

CHAPTER 5 LEGISLATION IN SELECTED COUNTRIES

Laws and Regulations are important and efficient tools for environmental management. They can have an effect on which waste management approach will be used. This chapter will explore overview of current promulgated environmental laws and regulations for waste management in Thailand. This study will emphasise on legislation which is relevant or concerned with waste exchange. It also describes the Environmental fund, a tool for environmental problem solving, and the environmental policies from Enhancement and Conservation of National Environmental Quality Act B.E. 2540-2559 that may affect environmental laws and regulations in future.

In order to understand how legislation enhance waste exchange approach in developing countries, other legislation from USA, Canada, and Denmark are studied and compared with Thai's legislation.

Thailand

Since 1992, four environmental legislation which dramatically reform the country's regulatory and legislative framework have been enacted. Those laws are :

- ◆ Enhancement and Conservation of National Environmental Quality Act (NEQA) B.E. 2535
- ◆ Factory Act B.E. 2535
- ◆ Hazardous Substance Act B.E. 2535
- ◆ Public Health Act B.E. 2535

Summaries of content for each act are described below.

Enhancement and Conservation of National Environmental Quality Act (NEQA) B.E. 2535

The purposes of the NEQA B.E. 2535 are :

- to reorganise National Environmental Board (NEB);
- to decentralise decision making regarding pollution matters;
- to establish Polluter Pay Principle, anyone who pollute environment has to pay fine for doing wrong and compensate for all damages in full;
- to designate pollution control area in order to control, reduce, and eliminate pollution;
- to set requirements for preparing environmental impact assessment (EIA) in the industrial permitting procedures of specified activities;

- to promote and create the methods for environmental problem solving by tax incentive and establishment of Environmental Fund;
- to increase public participation for enhancement and conservation of national environmental quality;
- to establish Pollution Control Committee who propose the action plans for pollution prevention problems to NEB;
- to improve minimum emission or effluent standards, and types of point sources of pollution which are controlled according to the emission of pollutants for being used by all concerning Ministry;
- to establish methodology and system for enforcing all related laws and regulations from different Ministry; and
- to improve environmental impact assessment reporting system.

Under the NEQA, the Ministry of Science Technology and Environmental (MOSTE) was named in place of the Ministry of Science, Technology, and Energy and established to supervise factories so that each factory follows the regulations correctly. The Office of Environmental Policy and Planning (OEPP), the Office of Environmental Quality Promotion (OEQP), and Pollution Control Department (PCD) are the three key responsible parties in the MOSTE. All of them perform environmental tasks as public awareness inducers and enforcement agencies.

Section 73 mentioned that no person is allowed to engage in a business of monitoring control operator or service contractor for wastewater treatment or waste disposal without obtaining license from local authority. Service charge of this service shall not be greater than specified rate prescribed in ministerial rules under this Act. Whoever fail to comply with this section has to be fined not greater than 100,000 Baht or imprisoned one year or both under section 105.

Section 78 specified that collection, transport and other activities for garbage and other solid waste treatment and disposal shall be comply with the governing concerning laws.

In section 79 mentioned that if there is no specific law for hazardous waste, the Minister with the advice of Pollution Control Committee has power to issue ministerial regulations to control of collection, storage, safety measures, transportation proper and technically sound management treatment and disposal of hazardous waste. This regulation will designate types and categories of hazardous generated from production and usage of chemicals or hazardous substances in the production process of industry.

Notification of NEB no. 9 B.E. 2537, dated March 15, B.E. 2537 issued under the NEQA B.E. 2535 specified Samutprakarn province as a pollution control area. Under section 60 in part 3 pollution control area of the NEQA B.E. 2535, provincial governor of Samutprakarn province can set the action plan to control and reduce pollution in this area.

Notification of the MOSTE No. 4 B.E. 2539 issued under NEQA B.E. 2535, published in the Royal Government Gazette Vol. 113 Part 13 D dated February 13, B.E. 2539 specified industrial effluent standard for industry group 2 and 3 under the Factory Act B.E. 2535 and all kinds of industrial estates.

Notification of the Pollution Control Committee No. 3 B.E. 2539 dated August 20, B.E. 2539 issued some certain types of industry which are allowed to have different effluent standards from the Notification of the MOSTE No. 4 B.E. 2539.

Factory Act B.E. 2535

This Act give the power to the Minister to regulate engagement in factory business without causing disturbances, damages, and danger to the public or the environment. Under his power, he can prescribe :

- location, environment, and description of factories;
- the categories and types of machinery and equipment used in engagement of factory business;
- standards and procedures for control of waste, pollution, and any activity which may harm the environment caused by engagement in factory business; and
- any necessary documentation and data that have to be kept by factories to ensure compliance with the Act and its regulations.

To promote effective control of engagement in factory business, three groups of factory are defined in section 7 of this act. Group 1 factory is factory which person can engage in factory business as immediate as he want. Group 2 factory is factory which person has to inform to the Grantor in advance before starting engagement in factory business. Group 3 factory is factory which require license prior to engage in factory business.

In section 8 of this Act, the Minister is empowered to control engagement in factory business by issuing standards and methods of controlling the discharge of waste, pollutants or anything that affect the environment. Anyone who violate ministerial rules or announcement of the Minister issued pursuant to this section shall be fined not exceeding 200,000 Baht.

Section 37 of this act allows authority to order person to stop violating act or correct manner which cause harm, injuries or troubles to the person or property in the factory or its vicinity within specified time. If person engaging in factory business does intentionally not follow the order of authority under section 37 or engagement in factory may lead to serious harm, injuries or troubles to persons or property in the factory or environment, Permanent Secretary of the Ministry of Industry (MOI) or person assigned by Permanent Secretary will have power under section 39 of this Act to order person to stop engagement in all or part of factory business

and correct that problem within specified period. Any person who violate section 37 shall be fined not great than 100,000 Baht or imprisoned not exceeding one year or both and has to pay additional fine 5000 Baht per day during violating period.

