProcessorWasteClass		
Description	Detail of the waste classification used in the processor database		
Fields			
Name	Type	Size	Descriptions
ProcessorWasteClassID	Text	10	PK
ProcessorID	Text	20	
DIWWasteClassID	Text	5	
Description	Text	40	
DetailDescription	Text	180	

e. Outcome of the MS DB and Future Usage

From the work of this database development, the following was revealed.

- In total, 18,812 of manifest form copy 1 from 549 factories in 2000 and 6,689 from 413 factories in 2001 (from January to June) were submitted to DIW. The unit to express the amount of waste is not unified and tons and cubic meters are used. If the figures are simply summed up regardless the unit, it comes to 131,752 in 2000 and 47,631 in 2001.

Table 6-3: Manifest Data from Samae Dam Center (Number of Factories, Number of Manifest Sheets and Waste Amount)

Year	2000	2001 (Jan.-June)
Number of Factories	549	413
Number of Manifest Sheets	18,812	6,689
Waste Amount (ton and/or m3)	131,752	47,631

- Factories which send waste to the center are controlled by their names and DIW factory registration codes are not used.
- It was found not easy to sum the amount of each type of waste. This is because the center categorizes waste for the purpose of price setting, and different code numbers are assigned to even the same type of waste if it comes from different factories.
- The treatment capacity of the center is 1,000 ton/day. If ton is used as the unit and the center operates 300 days in a year, the operation rate of the center is about 44%.

DIW specifies the submission of Copy 1 of the manifest form as a condition of the Code 101 license. The present study only dealt with the manifest data from the Samae Dam Center, which were already digitised by the center. If DIW makes sure that all the code 101 factories submit Copy 1 and data is transferred to the MS DB, the total amount of waste that is properly treated of disposed of can be obtained and useful to verify the waste flow.

If DIW is to introduce the electric manifest system, this database will serve as a base.

f. Institutional System of the MS DB

The MS DB is the new database as well as non-HW DB, and the DIW currently does not have an institutional system to operate and maintain the MS DB as a regular work.

However, the Samae Dam Center has been digitising its data. If DIW standardizes a rule of data format (see the next section, g.), enforces the rule at the Samae Dam Center, and has the digitised data sent to DIW together with Copy 1, it should not be a trouble to update the data of Samae Dam Center. The similar procedure should be applied to the other code 101 factories.

To facilitate the O&M of MS DB, the team prepared an operational manual, as shown in Annex 6.2.

g. Improvement of MS DB

At present, the bill of hazardous waste manifest system of PCD/MOSTE described in Section 5.4.2 is under discussion. DIW/MOI should be prepared to modify or improve the MS DB to adjust it to the manifest system.

It is essential to standardize the digital data format for the improvement of the MS DB. Specifically, the following issues should be sorted out.

- The unit to express the amount of waste should be unified.
- In the manifest, the DIW registration number is not written. Without the code, it is not possible to make a full link between the Manifest DB and the main factory registration DB of DIW it is difficult to really utilize this DB to control waste management at factories. The team recommends DIW to use the DIW registration number to identify all the factories which send waste to Samae Dam. Otherwise it will be hard to know which factories registered at DIW send how much waste to this treatment center.

- The two DB use different waste classification. DIW is strongly recommended to define its solid waste classification system to be applied to both. .

The team in cooperation with IT Center attempted to link the Samae Dam manifest data with the DIW factory registration DB by referring to the name of factories and assigning a corresponding DIW registration code. Out of 599 customers registered at the Samae Dam Center only 275 were found in the DIW factory registration DB, and furthermore, some of their names were not correct. It will be difficult to check all the factories. Therefore, from now on, the treatment center must be enforced to use the DIW registration code.

Chapter 7

Current Issues on IWM

7 Current Issues on IWM

This chapter presents the issues requiring improvement found in the present study as of June 2002 and the schemes for improvement that the team should address.

7.1 IWM at Factories (Generation Sources)

7.1.1 Current Issues

In general, factories in the study area well manage the production lines and work environment by keeping the work areas in good order. The factory survey that the team carried out by visiting 215 factories, however, suggests that IWM at factories is not adequate from the following findings. These are particularly observed at small-to-medium-sized factories.

