Chapter 2

Environmental Conservation

by Japanese Companies in Vietnam

: Case Studies of Corporate Practices and Policies

The Japanese companies in Vietnam studied in this project are implementing steady environmental conservation measures, with particular emphasis on wastewater treatment. Some of these companies have set their own effluent standards stricter than the Vietnamese legal standards and implementing excellent environmental conservation measures, beside statutory measures to meet various legal regulations. The industrial estates of Japanese capitals, where a large number of Japanese companies are established, also promote their own environmental conservation measures. These measures include their own effluent standards on the basis of Japanese experience on industrial pollution, or a termination clause in their tenant contracts enabling the industrial estates to retire the tenant that causes an environmental violation. Thus, the industrial estates of Japanese capitals indirectly contribute to upgrading environmental conservation measures of Vietnam.

Chapter 2 presents 16 practical cases of environmental conservation measures by Japanese companies, mostly in the manufacturing sector, on the bases of the interview and inspection surveys on about 20 Japanese companies in Vietnam. Section 1 of Chapter 2 first outlines environmental conservation measures by Japanese companies and second presents the 16 cases. Sections 2, 3, 4 and 5 present four cases of coping with strict effluent water standards, three cases for establishing the environmental management system, four cases of positively dealing with industrial wastes, and five cases of promoting innovating environmental conservation measures, respectively.

Section 1
Japanese Companies in Vietnam and Their Environmental Conservation

The study team conducted interview and inspection surveys on about 20 Japanese companies operating in Vietnam from November to December 2001 The study team visited the field establishments of these companies, where environmental conservation measures were implemented, and inspected their various measures and manufacturing processes. The Japanese enterprises have begun advancing to Vietnam at a significant pace since around 1994 Most Japanese companies the team visited this time have been operating in Vietnam not more than ten years, and are operating in industrial estates, with a few exceptions. These companies are all in the manufacturing sector except for industrial estate managing companies.

This chapter introduces in the next section and onward 16 practical cases of environmental conservation measures taken by Japanese companies. As are explained in these cases, these Japanese companies are implementing environmental conservation measures, comparable to or even more advanced than those taken in Japan, with wastewater treatment to meet effluent standards stricter than the Japanese standards, as the center of their measures. Many of them are keen in the establishment of environmental management systems One of Japanese companies was the first in Vietnam to acquire the certification of ISO14001, or the certification by the International Standards for Environmental Management System.

The environmental regulations are generally copies of the U.S. or European standards, and therefore they are generally very strict. By contrast, the environmental policy measures are not very coherent, as may be explained by the fact that Vietnam has yet to have a facility to treat or dispose of hazardous wastes. The Japanese companies, intending at least to implement environmental conservation measures necessary to satisfy legal requirements, found many difficult problems with promoting environmental conservation measures in Vietnam.

1. Firm Environmental Conservation Measures for Various Problems by Companies of Japanese Capitals

The survey team conducted interview and inspection surveys on about 20 manufacturing Japanese companies in the Northern Region around Hanoi, and the Southern Region around Ho Chi Minh City. Besides, the survey team conducted interview and inspection surveys on 4 industrial estate development and managing Japanese companies.

Every company we visited has executed firm environmental conservation measures, with wastewater treatment as one of the core pollution prevention measures. With only some 10 years since the government of Vietnam began taking measures against environmental issues, naturally the Japanese companies face a number of constraints in executing their routine environmental conservation measures. These constraints include insufficient environment-related infrastructure, unprepared environment-related legal systems, and people's unawareness of environmental issues. These issues stem mostly from Vietnam's national socioeconomic system and administrative system; therefore, it is difficult for a Japanese company alone to solve these issues. Besides, it would take long to solve them. Under such circumstances, the Japanese companies are operating under adverse situations as far as environmental conservation measures are concerned.

In Vietnam where economic development has the top priority, environmental conservation measures do not necessarily have a high priority. Naturally, Vietnam's administrative organizations in charge of environmental conservation are not as capable as their counterparts in Southeast Asian countries. Accordingly, effectiveness of the environmental regulations is not necessarily ensured. To make the situation even worse, state-owned companies, while accounting for about half the nation's mining and manufacturing production, execute almost no environmental conservation measures. Some Japanese companies that have advanced to Vietnam in the form of a joint venture with a state-owned company complain that the Vietnamese joint venture partner does not understand the importance of environmental conservation measures even when the Japanese side formulates excellent ones.