In case of non compliance with section 39, person engaging in a factory business, architect, and engineer will be fined not exceeding 200,000 Baht or imprisoned not more than two years or both and additionally fined 5000 Baht per day until stop in engagement of factory business.

Under this Act, the Department of Industrial Work (DIW), the MOI is the primary environmental enforcement agency. If the DIW's performances are not efficient; however, PCD, the MOSTE is instead empowered to take action under NEQA B.E. 2535.

Responsibility area of DIW under this act are :

- industrial pollution and safety;
- setting and enforcement of industrial effluent and emissions standards;
- monitoring of procedures for wastewater and hazardous waste management;
- establishment of central waste waster and hazardous waste treatment facilities; and
- control of establishment and operation of factories through factory licensing in 3 years intervals.

According to the Ministerial Regulation No. 2 B.E. 2535 issued under the Factory Act B.E. 2535, published in the Royal Government Gazette Vol. 109 Part 108 dated October 16, B.E. 2535, licensee has to always keep the factory clean, provide waste container as need, and separate waste or unusable material which has any mixture of poison, or cotton wool, cloth or piece of cotton stained with flammable material in separate container with suitable lid. Licensee has to safely dispose that waste without causing any harm to human and environment.

Notification of the MOI No. 2 B.E. 2539, dated June 14, B.E. 2539, issued under Factory Act B.E. 2535, published in the Royal Government Gazette Vol. 113 Part 52 D, dated June 27, B.E. 2539 mentioned that wastewater cannot be allowed to drain from the factory unless it is treated and has characteristics below or equal effluent standards specified in this laws. And dilution method to make characteristics to wastewater to comply with this law shall not be allowed.

Notification of the MOI No. 6 B.E. 2540, dated October 29, B.E. 2540, published in the Royal Government Gazette Vol. 114 Part 104 D, dated November 13, B.E. 2540 (Special Edition) issued under Factory Act B.E. 2535 is the law regarding treatment or disposal of solid waste or unusable substances from factories. The contents in this law are:

- to list comprehensively solid wastes or unusable substances i.e. ignitable substances, corrosive substances, reactive substances, toxic substances, leachable substances, discarded materials, off-spec materials, container and spill residues, wastes and discarded materials from non-specific sources and specific sources, and chemical waste that have to be treated or disposed according to the methods specified in this law;
- to specify solid wastes or unusable substances mentioned above shall not be removed from factories unless permitted by the Director of the DIW; and
- to report types, quantities, characteristics, properties, and storage areas of solid waste or unusable substances designated under this law including storage method, detoxification, treatment, disposal, landfill, transfer, and transportation in the forms according to this law.

In item 1.8 of Annex 2 in this law specified that waste exchange for waste utilisation in production processes is one method to handle specified solid waste and unusable substances.

Notification of the MOI No. 1 B.E. 2541, dated May 26, B.E. 2541, published in the Royal Government Gazette Vol. 115 Part 44 D, dated June 5, B.E. 2541 (Special Edition) issued under Factory Act B.E. 2535 is issued follow the Notification of the MOI No. 6 B.E. 2540. It emphasise on solid waste and unusable substances from specific industrial processes which is not specified in Notification of MOI No. 6 B.E. 2540. This law is enforce for industries located in Bangkok, Samutprakarn, Nonburi, Phatumthani, Samutsakorn, Nakornprathom, Chonburi, Chachoengsao, Rayong, Prachinburi, Nakornratsima, Lampoon, Saraburi, and Phranakorn Sri Ayuthaya. The contents in this law are:

- specified types of industrial non-hazardous wastes without contaminated or mixed with solid waste and unusable substances under the Notification of the MOI No. 6 B.E. 2540 and wastes from specific industrial processes under this law have to be treated or disposed according to the methods specified in this law; and
- solid waste and unusable substances above shall not be exported from the factory except there is a permission from Director-General of DIW or person assigned by Director-General to dispose or destroy that waste according to criteria and methods prescribed in Annex 2 of this law.

Specified method to treat or dispose waste and unusable substances under this law are sanitary landfill with water leakage protection, leakage monitoring, gas ventilation, and wastewater treatment system, and incineration with emission standards according to Notification of MOSTE

dated June 17, B.E. 2540, published in the Royal Government Gazette Vol. 114 Part 63 D, dated August 7, B.E. 2540 . Recycle, reuse, recovery, and composting of wastes from specific industrial processes such as spent catalyst, sand from foundry casting, waste from cutting tanned leather have to be approved from DIW. If third party services are used, permission from DIW is required.

Hazardous Substance Act B.E. 2535

The content in Hazardous Substance Act B.E. 2535 is regarding comprehensive management and systematic classifications for hazardous substances and wastes. It also defines the control criteria for importation, production, transportation, consumption, disposal and export of hazardous substances.

This Act is under the direct authority of the Ministry of Industry with the co-operation of the Minister of Defence, the Minister of Agricultural and Co-operative, the minister of Interior, the Ministry of Public Health, and the Minister of Science Technology and Environment.

Types of hazardous substances mentioned in this Act can be grouped as follows:

1. Explosives
2. Flammable substances
3. Oxidising agent and peroxide
4. Toxic substances
5. Substances causing diseases
6. Radioactive substances
7. Substances causing mutation
8. Corrosive substances
9. Irritating substances
10. Other substances either chemicals or otherwise which may cause injury to the persons, animals, plants, property, or environment

Anyone who produce, process, or handle hazardous substances or hazardous wastes have to act according to safe labelling, storage and handling procedures specified in ministerial rules under this Act.