- Waste is often discharged without separation. 17.2% of 215 factories mix non-HW and HW, and 24.6% mix non-HW from production and non-HW from the other part of the factory.
- One third of 215 factories do not have storage facilities for industrial waste in their premises.
- Three fourths of the factories replied that the amount of their industrial waste will not increase in future, but factories, which have a plan of waste reduction and/or waste reuse/recycling, are only 8%.

7.1.2 Scheme for Improvement

In order to establish a proper IWM the important issues are (i) to reduce IW generation as much as possible (Reduction), (ii) to reuse/recycle IW generated as much as possible (Reuse/Recycling) and (iii) to properly treat/dispose of IW, which could not be reused/recycled (Proper Treatment/Final Disposal).

The fundamental of IWM is that the waste sources, i.e. factories, reduce their waste, reuse/recycle IW generated and subcontract waste treatment and final disposal, if necessary, in an appropriate way. For this purpose, factories should have a clear mechanism to place responsibility for waste management and a technical control system. It is therefore recommended for factories to appoint a technical manager who comprehensively oversees IWM. On the other hand, the government will be required to encourage human resource development by, for example, establishing training programs and a certificate system and legally enforcing the appointment of the technical manager of IWM at every factory.

7.2 Non-HW Management

7.2.1 Current Issues

a. Limitation of the Study Results

The status of non-HW management had not been studied and was unknown. The present JICA study is the first trial to understand it from generation to final disposal

by interviewing 215 factories using a questionnaire. Out of 215, 206 factories provided necessary data for the team to analyze the waste flow. However, they are merely 0.62% of the total number of factories in the study area, 33,092. It should be noted, therefore, that the analysis of the status of non-HW management is merely derived from the answers of such a small group of factories.

b. High Waste Reuse/Recycling Rate and Unclear Reuse/Recycling Activities

According to the non-HW flow in 2001 developed using the factory survey result, more than 78% of non-HW is reused or recycled. This rate is two times more than that in Japan (37% in 1996). The high reuse/recycling rate in the study area is not, however, extraordinary, because:

- the waste flow in Japan takes account of sludge, which is hard to recycle (only 7% of generated sludge is recycled in Japan) but generated in large volume (its generation amount accounts for 47.7% of total IW generation amount, 405 million tones a year), but sludge in the waste flow in the study area is only a little (55.5% of the mixed waste (category C11) equivalent to 1.1% of the total of non-HW), and
- cost for raw materials is comparatively expensive than personnel cost and there is an economic incentive to reuse/recycle waste.

Although such high reuse/recycling rate should be appreciated, the reality of reuse/recycling activities is not yet clearly understood. Recycling of waste is mostly done off-site (64.8% in 78.4%) and 48.5% of non-HW is sold to Por Kha Khong Gao (Waste Buyer) for off-site recycling. Whether waste collected by Por Kha Khong Gao is properly recycled is open to question.

c. Inadequate Capacity of Treatment/Final Disposal Facilities

The number of treatment facilities for non-HW except those for municipal waste is only three in the study area. They are small incineration plants installed in industrial estates under IEAT, each of which has the capacity of less than 0.5 ton/hour. They receive waste only within the industrial estate in which they are located, are not registered at DIW, and are not fully operated. DIW gave a license of Code 101 to a private non-HW incinerator operator in Samut Prakarn, but there is no facility yet. The study area does not have any private-own waste disposal site authorized by DIW.

There are four private incineration plants for intermediate treatment with DIW registration. They are, however, also small and intended to accept non-HW only from factories within the industrial estate to which each of them belongs. The non-HW final disposal sites with DIW registration are three. As of June 2002, one of them located in Saraburi, 1.5-hour drive from Bangkok, and another in Chonburi, 1 hour drive from Bangkok, are operated, and the other, located in Sakaeo, 3 hours drive from Bangkok is under construction.

According to the non-HW flow developed in the present study, the fate of non-HW, which is not reused or recycled, is on-site final disposal (14.1%), final disposal together with municipal waste (2.8%), and treatment/final disposal by the private sector (2.5%) in a descending order. As these figures show, treatment/final disposal facilities have not been sufficiently developed by the private sector, which should be primarily responsible for non-HW treatment/final disposal.