Under such circumstances, the Japanese companies that have advanced to Vietnam are obliged to abide by the environmental regulations, irrespective of whether these regulations are reasonable or not, and firmly implement environmental conservation measures, comparable to or even more advanced than, those done in Japan. Actually, some of the companies the survey team visited have already executed excellent environmental conservation measures. These measures include achieving their own effluent standards even stricter than the already strict effluent standards of Vietnam by innovating their environmental measures. For example, they have installed controlled landfill sites for hazardous industrial wastes in their own premises, or made necessary measures for lack of such public treatment and disposal facilities in Vietnam. The Japanese industrial estates all provide excellent facilities for environmental conservation, including wastewater treating facilities, for the tenants to use, thereby playing the role of forerunners in upgrading environmental conservation measures of Vietnam as a whole.

2. Environmental Conservation Measures of Japanese Companies Focusing on Wastewater Treatment

The 20 Japanese companies that accepted the survey team visits this time are mostly such manufacturing industries as machine assembly or part manufacturing; in other words, the type of industry that does not normally pose great environmental loads. Nevertheless, all these companies have executed firm environmental conservation measures based on the principle that the environmental conservation measures constitute a normal corporate activity. This is partly because many of their parent companies are all established firms that could promote similar environmental conservation measures to the extent possible whichever countries they advance, on the basis of their global environmental policies. This is also largely because their Japanese executives have experienced environmental conservation measures in manufacturing plants in Japan. In addition to that, quite a few companies recognized reduction of energy cost and production cost through implementation of environmental conservation measures. The Japanese companies advanced to Vietnam are internationally well known so their brand names are

recognized as product names in Vietnam. For such companies, any environmental damage caused by them could harm reputation of their brand images. This is one of the reasons why these Japanese companies are very keen to take environmental conservation measures.

The Japanese companies in Vietnam have rather concentrated on wastewater treatment. As explained in Section 4 of Chapter 1, the effluent standards of Vietnam are much stricter than the corresponding Japanese national standards. This is true with those for COD, an index or organic contamination, and heavy metals. These companies have installed high-performance wastewater treating facilities to comply with these effluent standards. These facilities require minute routine operation cares. These companies exercised utmost caution in the operation of these facilities and comply with the effluent standards. Some of them have set their own stricter standards to achieve, as well as easily achieving the standards of Vietnam, or made substantial investments in installation of wastewater treating facilities. Others expanded their wastewater treating facilities after they had commissioned their plants when the government of Vietnam established new effluent standards.

In case of a plant in an industrial estate with a central wastewater treatment facility, the central wastewater treatment facility on principle treats BOD, COD and suspended solids to the secondary treatment. Some of the Japanese companies treat these 3 pollutants to the secondary treatments at their own wastewater treating facilities before sending their effluent water to the central wastewater treating facilities of the industrial estates, in consideration of associated environmental risks. The survey team visited plants of the Japanese companies located not in industrial estates. Because these plants discharge treated wastewater directly to rivers, they exercise utmost caution to comply with the effluent standards. There are cases of plants where the plants every day measure such basic water quality indicators as BOD, and discharge to the river is stopped if any abnormality is found.

The Japanese companies we visited implement excellent wastewater treatments. The survey team noticed a number of such contradicting cases as Japanese companies were keenly engaged in the wastewater treatment while nearby state-owned companies discharged foul water without any treatment, or the quality of river water was inferior to that of the water discharged by Japanese companies.

The survey team visited during the field survey the National Environment Agency (NEA) and the Department of Science, Technology and Environment (DOSTE), the latter both in Hanoi and Ho Chi Minh City. The officers in charge of pollution control of these authorities highly evaluated wastewater control measures of the Japanese companies as being particularly good among companies of foreign capitals.

Regarding atmospheric pollution measures, very few Japanese companies we visited this time emit pollutants from their manufacturing processes. Some of them have their own in-house power generators or steam generating boilers to cope with unreliable public electric power infrastructure. These plants exercise their own air pollution prevention measures to these facilities. Regarding sulfur dioxide emission, as explained in Section 5 of Chapter 1, a low-quality fuel oil containing sulfur at 3% is the only commercially available fuel oil in Vietnam. There are cases where plants have to exercise difficult measures to deal with effluent gas. This is one of the problems peculiar to Vietnam, which is lagging behind other Southeast Asian countries in preparation of social infrastructure.

A number of Japanese companies are keen to establish their environmental management systems. One of Japanese companies was the first in Vietnam to acquire certification of ISO14001, the International Standards for Environmental Management System. At the time of the field survey, about 30 establishments in Vietnam had reportedly acquired the ISO14001 certification. Almost all of them were Japanese companies. Not merely just acquiring the certification, the process of acquiring the ISO14001 certification was used to enhance the environmental awareness of the Vietnamese senior members and operators. In such a case, the works for acquiring the certification were delegated to the Vietnamese staff and employees to the extent possible. The Vietnamese senior members participated in conferences of persons responsible for environmental conservation of group companies in Southeast Asian countries,

or even in environment-related conferences in the parent companies' head offices in Japan. Through such arrangements, efforts were made to get the Vietnamese staff and employees to understand environmental considerations of group companies in other countries, and level of the Vietnam's environmental conservation measures and their problems.