To control hazardous substances, it is categorised into four groups under section 18 of this Act as follows:

- type 1 hazardous substance is hazardous substance which the production, import, export or having in procession must follow the specified procedures and criteria;
- type 2 hazardous substance is hazardous substance which the production, import, export or having in procession have to be notified in advance to authority and has to comply with the specified procedures and criteria; and

- type 3 hazardous substance is hazardous substance which is required permit to produce, import, export or have in procession; and
- type 4 hazardous substance is hazardous substance which is prohibited to produce, import, export or have in procession.

Under section 20 of this Act, the Minister with opinion of the committee on hazardous substance is empowered to issue composition, qualifications and mixtures, containers, methods of examining and testing the containers, labels, productions, imports, exports, sales, transports, storage, disposals, destruction, treatments of hazardous substance containers, notification of facts, submission of specimens or any other matters concerning hazardous substances of the control, prevention, mitigation or stop of the dangers to persons, animals, plants, property or environments by taking into consideration of international covenants and conventions.

If any person who have activity relating to type 1 and type 2 hazardous substance fail to comply with section 20 of this Act, he shall be fined not exceeding 50,000 Baht or imprisoned not more than six months or both.

For person who engage business with type 3 hazardous substance violate section 20 of this Act, he will be imprisoned not exceeding one year or fined not greater than 100,000 Baht or both.

Other important aspects in this Act are:

- the Information Centre for Hazardous Substances in MOI shall be established as a co-ordinating centre for various governmental agencies including private sectors according to section 17;
- civil liabilities shall be prescribed for any person handling hazardous substances in case it causes injury to the persons, animals, plants, or environment.

Public Health Act B.E. 2535

Public Health Act B.E. 2535 is regarding control of the waste and garbage transportation/disposal and establishment of control criteria for nuisance. Local authorities, public health authorities, and a person appointed by local authorities are empowered under this Act to arrest or to suppress whoever failed to comply by this Act.

Section 18 in this Act specified that local authority is responsible for disposal of solid waste and night soil or assign any person to do it according to section 19.

In section 19 mention that If anyone would like to carry on a business of collection, transportation, or disposal of solid waste or night soil, he have to get the license from local authority.

Section 20 of this Act empowered local authority to issue laws or regulations on:

- prohibition to dump solid waste in any place which is not allowed;
- setting methods to collect, transport, and dispose solid waste and night soil;
- specifying collection and transportation fees of solid waste and night soil which not exceeding rate specified in ministerial regulation; and
- establishment of regulations on criteria, methods, and conditions for collection, transportation, and disposal of solid waste and night soil including maximum rate of services fee for licensee under section 19 to follow.

Under section 71 and 73 specified that person who violates section 19 or 20 shall be fined not greater than 10,000 Baht or imprisoned not more than six months or both.

Meaning of solid waste under this Act is piece of paper, cloth, food, commodities, plastic bags, food containers, ash, animal remains including other objects collected from roads, markets and other places. And the meaning of night soil is human excretions and other dirty and stinking objects.

Industrial Estate Authority of Thailand Act B.E. 2522

Industrial Estate Authority of Thailand Act B.E. 2522, dated March 19, B.E. 2522, published in the Royal Government Gazette Vol. 10 Part 41, dated March 24, B.E. 2522 described establishment of Industrial Estate Authority of Thailand and industrial estate, duties and responsibilities of Committee, Governor and authority, engagement in factory business, benefit, prohibition, controlling, and penalties of factories in industrial estate .

Section 51 of this Act mentioned that if imported materials to export industrial zone including products, by-product, or any substance from production process is exported from export industrial zone to be used in country, special fee according to laws of investment promotion, import tax, and business tax have to be paid.

Under section 54 of this Act, If Industrial Estate agree to destroy unusable material or refuse material of factories in export industrial zone, Industrial Estate has to notify person engaging in factory business who own that material or representative and Director-General of Customs Department or person assigned by Director-General of Customs Department in letter. If Director-General or person assigned by Director-General agree, he will order to destroy that substance according to criteria and method designed by Director-General.

Nobody can export any substance from export industrial zone except there is a permission letter from Governor of Industrial Estate or person assigned by Governor. This statement is mentioned in Section 55 of this Act.

Notification of the IEAT no. 60 B.E. 2538, dated July 21, B.E. 2538 mentioned about the criteria for calculating quantity of wastewater of

industries in industrial estate. It is equal to 80% of water quantities both tap water and deep well water of each month. All industries in industrial estate have to pay the wastewater fee even they do not discharge wastewater to the central treatment plant.

Notification of the IEAT no. 63 B.E. 2538, dated July 21, B.E. 2538 specified the empirical to be use for wastewater fee. This empirical is

$$T_c = 100 + 4.80V_i + 9.48V_iS_i/1000 + C_p^*$$

where

T_c = waste water fee, baht/month

V_i = quantity of wastewater, m³/month

S_i = BOD of wastewater, mg/l

C_p^* = wastewater fee in case of qualities wastewater to central treatment plant are higher than standards.

If parameter is higher than 1 time but not greater than 1.5 times, then

$$C_p^* = 3 * (C_g + C_f + C_v)$$

If parameter is higher than 1.5 times, then

$$C_p^* = 5 * (C_g + C_f + C_v)$$

Where

$$C_g = 100$$

$$C_f = 4.8V_i$$

$$C_v = 9.48V_iS_i/1000$$

From all shown information, it can be concluded that there are not any specific laws or regulations concerning waste exchange. Present laws and regulations are mostly stressed on pollution control rather than pollution prevention. They include the implementation of Pollution Pay Principle; however, and the remedy of incurred damage or danger to the persons, animals, plants, or environment.

The Eighth National Economic and Social Development Plan

This plan was commenced in October 1, B.E. 2540. Section 6 of this plan is the management of natural resources and environment. Chapter 2 of this section introduce the guidelines for environmental management as follow:

- reduce quantities and dispersion of pollutants in environment to level which not be harmful to human health and their living;
- reduce and control hazardous substance at source;
- reuse and recycle waste with suitable method;

- promote to build the central waste treatment and central waste disposal plant; and
- support and develop waste treatment technologies and green technologies of production processes to have less effect to the environment.