7.2.2 Scheme for Improvement

a. Understanding the Status of Non-HW Management in Detail

Improvement should be started with the full understanding of the status of non-HW management. In the present study, the team developed the non-HW flow using the valid replies of 206 factories out of 215. The team also established the non-HW database containing data of those 206 factories. This database should be further expanded for proper non-HW management.

In order to obtain necessary data for database expansion, it is necessary to carry out a factory survey as conducted by the team should be repeated regularly (In Japan, every five year such survey is conducted.). For the efficient execution of regular factory survey, it will be effective to issue a ministerial announcement, which obligates factories to disclose data on request by the authorities of industrial waste. Database development will enable the renewal of the estimation of current and future waste generation amount and the waste flow.

b. Improvement of Reuse/Recycling System and Maintenance of High Reuse/Recycling Rate

The prime issue in non-HW management for the future is the quality improvement of current reuse and recycling activities by which nearly 80% of non-HW is dealt with, and maintenance of such a high reuse/recycling rate even along with the increase in personnel cost. The achievement of this requires to urgently investigate the actual conditions of the reuse/recycling system that the present study could not explore in depth, to detect problems, and to formulate an improvement plan. Moreover, it is needed to establish a system to supervise and control waste recycling business enterprises including waste buyers.

c. Promotion of Construction of Treatment/Final Disposal Facilities by the Private Sector and the Examination of Continuous Use of Municipal Waste Final Disposal Site

The off-site treatment amount and off-site final disposal amount of non-HW is only 125,000 ton/year, or 5.3% of total generation. More than half of that is disposed of at municipal landfills and the rest is treated and disposed of at private-own facilities which is limited in number and in capacity. Therefore, it is important to examine how to promote the construction of treatment/final disposal facilities by the private sector, but whether investment can be recovered is critical since the construction of such facilities costs the private sector significantly. In order to make the private waste treatment/final disposal business profitable, it is highly important to strictly control and eliminate the inappropriate or illegal waste routes.

The types of waste which is mostly disposed of off-site without reused/recycled are C09-01 Ceramics (reuse/recycle rate: 0%), C10 Stone, sand, etc. (reuse/recycle rate: 18.7%), and C11 Mixed waste (reuse/recycle rate: 0%). As far as the social and economic situation of the study area does not dramatically change, non-HW, which is not reused or recycled, should be disposed of at sanitary landfills, which is a cheap disposal option. Even if non-HW, which is currently disposed of on-site, is to be treated and/or disposed of off-site, the off-site treatment/final disposal amount is merely 460,000 ton/year. This is only 11.6% of the treatment/final disposal amount of municipal waste (3.97 million ton/year, mostly landfilled) and is presumably small

enough to be received at the municipal waste landfills. Therefore, it is one possible way to continue using the municipal waste landfills to dispose of non-HW as today, in parallel with the promotion of private sector's participation in the non-HW treatment/final disposal business.

7.3 HW Management

7.3.1 Current Issues

a. Difference between the GTZ HW Study and the Present JICA Study

Different organizations have been studied HW since the study of MOI[1] in 1984. Some studies cover not only HW from factories but also infectious waste and HW from households, and there is no common definition of HW among the previous studies. HW from factories, which the present study deals with, was most recently studied in Samut Prakarn Province by GTZ[2], which carried out a factory survey and estimated the generation amount of HW. The result of this GTZ HW study was used by DIW to estimate the generation amount of HW in the whole country.

In order to be consistent to the GTZ HW study, the team carried out the factory survey applying the HW categorization used in the GTZ HW study, and estimated not only generation amount but also a HW flow, which was not analyzed in the GTZ HW study.

As a result, the figures of total HW generation estimated by the two studies were close, but data of each industrial sector or each waste type were diverse. This will be because GTZ selectively studied industrial sectors, which were highly likely to generate HW in Samut Prakarn Province while the present study distributed the limited number of questionnaires to factories in all the industrial sectors in the five provinces since the team also aimed to study the status of non-HW and non-HW can be generated in every sector.

b. Low Reuse/Recycling Rate and High On-site Treatment/Final Disposal Rate

According to the HW flow in 2001 developed from the factory survey, the reuse/recycling rate of HW is 18.2%, only one fourth of that (more than 78%) of non-HW. By contrast, more than half (54.4%) of HW is treated on-site (32.8%) or disposed of on-site (21.6%), while on-site treatment and on-site final disposal of non-HW amount is only 15% of total generation.