There are about 70 industrial estates and export processing zones in Vietnam. The Japanese industrial estates, though constituting only a small fraction of these establishments, exercise excellent environmental conservation measures, thereby contributing to upgrading environmental conservation measures of Vietnam. These Japanese industrial estates naturally have their own environmental facilities such as wastewater treating facilities. A certain industrial estate includes alkyl mercury and PCBs, the substances not included in the Vietnamese standards, in its effluent standards based on Japanese experience on industrial pollution. The industrial estate requires the tenants to abide by the estate's standards including these substances. The company managing this industrial estate considers that preventing the industrial estate from causing environmental problems eventually leads to the protection of the interest of the tenant companies. Inclusion of alkyl mercury and PCBs, the two substance groups that respectively caused the Minamata disease and Kanemi oil poisoning symptoms, in the company's effluent standards stems from this principle. Another Japanese industrial estate provides a termination clause in its tenant contract, in which the estate reserves the right to retire the tenant from the industrial estate in case the tenant causes an environmental violation. The industrial estate managing company first demands the tenant causing an environmental violation to rectify the situation. If the tenant fails to rectify the situation the tenant has to leave the industrial estate. Tenants can advance to this industrial estate on condition that the tenants will abide by this termination clause.

Japanese industrial estates tend to be mainly occupied by Japanese companies. However, there are some non-Japanese foreign companies operating in Japanese industrial estates. It is expected that Vietnamese companies will advance to the Japanese industrial estates. In view of such a trend, the forward-looking environmental considerations by these Japanese industrial estates will greatly contribute to environmental conservation measures of Vietnam, while these measures are indirectly effective on the environment in Vietnam.

3. Treatment and Disposal of Hazardous Industrial Waste, Unavoidable Challenge

As explained in Section 6 of Chapter 1 and in other parts, the issue of industrial wastes, hazardous industrial wastes in particular, will present a serious environmental challenge to Vietnam. The government of Vietnam promulgated the Regulation on Hazardous Waste Management (Decision No.155 /1999/QD-TTg) in 1999, marking the beginning of regulation on hazardous industrial wastes. However, no facility for treating and disposing of hazardous wastes in conformity with this regulation has been built in Vietnam. Although the government plans to build 3 facilities to treat hazardous wastes, one each for the Northern, Central and Southern Region, the government is unable to allocate fund for these facilities, and there will be some time before these facilities are completed. In Vietnam the custom of sorting wastes is not established or the concept of industrial wastes has yet to be well understood. Once consigned to collection service agents, wastes of any kind will be collected; however, these wastes are lumped together and used for land filling regardless of whether the wastes are hazardous ones or municipal wastes. The field survey identified certain Japanese companies worrying about treatment and disposal of hazardous industrial wastes generated at the manufacturing processes for fear of them causing environmental contamination. Since only few of the Japanese companies produce hazardous industrial wastes and, therefore, the issue of industrial wastes has not become a matter of urgency. The issue of hazardous industrial wastes is expected to present unavoidable challenges to Japanese companies operating in Vietnam, as Japanese companies increase in number and become versatile in industrial type.

Malaysia was in a similar situation some 10 to 20 years ago. Malaysia began regulating hazardous industrial wastes in 1989 without having a treating and disposal facility for hazardous wastes. Japanese companies then operating in Malaysia were obliged to store hazardous industrial wastes within their own plant premises in order to abide by the law for about 10 years until 1997, when such a facility began partially operational. Those days, these companies' plant premises were generally filled with drums

containing hazardous industrial wastes being stored.

The Japanese companies in Vietnam are not necessarily expected to experience a situation similar to that occurred in Malaysia. Nevertheless, some Japanese companies cope with hazardous industrial wastes in innovating manners. Certain Japanese companies with chemical treatments or painting processes have begun storing their hazardous industrial wastes in their own plant premises or rented plots of the industrial estates. Certain companies have installed controlled landfill facilities with lining to prevent seepage in their plant premises, to improve safety of storage of the wastes. Further, a company operating a plant with a process that may produce wastewater sludge containing heavy metals made a heavy investment in a treating facility, comparable to commercial intermediate treatment and disposal facilities of Japan, to treat the sludge. The sludge containing copper is enriched in copper content following a primary treatment and is exported to a Japanese copper refining company as a raw material for copper.