The Plans and Policies for Enhancement and Conservation of National Environmental Quality Act B.E. 2540-2559

This plan will be a guideline for management, enhancement, and conservation of natural resources and the environment in accordance with the Enhancement and Conservation of National Environmental Quality Act B.E. 2535. All concerned government agencies and state enterprises have to take actions within their functions and power to support effective implementation of this plan. This plan will be transferred into continuous 4 phases of “Environmental quality management plan” and each phase takes five years for implementation. Main policies of this plan are divided into 6 items as follows :

1. natural resources protection;
2. pollution prevention and eradication;
3. natural resources and cultural environment conservation;
4. community environment development;
5. environment education and promotion; and
6. environment technology.

Objectives of this plan are :

- to protect and rehabilitate environmental quality for enhancement of better health of human being and quality of life;
- to conserve natural resources to be resource base for sustainable development by rehabilitating degraded natural resources for future development, by preserving and sustainable using non-renewable resources; and
- to boost institutional capacities to administrate and manage environmental quality, in additional to decentralising power to provincial and local authorities.

Only topics in main policies which relevant to waste exchange are described briefly in this chapter.

Soil and land use in policy on natural resources protection

To protect soil resource from degradation and loss due to polluted activities such as inappropriate removal and disposal of dangerous wastes from industries, this policy encourage concerned government agencies and state enterprises to formulate specific laws for land use zoning and

controlling activities which may affect the soil resource and effective enforcement of laws and regulations.

Energy resource in policy on natural resources protection

To utilise energy sparingly and efficiently without destruction of the natural balance, promotion of solid waste recycling to be used as a source of reserve energy is encouraged.

Water pollution in policy on pollution prevention and eradication

Relevant policies in this topic are described as follows:

- reduce and control water pollution generated from industry;
- enforce water polluters to pay fee for water pollution management; and
- promote and support private sector to participate in investment and management to solve water pollution problems.

There are guidelines used to support the above mentioned policies to reduce water pollution problems. Those guidelines involve with

- decentralise power and responsibility to provincial and local personnel;
- strengthen mechanisms and the capacity of concerned institutions;
- accelerate a strict and continuous enforcement of measures for collection of fees for wastewater treatment;
- improve water quality effluent standards;
- amend related laws to support solving of water pollution problems;
- support research and education which promote efficient water quality management technologies and controlling discharge of waste water at source; and
- reduce more taxes on imported equipment to be used in wastewater treatment.

Pollution from solid waste and night soil in policy on pollution prevention and eradication

There are specified goals in this topic which may promote waste exchange methodology. They are listed below.

- To reduce or control solid waste production rate not greater than 1 kg/person/day.
- To promote waste utilisation in BMA and community area not less than 15% of waste production rate.
- Every province shall have the master plan and the management plan for sanitary solid waste and night soil treatment. Every municipality and public health shall have proper solid waste and night soil treatment systems.

Listed guidelines to promote these goals are:

- manage night soil and solid waste at the provincial level in accordance with environmental quality management plans;
- introduce polluter pay principle;
- introduce the system which requires producers to buy back used packaging from consumers;
- establish an information co-ordination centre for solid waste recycling;
- improve effluent and emission standards;
- introduce laws, regulations, orders, and standards to establish mechanisms for returning used products and packaging for reduction and recycling of solid waste;
- amend related laws to support solving of solid waste and night soil pollution problems;
- support research and education which promote efficient solid waste and night soil management technologies; and
- promote and provide incentive for private sectors or agencies who provide services on solid waste management, including recycling without generating environmental problems.

Pollution from hazardous material in policy on pollution prevention and eradication

Relevant policy in this topic is to introduce effective system for hazardous material management including import, production, trade, transportation, utilisation, storage, and waste destruction processes. Guideline to support this policy is to amend laws and regulations for systematic hazardous material management in all stages i.e. importing, production, selling, transportation, utilisation, storage, and waste destruction.

Pollution from hazardous waste in policy on pollution prevention and eradication

Relevant policy to tackle pollution problems from hazardous is to establish efficient hazardous waste management system from import to disposal stage. Guidelines to encourage this policy are explained in the followings.

- Introduce criteria and standards for collection, transportation, recycling, treatment, and disposal of hazardous wastes.
- Establish information network for sources of pollution and amount of hazardous waste generated by each type of various sources.
- Introduce polluter pay principle.
- Strict laws enforcement.
- Introduce laws, regulations and rules to facilitate hazardous waste management.

- Support research and education which promote efficient hazardous waste management technologies and promote uses of technology for recycling hazardous waste.
- Promote private sector to participate in hazardous waste management by establishment mechanisms of financial and monetary incentives.

Policy on environmental technology

Research and development of the sustainability of technology for environmental management and waste treatment in industry is promoted. Financial and incentive for development, services, and treatment of hazardous waste in accordance with standards is used to support this policy.

The Plans and Policies on Pollution Management

From the Plans and Policies for Enhancement and Conservation of National Environmental Quality Act B.E. 2540-2559, PCD has developed its plans and policies on Pollution Management base on the OEPP's Plans and Policies. Time frame of this plan is 10 years. Most topics in this plans and policies are relevant to the Plans and Policies prepared by OEPP but they are more specific. For example, controlled industries who produces hazardous wastes and effluent standards have to be designated and establishment and code of practice for solid waste treatment shall be defined.

Denmark

The reason why environmental legislation in Denmark is in this study is the successful of industrial symbiosis in Kalundborg which has a similar concept as waste exchange. Since Denmark is a member of the European Community (EC), environmental laws of EC has also an effect on activities in Denmark. But environmental laws of Denmark are stronger than that of EC. From this reason, this paper will consider only environmental laws in Denmark. Due to rarely information of Denmark's environmental legislation and regulation in English. Only Environmental Protection Act will be examined.