The residue of on-site HW treatment is, however, mostly disposed of at municipal waste landfills. The safety of on-site final disposal is also questionable.

c. Shortage of Off-site Treatment/Final Disposal Facilities

The number of HW treatment/final disposal facilities is two in the study area and eight outside of the study area (GENCO's Map Ta Phut plant, which has a treatment facility and a final disposal site, is counted as single facility) as of April 24, 2002.

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[1] "Pre-feasibility Study for the Construction of Inorganic Waste Treatment Facilities in Thailand", 1985, Department of Industrial Plant, MOI

[2] "Preparation of Register on Hazardous Waste Generation and GIS Application for the Province Samut Prakarn", November 1999, DIW, MOI.

These ten facilities are not adequate to meet all the demand for HW treatment/disposal of the country.

Table 7-1: Off-site HW Treatment/Final Disposal Facilities

	Name	Location	MOI Code	Target Waste	Capacity, etc.
Treatment	GENCO, Samae Dum Center	Bangkok	101	Wastewater from factories, sludge	110,000 ton/year 30,000 ton/year
	GENCO, Map Ta Phut Plant	Rayong	101	Waste oils and waste solvents Sludge	200 ton/day 600 ton/day
	Technochem Co., Ltd.	Chachoengsao	101	Waste solvents	15,000 ton/year
	Recycle Engineering Co., Ltd.	Chonburi	101	Waste solvents	10,000 ton/year
	Siam Cement Kaeng Koi Plant	Saraburi	101	Waste oils, waste solvents and others	46,000 ton (actual amount during Jan-Sep 2001)
	Siam City Cement	Saraburi	101	Waste oil, Wax oil, Fly ash, others	192,029 ton (actual amount during Jan-Apr 2002)
	Refine Tech Co., Ltd.	Samut Prakarn	106	Isopropyl alcohol	5 m3/day
	Asian PVS Chemical Co., Ltd.	Chachoensao	106	Acid pickling waste (Iron chloride $FeCl_2$ solution)	1,000 ton/month
Final Disposal	GENCO, Map Ta Phut Plant	Rayong	101	Solid HW	Remaining capacity is scarce and a new disposal site is under construction
	Rachaburi Landfill	Rachaburi	101	Sludge treated at the Samae Dum Center	Remaining capacity is sufficient and expansion is also possible.
	Professional Waste Technology Co., Ltd.	Sakaeo	101, 105	Solid HW	Under construction

As of October 2001, Code 101 is the only code specified in waste business and there were only five facilities registered as Code 101. Codes 105 and 106 were newly established in December 2002 and the number of waste related facilities increased to ten, as the table above shows. The situation seems improved, but ten is still a too small number. In Japan, the number of treatment/final disposal facilities receiving HW and/or non-HW is 16,883 (in 1999). In Thailand, in reality, there are many recycling factories but they are registered as other codes depending on what they produce (e.g. thinner recyclers are categorized as chemical manufacturers). Since they

have not attained codes of waste related facilities, it is not easy for waste generators to obtain transport permits if they are to deliver waste to such recyclers.

The shortage of the capacity of treatment/final disposal facilities and consequent rise in treatment/final disposal fee is a serious problem by which the manufacturers are confronted. The questionnaire survey of the Japanese manufacturing companies conducted by Japan Chambers and Commerce in Bangkok in August 2001 revealed that 91 out of 148 replies (61.5%) stated that the treatment and final disposal of industrial waste is the most serious environmental problem of the manufacturers.

The urgent construction of treatment/final disposal facilities for HW which is difficult to recycle is strongly required, but the strong public opposition against the construction plan is highly anticipated. Therefore, the development of treatment/final disposal facilities in a short term will be significantly difficult.