4. Required System for Sharing Environmental Information

The Japanese companies now operating in Vietnam, including those exercising innovating environmental measures, are acting on their own in their environmental conservation measures and collection of relevant information, partly because the number of Japanese companies is still small. As is explained previously, the environment-related infrastructure and related legal systems are still in the preparation stage in Vietnam; therefore, Japanese companies are often confronted with difficult problems in pursuit of their environmental conservation activities. Most of these problems are too complicated to be solved by a Japanese company alone, because these problems stem from the socioeconomic structure and the administrative system of Vietnam. Under such circumstances, the Japanese companies should develop an information network as soon as possible whereby these companies can cooperate with each other, collect environmental information more efficiently, share common information, and work together on the government for improvement of undue environmental regulations.

A certain Japanese company filed a request with the government for early installation of a treating facility of hazardous industrial wastes. Such an initiative would be more effective if several Japanese companies with significant presence in Vietnam would jointly do it. The Japanese companies can jointly make appropriate and practical recommendations suited to the conditions of Vietnam to the government when the government attempts to revise environment-related laws and regulations. Similar approaches have already been done in such fields as capital investment, labor problems, other than environmental conservation. An arrangement whereby Japanese companies can cooperate to deal with common problems would be necessary in the issues relating to environmental conservation.

In certain Southeast Asian countries where a large number of Japanese capitals have advanced and have been operating for many years, Japanese companies have established a committee to deal with environmental problems in such organizations as Japan Chamber of Commerce and Industry. Such a committee prepares guidebooks for environmental conservation measures, routinely collects information, thereby playing an important role in provision of environment-related information to Japanese companies. In such countries as Malaysia, activities of such an organization include filing a petition with the government for reduction of the fees for treatment and disposal of hazardous industrial wastes.

If such an organization is established either in the Japan Business Association in Vietnam, or the Japanese Business Association of Ho Chi Minh City, or in both, the organization could do many things. Such an organization could collect environment-related information to be shared by the Japanese companies, form a group of Japanese companies in each industrial estate for promoting exchange of information to facilitate acquisition of the ISO14001 certifications. A major Japanese manufacturer of water treating facilities has established a local company in Vietnam. This local company is providing its clients, or Japanese companies, with various pieces of environment-related information. This constitutes a favorable condition. Cooperation by such a company would be necessary.

As is mentioned previously, the Japanese companies have begun making contributions to human resource

development through such efforts as those to acquire the ISO14001 certification. Very few Vietnamese officials occupy the posts responsible for environmental conservation measures in Japanese companies, because of their short presence in Vietnam. In future, the local staff and employees will be responsible for environmental conservation measures in the Japanese companies as are the case with their counterparts in other Southeast Asian countries. It is therefore necessary to develop professionals in environmental measures on one hand; it is also necessary to enhance awareness for environmental conservation among general employees. This could lead to upgrading of environmental conservation measures in general of Vietnam, including resolution of the problem of residential wastes, if such endeavors are seen in a broader perspective. It will also become necessary in future to transfer the Japanese companies' innovating technologies for environmental measures and knowledge on past pollution controls to administrative organs for environment of Vietnam.

Regrettably, among the companies visited, there are cases where the process of determining and implementing environmental conservation measures from the time of advancing to Vietnam has not been clearly handed down to the present management, staff and employees, although the companies' presence in Vietnam is not very long. In the case of Japanese companies, the management staffs mostly change in a few year intervals. Nevertheless, it is desired that sure systems be established in every company whereby the past environmental conservation measures be transferred to the succeeding persons in charge of environmental conservation, in order to be able to implement excellent environmental conservation measures on a long-term basis.

Section 2
Cases of Meeting Strict Effluent Standards

Sections 2 through 5 summarize the findings in their environmental conservation measures by visiting surveys at the subject companies. The report contains numerical information on such items as amounts of pollutants discharged and their concentrations in the effluent streams to the extents the subject companies disclosed.

When the government of Vietnam determined effluent standards for wastewater, the government received assistance from American and European consultants. Consequently, many of the standards were copied from the strict European and American standards. Some of the standards are extremely stricter, compared with the corresponding Japanese national standards.

To comply with these strict standards, the Japanese companies adopted highly advanced technologies for wastewater treatment, exercised appropriate operation control, or became so innovating that they applied their own standards that were stricter than the official ones and have executed environmental conservation measures according to their own standards.

Case 1 Example of Applying Closed System to Plant Wastewater Treatment

1) Outline of the Company

Company A
Business line: Manufacture of motored bicycles
Number of employees: 916
Start of operation: 1996
Location of the plant: Vinh Phuc Province about 40km to the northwest of Hanoi
Japanese equity ratio: 70%

2) Background

Company A (the same as Company H) manufactures motor bicycles. All the operations from press working through painting, aluminum die casting of engines, assembling to inspection are done in this plant. A wastewater containing heavy metals and organic compounds is generated at the painting process. The environmental impact assessment developed at the time of construction planning of this plant adopted Standard A for wastewater. Company A was required to execute first-class environmental conservation measures, because its parent company was one of top manufacturers of motored bicycles in the world. The effluent standards imposed on Company A were very strict ones equivalent to those applied to effluent streams discharged to sources of drinking water. It was found very costly to treat the wastewater from the painting process to a quality level to the standards; therefore, the Company opted to use a closed system, which did not need to discharge the wastewater to outside the plant.