Denmark is divided into fourteen regional areas, and 275 municipalities. Local authorities who is locally elected act as final decision makers for law enforcement and implementation. Denmark has important environmental laws i.e. Environmental Protection Act. This act restructures former acts and combined them into one act. Those acts combined into Environmental Protection Act are as follows :

- ◆ The Act on Recycling and Limitation of Disposal;
- ◆ The Act on Limitation of Sulphur Dioxide and Nitrogen Oxide Deriving from Power Stations;

- ◆ The Act on the Contents of Lead in Gasoline;
- ◆ The Act on Limitation of Sulphur in Fuel; and
- ◆ The Act on Disposal of Oil and Chemical Waste.

The latest Environmental Protection Act is Environmental Protection Act no. 625 which promulgated on 15th of June 1997. This act emphasised on prevention of air, water, soil, sub-soil, noise and vibration from pollutant. It stated clearly in objectives of this act that cleaner technology and recycling would be promoted.

Key principal of this act is based on cleaner technology. Activities involving pollution are considered in term of total effect on the environment i.e. effect on the environment will be considered from production through consumption to disposal. The principle of cleaner technology can be more explained as follows :

- Pollution and limitation of pollution have to be considered in term of the cycle of substances, materials and products as a whole;
- In each step from obtaining of raw material to disposal of waste, industries have to undertake waste minimisation as early as possible; and
- Try to replace harmful substances first. If it is not possible, it should be optimise the process procedures to limit the use of harmful substances by using closed systems and reuse these substances to let it go to the nature as less as possible.

Term of the best available technologies (BAT) which means technology that is technically feasible and financially attainable for the enterprise in question is used in this act. BAT is used when environmental matter of any enterprise is considered by government agencies. For example, effluent standards from all enterprises is based on BAT principle.

This act does not allow any substances which may pollute water discharge to watercourses, lakes, or the sea. And they must not be stored near any water resources which they may create a risk of the being washed into the water. But there are some exception in these cases.

Industries who have oil or chemical wastes have to report to local authorities. These wastes have to sent to specific receiving station before sending to disposal site. If any industries have capabilities to dispose their wastes in an environmentally sound manner, they may receive a special permits to not follow the mentioned procedures.

Significant topics in this act which will promote waste exchange concept are :

- Subsection (1) of section 8 in Part II General Provisions mention about environmental label which will be issued for products or goods having recycled or recyclable materials or for environmental reasons be preferred to other materials, products or goods intended

for the same application. Environmental label or green label is very important factors for decision of consumer to buy or not buy products or goods in Denmark.

- Subsection (1) of section 9a in Part II General Provisions state that the Minister can enact the rule to force manufacturer or importer responsible for marketing of specified materials, products or goods to take back used materials, products or goods to be recycled or managed in specified manners.
- Subsection (1) of section 10 in Part II General Provisions let the Minister has authority to limit the use, discharge or disposal of specified products, substances or materials.
- Subsection (1) of section 35a in Part V Polluting Activities allow the Minister to lay down the rules to enforce industries to prepare green accounts which will reveal amount of generated wastes per annum. These accounts will be publicly available. However, industries can ask The Minister to not publicly reveal commercially sensitive information.
- Subsection (1) of Section 44 in Part VI Waste mention that The Minister can establish rules on waste disposal including notification, separation, storage, collection, transport, treatment and processing of waste. This rules may also be used for specified waste types, waste products, and waste materials.
- Subsection (4) and (5) of section 45 in Part VI Waste specify that local authority is responsible for setting up collection of the waste or recycle of waste materials. For oil and chemical waste, local authority can allow enterprises to use third parties' services for recycling these wastes.
- Subsection (1), (2), and (3) of section 51 in Part VII Recycling and Cleaner Technology mention that The Minister can introduce rules on types of material which should be recycled, percentage of recycled materials in specified products, recycled materials using in public authorities and publicly owned or controlled enterprises, and providing of information concerning recycling, cleaner technology, and pollution problems of specified products.
- Subsection (1) of section 54 in Part VII Recycling and Cleaner Technology specify that development projects, research, and awareness and information activities which promote recycling can be granted both for non-profit projects and enterprise's own projects.
- Subsection (1) of section 55 in Part VII Recycling and Cleaner Technology mention that support can be granted up to 25% for investment in recycling plants.

Danish government developed Action Plan on Waste and Recycling 1993-1997 which used to reduce the amount of waste and the environmental burden causing from its disposal. Significant issues in this plan are :

- preventive strategy such as cleaner technology and recycling is more preferable than pollution control strategy for example incineration or waste treatment;
- target on recycling waste is 50% of waste produced in Denmark; and
- landfill is the last method for considering in waste management.

Costs of disposal and treatment by other method such as incineration or wastewater treatment is higher than recycling or exchange waste. In 1997, cost for waste deposition is 285 DKK (1,425 Baht if 1 DKK = 5 Baht) per ton, for ordinary incineration is 210 DKK (1,050 Baht) per ton, for incineration in combination with electricity generation 160 DKK (800 Baht) per ton, and average cost for hazardous waste treatment 2500 DKK (12,500 Baht) per ton. There is financial fund under Financial Act for recycling and cleaner technology project. For the period 1993-1997 100 million DKK (500 million Baht) is available for waste and recycling projects and 380 million DKK (1,900 million Baht) is available for cleaner technology projects. From these reasons, many industries in Denmark try to reduce their wastes first. If there is still some wastes produced, next step of consideration is recycling or reuse. The last choice is treatment and disposal. All this reasons and supporting from environmental legislation make waste exchange be successful.