7.3.2 Scheme for Improvement

a. *Understanding the Status of HW Management in Detail*

The importance to understand the status of HW management can not be emphasized. As in the case of non-HW management, the periodical execution of a factory surveys as in the present study and the review of present and future generation amount and waste flow are necessary. In visiting factories for the survey, the manner of on-site disposal may need inspection since on-site disposal is applied more than half of HW. In order to trace the waste flow outward from factories, the comprehensive implementation of the manifest system is desired.

b. Promotion of Urgent Construction of Treatment/Final Disposal Facilities

The principal cause of the on-site treatment and final disposal of more than half of HW is that appropriate treatment/final disposal facilities are limited. Accordingly, competitive pricing does not work, and off-site treatment/final disposal cost exceeds on-site treatment/final disposal cost. Therefore, it is necessary to promote the urgent construction of treatment/final disposal facilities and to encourage competitive pricing. When improper on-site waste disposal, particularly final disposal, is found from the factory survey, inspection, annual report, or other occasions, it is important to require improvement and, if necessary, to divert waste to off-site facilities.

According to the result of the public opinion survey (POS), large part of the respondents pointed out that the most desired condition to agree a plan of waste treatment/final disposal facilities is the participation of the local residents or their representatives from the planning process. It is therefore necessary to consider how to involve the public from the planning stage of treatment/final disposal facilities.

Such participatory planning, however, requires substantial time before the construction plan is finally agreed and proceeded. Meanwhile, it will be more practical to feed waste as raw material or fuel to cement plants, which exist at this very moment and leave little residue.

c. Promotion of Reuse/Recycling

In addition to the promotion of urgent construction of treatment/final disposal facilities, the reuse/recycling rate of HW, which is less than one fourth of that of non-HW, should be raised. The utilization of cement plants is an effective measure to

compensate the shortage of treatment/final disposal facilities and to forward reuse/recycling.

When waste is received at cement plants, however, waste quality must be well analyzed and adjusted, and different types of waste may need compounding in order not to impair product quality. It is desirable to raise and guide a new intermediary business, which provides a service of waste quality control. Some types of waste cannot be simply put into cement production process, and it is also needed to investigate how the existing plants should be improved and how much investment is required. Waste Utilization Data Center that the team has established should be a useful system to support such business enterprises including the cement plants, which play an important role in the reuse/recycling of HW and non-HW.

7.4 Institutional System

7.4.1 Current Issues

a. Lack of a System to Control Industrial Waste Collection/Transport Business

In Thailand, industrial waste means waste from factories, and is under the control of MOI in conformity with the Factory Act. According to the Factory Act, facilities with certain conditions in terms of the number of employees and horsepower are registered as factories, and MOI controls factories through the processes of registration, permission, reporting, and/or inspection. MOI controls IWM by taking sanctions such as fines, administrative directives, factory closure, and the cancellation of licenses against factories, which violate the relevant stipulations in the Factory Act. Therefore, factories, which generate waste, and factories that receive waste for treatment or final disposal are controlled by MOI.

Waste collection and transport from the generation source is to be controlled by the transport permit system, which is defined by MOI Notification No.6 B.E. 2540 (1997) as for HW and MOI Notification No.1 B.E. 2541 (1998) as for non-HW applied only in 14 provinces including the study area, to require waste generating factories to be permitted when bringing their waste out. In fact, however, small parts of factories actually apply for and obtain the permit. Comparing the total amount of waste to which transport permits were issued in 2000 and the waste amount of off-site disposal (i.e. waste brought out from factories) in 2001 estimated by the team, the former is far below the latter. The amount of non-HW with transport permit is 94,000 ton or 5.7% of its off-site disposal amount: that of HW is merely 6,400 ton or 2.6% of its off-site disposal amount.

On the other hand, there is no regulation to register, permit, control and monitor waste collection/transport business. One who is going to start waste collection/transport business has to firstly register the company with Ministry of Commerce, and secondly apply for a transporter license to Land Transport Department of Ministry of Transport and Communication in accordance to the Land Transportation Act B.E.2522 (1979). However, only major transport companies have licenses and the rest execute their collection/transport business without licenses. The said act does not stipulate the penalty to waste collectors/transporters for dumping waste entrusted to illegal waste dumps done by them. If a waste collector/transporter who illegally dumped waste is arrested, he/she will be fined only a small amount by

applying acts other than the Land Transportation Act. For example, in local administration areas, i.e. areas under the control of local administration such as BMA, the highest fine will be only 2,000 Bahts according to Cleanliness and Orderliness Act B.E. 2535 (1992). Moreover, the generators of waste that was illegally dumped by transporters are not accused of for illegal dump.