3) Measures Taken by the Company

a. Treatment of Painting Wastewater

The standards for all items of Standard A were applied to this plant. Of these items, the analytical values of 11 items closely associated with the manufacturing process must be reported once in every six months to the Department of Science, Technology and Environment (DOSTE) of Vinh Phuc Province where the plant is located. Figure 2-2-1 compares values of the standards applied to this plant with the corresponding values of Japan's national effluent standards. It may be noted that these standard values are much stricter than their Japanese counterparts. The measuring method of COD is different from that used in Japan as is mentioned previously (see Section 4 of Chapter 1). The effluent standard for COD, in particular, is very strict, corresponding to about 20mg/liter, if this standard is converted into that obtainable by the method used in Japan.

Figure 2-2-1 Effluent Standards for Company A

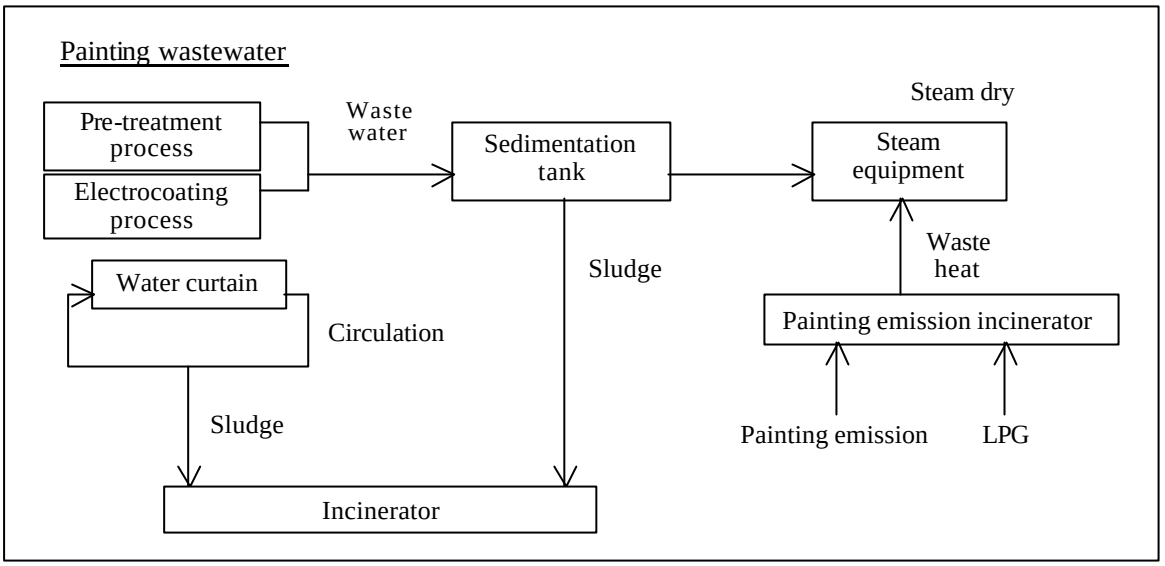
(Unit: mg/liter except for pH and coliform group number in MPN/100ml)

Item	pH	BOD	COD	SS	Oil	T-N	T-P	Pb	Zn	Ni	Coliform
Standard A	6-9	20	50	50	N.D.	30	4	0.1	1	0.2	5000
Japan	5.8-8.6	120	120	150	5	120	16	0.1	5	-	3000

It was necessary to use such expensive treating processes as activated carbon adsorption to treat the painting wastewater, amounting to about $10m^3$ a day, to this level of COD for sure. Therefore, the plant installed a wastewater treating system, of which the flow is shown in Figure 2-2-2. The wastewaters generated at the pretreatment of steel sheets and electrocoating are subjected to coagulation sedimentation to separate suspended materials. The separated water by the coagulation sedimentation is all vaporized to obtain dry solid residue. The waste heat from burning with LPG of the solvent-containing waste gas from the drying portion of painting process supplies the heat for vaporization. With this wastewater treating system, the plant does not have to discharge the painting wastewater, difficult to treat to the level satisfying the standard, and does not cause water pollution.

The sanitary wastewater and die-cast wastewater, both relatively easy to treat, are biologically treated and discharged to a river flowing nearby, after being stored in a balancing reservoir.