United State of America

Resource Conservation and Recovery Act (RCRA)

RCRA promulgated in 1976 and was amended in 1984. Proposes of these two laws are to prevent improper disposal of hazardous waste and create tools and methodologies to track management of it in every points between generation and disposal or it is called cradle to grave concept. Consequently, waste generator still has liability over his waste even he hires third party to handle it. Intention to promulgate RCRA is to enhance the recovery and conservation of valuable materials from hazardous waste which is opposite to waste disposal. RCRA concerns only present and future generated hazardous waste. If there is any problem due to mishandling hazardous waste in the past and from abandon site, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) will be applied. This law will be explained in the next section. This section will examine some parts of the law involving recycling of hazardous waste.

There are three important parts issued under RCRA i.e. subtitle C involving hazardous waste, subtitle D involving solid waste, and subtitle I involving underground tank. In this section subtitle I will not be covered.

To identify whether waste is hazardous waste under RCRA, it has to be solid waste. Definition of solid waste is not based on physical form of it. In section 1004(27) under RCRA defines solid waste as any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. Other meanings of solid waste are in section 261.2 under RCRA. It can be categorised into three parts.

1. *Abandoned materials* Waste materials which be disposed of, burned or incinerated including be stored prior to one of these activities are classified under this item (section 261.2(b)).
2. *Recycled materials* Waste materials which meet the below criterion are classified as solid waste (section 261.2(c)).
 - ◆ Waste or mixture of waste is placed directly on the land for example landfilling. It is called use constituting disposal. Commercial chemical products (CCPs) which is intended to place on land for normal use is excluded from solid waste definitions.
 - ◆ Waste is burned as fuel. CCPs inherently have characteristic as fuel e.g. off-specification fuel is not classified as solid waste when it is burned as fuel.
 - ◆ Waste is reclaimed to recover usable material. Certain manners which are categorised in this item are reclamation of sludge and by-products exhibiting a characteristic, and CCPs.
 - ◆ Material is recycled less than 75% of total accumulation amount in a calendar year which is called speculative accumulation. Exemption under this item is CCPs.
 - ◆ Waste is used to produce fuel or contained in fuel which directly used or reused.
 - ◆ Dioxin-containing wastes considered inherently waste-like (F020, F021, F022, F023, F026, and F028) which directly used or reused.
 - ◆ It is spent material which means that it cannot be used as original proposes without regeneration, reclamation, or reprocessing (Section 261.1 (C)(1)). For example, spent solvent, spent catalyst, and spent acid are classified as solid waste when they are recycled.
 - ◆ It is sludge in any physical form generated from water treatment plant, wastewater treatment plant, or air pollution

control system (Section 261.31 or 261.32). Sludge which exhibit characteristic under Part 261 Subpart C when it is reclaimed is excluded from solid waste definitions.

- ◆ By-product which is not primary product and cannot be separately produced by the production processes such as still bottom is designated as solid waste. But it is excepted from solid waste definition when it is reclaimed.
- ◆ CCPs, unused chemical intermediates, off-specification variants, and spill or container residues (Section 261.33) are categorised as solid waste. CCPs which exhibit hazardous characteristic and is not listed in Section 261.33 are also grouped in this category. If CCPs are reclaimed or speculative accumulated, they are not solid waste.
- ◆ It is scrap metal under Section 261.2 (c)(6).

If waste is directly used or reused as an ingredients to make product e.g. distillation bottoms from one process used as feed stock in another process, or as substitute for commercial products such as spent pickle liquor uses as a sludge conditioner in wastewater treatment, or returned to the original production process without reclamation, it will be not classified as solid waste (section 261.2(e)).

3. *Inherently waste-like materials* Material which may cause any harm to human or environment when it is recycled are classified under this item (section 261.2(d)). Examples of this waste materials are dioxin containing listed waste F020, F022, F023, F026, and F028. Unless waste material in F021 is used at the site of generation as an ingredient in a product, it is also classified under this item.

Section 261.4 (a) listed waste materials which is not defined as solid waste for example domestic sewage and special nuclear material under the Atomic Energy Act.

Waste that classified as solid waste will be hazardous waste if it meet the following conditions:

- It shows on analysis any of the characteristics of hazardous waste i.e. ignitability (D001), corrosivity (D002), reactivity (D003), or extraction procedure (EP) toxicity (D004-D017);
- It is named and listed as hazardous waste under this Act i.e. non-specific source wastes (F xxx), specific source wastes (K xxx), and commercial chemical products (P xxx and U xxx);
- It mixes with listed hazardous waste or characteristic waste and exhibit characteristic (mixture rule). There are some exemption from this rule. For solid waste which mixes with characteristic hazardous waste, if it is not exhibit hazardous characteristic, it will not be

hazardous waste. Certain listed hazardous wastes which is discharged to wastewater treatment facilities, mixtures of characteristic wastes, and specific mining wastes are excluded from this rule;

- It is a by-product from the treatment of any hazardous waste (derived-form rule). If waste is reclaimed for value material and is the residues from the treatment of specific wastes using very specific treatment processes, they are exempted from this rule; or
- It does not exempt from hazardous waste regulation.

Some solid wastes are not subjected to RCRA when they are recycled e.g. scrap metal, and industrial ethyl alcohol. Recycling of hazardous waste is a complex process. Level of regulation ranges from no regulation to full regulation depend on type of material and method of recycling. Figure 5-1 shows the analysis of hazardous waste recycling requirements. Details of each requirements will not be discussed in this chapter. Example of exemption from Subtitle C hazardous waste is when hazardous wastes are recycled in term of use constituting disposal and are mixed with commercial products for general public uses under section 266.20 (b) such as asphalt, cement, or Zinc-containing fertilisers.

Due to cradle to grave concept, any one who involves with hazardous waste has to comply with RCRA. Usually parties who involve hazardous waste are generator, transporter, and hazardous waste facilities.