In conclusion, there is no sufficient legal tool to supervise waste collectors/transporters, to prevent illegal dumps, and to strictly control wicked collectors/transporters who repeat illegal dumps. Even the number of IW collectors or transporters is not known. In Japan, the number of collection/transport enterprises of non-HW and HW are 117,507 and 14,494, respectively in 1998.

b. Inadequate Control over IW Reuse/Recycling Business

The Factory Act had categorized factories into 104 until very recent. Factories that run waste treatment or final disposal facilities were categorized as code 101: Centralized waste disposal or treatment factory, but waste reusing/recycling factories were not categorized as a single code of reuser/recycler, but were categorized as relevant codes according to their final output. To solve this issue, MOI created new codes 105 for waste separation and landfill and 106 for waste reuse and recycling in December 2001, but the registration process has not been well proceeded.

Moreover, most waste buyers who play important roles in IW reuse/recycling are not registered as factory since they do not meet the conditions of horsepower or the number of employees. Not only the Factory Act but also any other acts do not control nor regulate waste buyers (Por Kha Khong Gao). Therefore, if they illegally treat or finally dispose of waste that they bought from factories, they are punished with only a small fine, as in the case of waste collectors/transporters. The study of PCD/MOSTE[3] reported that there are 2,231 waste buyers, but details of their business are still not known.

c. Lack of Unified Control over IWM

The administration and management on IW is not under the unified control. As stated earlier, MOI controls the factories that generate waste and those to which waste is brought for treatment and/or final disposal since factories with certain scale need licenses and registration that enable DIW to control them. The area between the generation source and treatment/final disposal is, however, beyond the jurisdiction of MOI. Moreover, there are only three non-HW final disposal sites authorized by MOI in and around the study area, and the majority of non-HW from factories is disposed of at municipal landfills. The municipal landfills are managed by local administration, and industrial waste control by MOI does not reach them.

d. Inadequate Data Management

DIW has Information Technology Center that keeps a database of factory registration and other data concerning factories. Part of data is open to the public at DIW's website. However, the data in the database is not adequately updated.

In the present study, the team obtained the basic factory data such as the number of factories and the number of employees in the study area using this database. It found,

[3] Final Report of the Study on Guideline to Reduce Pollution by Recycling, Pollution Control Department, Ministry of Science, Technology and Environment, March 1998

however, that the number of factories and the number of employees in the DIW database are smaller than those in the database of IEAT. It was also found that the database does not contain sufficient data of factories located in the industrial zones, industrial communities and industrial parks.

As for the database on industrial waste, there are only two: the database on HW developed in the GTZ HW study, and the other on HW and non-HW developed in the present study. However, the number of factories covered by those databases is not large. DIW has data on IW in transport permits and in manifest forms from factories every year and from treatment/final disposal enterprises, but these data are kept only in a paper form in files not being digitized in a database.

e. Public Opposition against the Construction of Waste Treatment/Final Disposal Facilities

Today, as environmental awareness develops in Thailand, the general public has become concerned in development projects which may give negative impacts on human health and the environment. Especially the construction of any types of waste treatment/final disposal facilities faces strong opposition of the public, because the people have heard troubles at open waste dumps and have developed recognition that waste related facilities damage the environment by such problems as offensive odor and fires. As stated in Section 3.5, the operation of some of municipal waste landfills which were constructed after the successful EIA procedure have been stuck due to the public opposition in the study area. Therefore, it is highly anticipated that IW treatment/final disposal facilities can not be constructed and/or operated due to the public resistance, even with the approval of EIA by MOSTE and the authorization of DIW.

7.4.2 Scheme for Improvement

a. Examination of the Introduction of Consistent Manifest System

Whether waste taken out of the factories are properly dealt with is controlled by the transport permit system of DIW and IEAT and the manifest system. However, only part of factories apply for and obtain transport permits. The current manifest system only covers industrial waste that is treated or disposed of at treatment/final disposal enterprises with DIW authorization. In summary, neither of the systems can trace nor control the majority of waste that is discharged by factories.

Thorough industrial waste control covering every aspect of disposal including discharge, collection/transport, reuse/recycling, and final disposal necessitates the introduction of a complete manifest system. The system should use an unified format which is used by all the relevant organizations across the country.