Figure 2-2-2 Flow of Painting Wastewater Treatment of Company A



b. Environmental Management Program

The plant executes an environmental management program that consists of the following two aspects. One is an environmental education and training program, in which all the departments prepare and execute their programs, and the other is establishment and observance of its own standards for noise, effluent gas and sanitary wastewater. The own standards for the plant specify standard values stricter than the government's standards as may be noted from Figure 2-2-3. By observing the plant's standards, the plant can automatically guarantee conformity to the government's standards. The persons in charge of environment of the Facility Group measure these items; noise once in four months, waste gas once in six months, and wastewater once in every month. If any abnormality is found in the measured data, such is informed to the field operating section in charge, which immediately takes corrective actions. The results of these activities are reported to the management, and reflected in the yearly plan. The person in charge of environmental conservation is a female engineer, a major of environmental science of Hanoi University of Technology. She is also a member of the ISO14001 Committee. This assignment may be interpreted as an indication of the positive attitude of Company A toward human resource development in the field of environmental conservation. It is one of proud management policies of Company A to take environmental conservation measures earlier than they are actually necessary. This could prevent potentially large future expenses and the Company can be proud of its attitudes toward the environment, a feeling of proud difficult to experience elsewhere which further generates other desirable effects.

Figure 2-2-3 Emission Standards Set for Company A's

Noise Standards			
Category	Unit	Vietnam's standards	Company's own standards
Day（6:00 - 18:00）	dB-A	75	70
Night（18:00 - 22:00）		70	65
Midnight（22:00 - 6:00）		50	50
Emission Standards			
Items	Unit	Vietnam's standards	Company's own standards
dusts	mg/m^3	400	200
CO		500	250
SO_X		500	250
NO_X		1000	500
Effluent Standards			
Items	Unit	Vietnam's standards	Company's own standards
pH	-	6 - 9	6.5 - 9
BOD	mg/liter	20	20
COD		50	50
SS		50	45
Coliform	MPN/100ml	5000	5000

Case 2 Example of Treating Difficult-to-treat Concentrated Wastewater in the Plant Premises

1) Outline of the Company

Company B
Business line: Manufacture of printed circuits for personal computers
Number of employees: 2,245
Start of operation: 1996
Location of the plant: An industrial estate in Dong Nai Province 20 km to the east of Ho Chi Minh City
Japanese equity ratio: 100%

2) Background

The process of manufacturing printed circuits produces various wastewaters containing at high concentrations such pollutants as copper, organic substances, oxidizing agents. These wastewaters are so difficult and expensive to treat by each plant that in Japan treatment of these wastewaters is normally consigned to intermediate treating companies of industrial wastes. The intermediate treating company collects similar wastewaters from a number of companies and treats them on a large scale. In the absence of such a specialized treating company equipped with necessary technologies in Vietnam, Company B could not consign treatment of the wastewaters to local collecting and treating agents, which the Company could not trust for not causing environmental problems from the hazardous wastes. Company B opted to install a treating facility similar to those owned by Japanese waste intermediate treating companies.