Duties of generator when his waste is characterised under RCRA are :

- obtaining EPA identification number;
- labelling and marking wastes;
- keeping complete records;
- filing biennial reports to EPA;
- following good house keeping standards; and
- compliance with hazardous waste manifest system when hazardous waste is sent off-site for management.

Hazardous waste transporters have to obtain EPA identification number, follow hazardous waste manifest system, only sent hazardous waste to the facility which is chosen by generator, and immediately clean up discharges and spills.

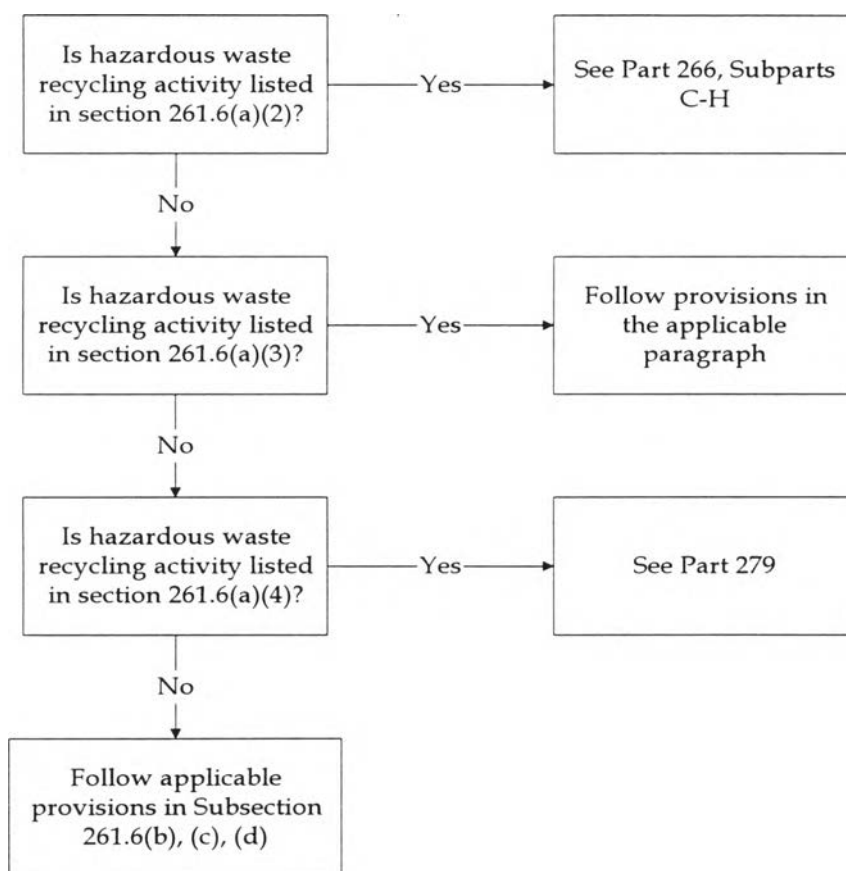


Figure 5-1 Analysis of Hazardous Waste Recycling Requirements

Source : USEPA (1996)

Responsibilities of hazardous waste facilitators who handle hazardous waste are:

- obtaining EPA identification number;
- keeping complete records;
- labelling and marking wastes;
- reporting activities;
- following good house keeping standards;
- preparing and following closure and post-closure plans;
- showing that funds is available to close facility if necessary;
- following technical standards for specific waste management practices;
- providing insurance following closure for care of land disposal facilities; and
- monitoring ground water in case of land disposal facilities.

Recycling facilities are exempt from above responsibilities.

If generators produce hazardous wastes less than 100 kg per month, store hazardous wastes on site less than 1000 kg at period of no longer than 90 days, produce acutely hazardous waste less than 1 kg per month, or store acutely hazardous waste less than 1 kg at period of no longer than 90 days, they will be a small-quantity generator (SQG) who is exempted from Subtitle C regulation system. This may not be compatible of waste exchange for SQG who has to store waste until meet some volume to reduce transportation cost.

If wastes are not classified as solid waste, generators have to prepare evidences to show as per request that their wastes are conditionally exempted from the regulations. RCRA is complex and expensive so that alternative management, recycling hazardous waste, is prefer choice and less cost than treating or disposal it. As a consequence of this, many waste generator try to recycle or reuse them which is easy and use less money in handling their wastes. Some of these waste generators do not exactly reuse or recycle their wastes which is called sham recycling. They just only want their waste not classified under RCRA. From this reason, amendment of RCRA to prevent sham recycling is through definition of solid waste that intricate, confusing, and inconsistent set of regulations.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

As explained earlier, CERCLA involves clean up the problems from mishandling hazardous waste. It was enacted in 1980 and amended by Superfund Amendments and Reauthorization Act in 1986. Under this Act Environmental Protection Agency (EPA) is empowered to set up liability system to charge clean up costs from polluters and response to spills or environmental accidents. This law is very strict. When any problem from hazardous waste is arisen, generator or polluter will may be incurred liability and has to immediately solve that problems. When no party can be identified to be liable, EPA will use trust fund provided under this Act to clean up the problem. Generators have to report what types of hazardous waste they have, how they are stored, treated and disposed to EPA. Community Right-to-Know is also one part of amended CERCLA. This causes hazardous waste owner to make emergency plan and inform types of used hazardous substance to public.

There are some barriers from these two laws and regulations in USA which make waste exchange concept is less preferable. List of them is shown below.

- Hazardous wastes under RCRA are defined as hazardous wastes under CERCLA. If there is any problems occurred from mishandling them, waste generators have a liability under two laws. And penalties and correction costs is high.

- Complex provisions of laws and regulations make many secondary materials which can be exchanged among industries are subjected to RCRA.
- Derived-from and mixture rules of RCRA cause wastes which contaminated by hazardous waste even small amount of it are classified under RCRA.
- Lack of confidence that transactions will be conducted in compliance with the requirement of RCRA cause many waste generators are not quite sure about recycling or exchanging waste whether under these laws or not. And they have to very concern about who receive waste and how that entity manage their wastes.