The enforcement of the manifest system is conditioned on a register and permit system of waste collectors and transporters. Furthermore, intensive examination will be required to demonstrate a legal basis of DIW to control waste collectors and transporters. Meanwhile, it is important to strongly put into effect the present control measures including the submission of annual report by the factories to report about their waste management at the end of every year, transport permits, and filling in the manifest form by the treatment/final disposal enterprises as a receipt of waste and sending the copy from them to the factories in the annual report every year.

b. Examination of the Introduction of a License System

In order to practically implement the manifest system, it is necessary to examine the introduction of a license system, in which all the enterprises engaged in waste management including waste collectors/transporters, waste buyers, waste reusers/recyclers, and treatment/final disposal facility owners are required to register and obtain a license to run their business. The license should be issued to every type of business and every type of waste dealt with.

If the license system is established, it should possible to strictly control the waste business by withdrawing the license, ordering facility closure, etc. At the same time, it is also possible to provide the registered enterprises with benefits such as technical and financial assistance and the information of waste exchange, and to promote the waste treatment/final disposal business which is at present too small to meet demand. The license system is therefore has the carrot and the stick.

In December 2001, the amendment of a ministerial regulation pursuant to the Factory Act was enacted. By this amendment, new factory codes 105 and 106 will be newly set up by which facilities of waste segregation and waste reuse/recycling should be licensed prior to the facility installation under the Factory Act.

The critical point in the license system is to stringently regulate illegal operation by applying severe control and punishment on enterprises that operate without licenses. In parallel, tt is also necessary and probably more efficient to legally force waste generators to entrust off-site waste disposal only to licensed enterprises.

c. Unifying Waste Management

Covering all the aspect of IWM as addressed above will be difficult for the IWM system under the Factory Act. To overcome this deficit, it will be worth examining to establish a new act which regulates every issue of not only industrial waste but also municipal waste and hospital waste. The waste-relevant acts such as the Factory Act, Public Sanitation Act and others will be linked together under this new act.

d. Improvement of Data Control System

The establishment of the database is merely a starting point: it should be always functioning. Therefore, the maintenance of the current databases, and the development of a system to foster the database are required. Especially, it is urgently needed to develop an interface system to link the database of provincial industrial offices and the database of the IT Center, so that the IT Center's database is regularly updated.

The following measures should be further attempted.

- To appoint the necessary number of personnel who control and update the databases.
- To make a reporting rule thoroughly understood and executed so that data and information necessary for the database update can gather from bureaus within DIW, DIW regional offices, IEAT, and other relevant offices.
- To develop procedures to share the data in the databases such as waste classification by code numbers.

e. Public Consensus Making for the Construction of Waste Treatment/Final Disposal Facilities

The team carried out a public opinion survey (POS) which covered 400 people in the study area. According to the result of POS, more than 60% of the respondents recognize the pressing need to construct IW treatment/final disposal facilities. It was also found that the condition to agree a plan of waste treatment/final disposal facilities is, firstly, the participation of the local residents or their representatives from the planning process; secondly, careful site selection; and thirdly, strengthened measures to prevent illegal dumps. The majority of the respondents pointed out the necessity of the government to strengthen its control and punishment of illegal dumps followed by the development of public control as an effective measure to prevent illegal dumps.

With such understanding, it should be considered how to cooperate with the public and how to involve the public from the planning stage of IW treatment/final disposal facilities. In other words, it is necessary to make the construction of IW treatment/disposal facilities understood by disclosing information to the public as much as possible and by PR activities to the residents.

For the purpose of attaining public consensus, a company which recently started the operation of non-HW final disposal site discloses necessary information to the residents, grants a "community fund" to them in proportion to the waste disposal amount, and reserves a closure fund and a post closure fund to be used at the termination of the use of the site. The another company whose disposal site is under construction has openly explained the work to the residents since the planning stage for their right understanding, and intends to establish a public relation center for the publicity to the residents and NGOs.

Careful site selection requires the formulation of site selection standards. MOSTE have the only site selection standard which is simple and is applied to the treatment/final disposal facilities for municipal waste. It is recommended to develop as early as possible a site selection standard for IW treatment/final disposal facilities which satisfies the requirement of the public.