3) Measures Taken by the Company

a. Origin and Treatment of Wastewater

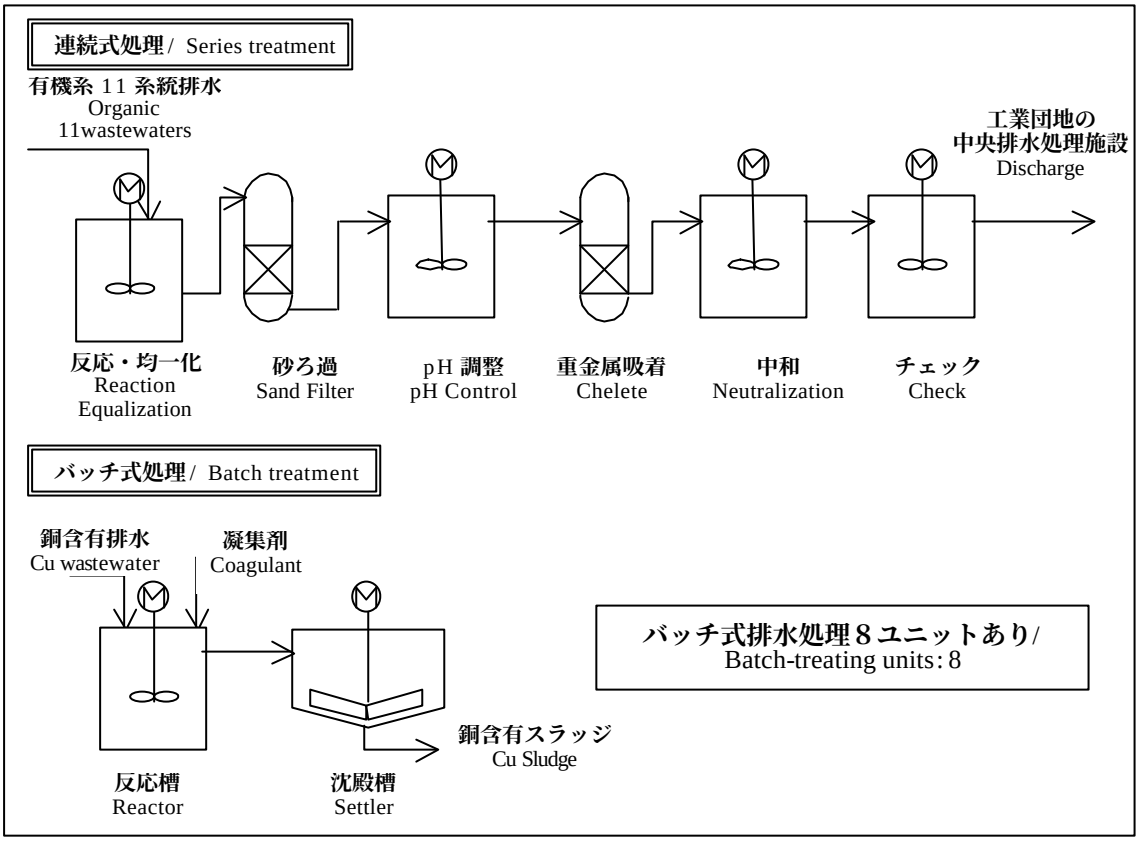
The plant generates more than 10 types of wastewaters. These include a wastewater containing easily degradable organic compounds, one containing copper, one containing very slowly degradable organic compounds, one containing oxidizing agents which make other wastewaters difficult to treat if mixed, and one containing hydrofluoric acid. The combined volume of these wastewaters is 5,000m^3/day. Figure 2-2-4 outlines treatment of these wastewaters.

The basic principle of wastewater treatment is that the similar wastewaters are mixed and treated, but wastewaters of different qualities are treated separately in a manner suited to each of them. This plant lumps 11 relatively easy-to-treat wastewaters containing organic substances into one stream and continuously treats it. Specifically, cyanides and others are first decomposed and the wastewaters are equalized, and subsequently subjected to sand filtering and heavy metal adsorption. The wastewater is sent to the central wastewater treatment facility after neutralization. This treating facility does not has the process to decompose organic substances; however, organic substances contained in the wastewater in this line are easily degradable and hence are satisfactorily treated by the biological treatment of the central wastewater treatment facility of the industrial estate.

Other 8 types of wastewaters containing difficult-to-decompose pollutants are separately treated in 8 separately installed batch-treating units. Copper contained in the copper-containing wastewater is precipitated and recovered, and sold to a Japanese non-ferrous metal refining company as a raw material for copper. This sediment contains copper at nearly 50%; therefore, this sediment can be exported to Japan as a resource. Japanese plants of this business line conduct this copper recovery operation only.

The plant operates a unit for decomposing slowly degradable organic compounds by oxidizing agents, a unit to reduce oxidizing agents by reducing agents, a unit to sediment and separate fluorine in the form of a fluorine compound, and other units to separately treat other pollutants, all in batch treatments. Having so many treating units requires a large capital investment. The operation cost is also very high, because the chemicals used for wastewater treatment are all imported. The company took such measures on the principle that the company would take positive environmental measures. The wastewaters after such batch treatments are discharged directly to a river flowing nearby.

Figure 2-2-4 Wastewater Treatment System



b. Waste Treatment

In Vietnam there is no facility to treat and dispose of the sludge generated from wastewater treatment. The wastewater sludge contains hazardous heavy metals. It was the Company's judgment not to consign the wastewater sludge to collecting agents who would receive the sludge at some charge, then just damp it. Therefore, Company B has asked the company managing the industrial estate to store the wastewater sludge in its warehouses. The stock has already reached 1,000 tons. It is not possible to have the wastewater sludge stored indefinitely; therefore, the company filed a petition with the Ministry of Science, Technology and Environment (MOSTE) for appropriate measures. MOSTE has not taken any effective measure so far.

Company B sells such recyclable materials as plastic boards, cardboards, waste paper, scrap iron, solder debris to undertakers. The Company consigns its garbage to a waste treating company at some cost.

c. Gas Emission

The plant has an in-house diesel-driven power generation facility to fill the plant's need for electric power. The plant has difficulty meeting the government's standard for NO_X, 1,000mg/m^3 maximum. When the plant was planned in 1993, there was no standard for NO_X. In 1995, the Industrial Emission Standards-Inorganic Substances and Dusts (TCVN 5939-1995) were enforced. The plant could have installed a low-NO_X diesel-powered power generation facility, if the plant had known such a regulation beforehand. The plant cannot change the power generation facility while the plant is in operation now, and has difficulty with the air pollution prevention measure.

d. Others

Company B has promoted planting mangrove trees as social activity. The Company has so far planted 0.5 million trees.