Pollution Prevention Act

Since existing laws are not support the pollution prevention concept and pollution prevention is more suitable and desirable than waste management and pollution control, this Act was promulgated in 1990 to encourage industries focus more on reduction at sources. Policies in this Act stated clearly that whenever possible pollution should be prevented or reduced at source first. The next step when pollution prevention is not feasible is recycle without cause any harmful to human and environment. The last choice to manage the waste is treatment follow by disposal. National strategy concerning source reduction is changed from a command and control regulatory approach to a voluntary cross media approach. Under this Act, advisory panel is established to help industries in technical matter regarding pollution prevention. Pollution Prevention clearinghouse is also set up to facilitate and co-ordinate pollution prevention activities between industries and government agencies. This Act enforces the industries to annually report toxic chemicals release which called toxic release inventory (TRI). Each toxic chemical, source reduction and recycling of it, percentage change from previous year, and adopted technologies for source reduction and recycling shall be also included in TRI report and sent it to EPA. Production ratio in the reporting year to the previous year and other necessary information which help EPA to identify the effectiveness and the progress of pollution prevention program have to be included in the report. EPA will provide grant to enhance pollution prevention program implemented by industries.

In 1991 US EPA established pollution prevention strategy to be used as a guide for incorporation pollution prevention activities in existing and new programs of US EPA. Examples of these programs are Waste Minimisation Branch, Pollution Prevention Information Clearinghouse, Office of Pollution Prevention, and American Institute for Pollution Prevention.

Clean Water Act

This Act regulates discharges to water surface in the USA. Lately amended of this Act was in 1987. Industries who would like to discharge waste water to surface water are required to have permit from EPA or state authority. Characteristics of this discharge has to meet the effluent standards set by EPA which based on best practicable and best available treatment technologies. This Act regulates wastewater discharge from both point sources such as industries and municipalities and non-point sources for example mining, farm lands, and forests. Discharge of storm water from industries and construction sites are prohibited without permit. Licensee to discharge storm water is required to develop a storm water pollution prevention plan.

Comparison of Environmental legislation

From all above information, it can be concluded that both Denmark and USA have laws and regulations which based on pollution prevention concept. But in USA, there are more complex laws and regulations for recycle, reuse or recover of wastes than that of Denmark. The reason is to prevent improper recycle, reuse or recover of wastes. Principle of environmental laws and regulations of these two countries is different from that of Thailand which is mostly based on waste treatment and disposal. Consequently, waste exchange which is concept of recycle waste is not supported from existing laws and regulations in Thailand. However, in Notification of MOI No. 6 B.E. 2540 allow waste generators to exchange their hazardous wastes for using by the others.

As mentioned above, most environmental laws and regulation in Thailand are concerning waste treatment and disposal. There is no specific laws and regulations regarding recycling or exchanging wastes. Enforcement of environmental laws in Thailand is ineffective in controlling industrial pollution. Two main reason of this are

- lack of co-ordinated management of environmental sectors; and
- lack of capacity and capabilities in monitoring and inspection of engagement in factories and enforcement of regulatory measures.

In case of factories in industrial estate, DIW have no authority in approval of industrial permit, monitoring and enforcing environmental standards even though there is some technical co-ordination between DIW and IEAT.

Fine and punishment for polluters in Thailand is lower than developed countries. Consequently, industries can afford fines and they do not fear to break the law. This make the law to be license to pollute. For instance, there is regulation to separate industrial waste from municipal waste specified under

Factory Act B.E. 2535. But there are some factories mix industrial wastes with municipal waste and send them to landfill facilities. This costs factories less than when they manage industrial waste separately from municipal waste.

As a consequence of being a developing country or newly industrialised country, the planning and permission for factory establishment in Thailand are not properly done.

All these problems lead to impossibility of some wastes being exchangeable.

Other barriers from laws and regulations in Thailand for waste exchange are :

- Management of hazardous waste by waste exchange under Notification of MOI No. 6 B.E. 2540 is mentioned in general. There is no specific types of waste which can be exchanged or specific criteria for exchanging waste. This may imply that when apply this method, permission from DIW is required. Getting approval from DIW sometimes takes long time. All these aspects may be the obstacles for waste generator and waste user. And the waste generators may have no interest to apply waste exchange.
- Recycle, reuse, or recovery of some non-hazardous waste under Notification of MOI No. 1 B.E. 2541 require permission from DIW. This cause the same effect as above.
- Factory located in EPZ has to get permission from Customs Department and IEAT if waste which can be exchanged or used by the other factories outside area of EPZ is transported to them. This may cause some difficulties or no consideration to waste generators to exchange their waste with the others outside EPZ. Consequently, utilisation of waste by the others will be limited.

To promote and support waste exchange concept, mentioned obstacles should be removed. MOI and IEAT may issue new regulations to specify amount and type of waste which can be used to produce some products as regulations of Denmark. They may promote industries which can use waste from the other industries to be located in the same area in order to reduce transportation costs. Waste exchange network should be set up to let waste generators and waste users know each other and make exchanging waste to be formal system. Legislation or necessary regulations should be established to support the operation of waste exchange network. In case of Bangpoo Industrial Estate, this system can be initiated by IEAT.

IEAT has a plan to establish subsidiary company which will be invested between IEAT and private companies. This organisation will in charge of utilities management for industrial estates under controlled by IEAT. One department or section of this organisation may be set up for sharing waste information among industries in industrial estates and potential waste users outside industrial estates. It may act as a middle man to

buy wastes from one company and sell it to another company or provide the transportation services between waste users and waste generators. Other services which can be done by this organisation in order to promote waste exchange are waste minimisation/pollution prevention training, waste information and waste management technology centre, and co-ordinator between waste users and waste generators and between waste generators and waste management technology's owner.