Case 3 Example of Plant Conformed to Strict Wastewater Effluent Standards Promulgated after Plant Startup

1) Outline of the Company

Company C
Business line: Manufacture of sewing machine needles
Number of employees: 350
Start of operation: 1995
Location of the plant: An industrial estate to the south of Ho Chi Minh City
Japanese equity ratio: 100%

2) Background

The metal plating, an essential ingredient of sewing machine needle manufacturing, produces a wastewater containing heavy metals and an alkali wastewater and others. When the plant was being planned before 1994, there were no effluent standards for wastewaters in Vietnam. Accordingly, the company was at a loss as to the type of wastewater treatment facility to be installed. Company C therefore designed and installed a wastewater treatment facility that could conform to the Japanese national effluent standards. In 1995 when the plant had been already placed in operation, the government enforced the Industrial Wastewater-Discharge Standards (TCVN 5945-1995). These standards included items that were not specified in the Japanese standards. Further, much stricter values were specified for the items that were also specified in the Japanese standards. Under such circumstances, the Company was obliged to strengthen the wastewater treatment facility to conform to these strict values of the government's standards, just a short time after the plant was commissioned.

3) Measures Taken by the Company

a. Wastewater Treatment

The plating process generates about 40m^3/day of wastewater. The industrial estate where the plant was situated is close to a river mouth. Legally, the plant is supposed to conform to the values specified in the government's Standard C. However, the plant is required to conform to the stricter B level standards by autonomous control of the industrial estate. The plant was not required to report results of effluent water quality analysis to the administrative office of the industrial estate. Nevertheless, the Company has its effluent water periodically analyzed by an analysis company for 6 items relevant to the plant's effluent water; namely, pH, SS, COD, NH_4-N (ammonia nitrogen), fluorine (F) and nickel (Ni). Figure 2-2-5 compares the Japanese national standards used as the design base in the planning stage with Standard B and Standard C of the government of Vietnam.

Figure 2-2-5 Wastewater Effluent Standards Set on Company C

(Unit: mg/liter except for pH)

Item	pH	SS	COD	NH_4-N	F	Ni
Standard C	5 - 9	200	400	10	5	2
Standard B	5.5 - 9	100	100	1	2	1
Japan	5.8 - 8.6	200	160	- (T-N 120)	15	-

Of these items of standards, fluorine (F) and nickel (Ni) contained in the wastewater produced at the plating process posed difficulties. The standard for fluorine of the Japan's national standards was 15mg/liter (amended to 8mg/liter in August 2001). In Vietnam, even the more lenient C level standards specify a strict value of 5mg/liter. Nickel, in addition to being not controlled in the Japanese national standards, it is no easy matter to conform to the standard of 2mg/liter. Company C therefore modified the already installed wastewater treatment facility to expand the treating capacity. Before, the concentrated wastewater from the plating process and the diluted wastewater from product washing were received in the same tank and continuously treated. This practice was terminated. After the modification, the concentrated wastewater was segregated, stored and treated separately. With this modification Company C now conforms to the specified values of the Standard B.

b. Wastes

The wastewater sludge is the largest and amounts to about 2 tons/month. The wastewater sludge is filled in drums and consigned to a dealer for disposal. Spent cutting oil and iron scraps are sold to dealers.

Case 4 Example of a Plant in an Industrial Estate Installing its Own Advanced Wastewater Treatment Facility

1) Outline of the Company

Company D
Business line: Manufacture of cell phone cases
Number of employees: 63
Start of operation: 2001
Location of the plant: An industrial estate in Hanoi (about 15 km to the north of the city center)
Japanese equity ratio: 100%

2) Background

Company D advanced to Vietnam after its major client had advanced to Vietnam. In order not to bother the client with environmental problems, the Company decided to take thoroughgoing measures for environmental conservation. During the planning stage, the Company learned that Standard B, stricter than the Japan's national standards, would be applied. Since the industrial estate had a central wastewater treatment facility, BOD and COD were supposed to be treated by this facility. The Company could have adopted more lenient standards for BOD and COD; nevertheless, the Company decided to install a facility that could satisfy all items of Standard B as a safeguard against any contingency. The Japanese parent company was fully experienced in the field of surface treatment that required highly advanced wastewater treatment, and also had an excellent record in wastewater treatment. The Company availed itself of the advanced technologies of the parent company in the installation of its wastewater treatment facility.

3) Measures Taken by the Company

a. Wastewater Treatment

Company D gives surface preparation and paints magnesium alloy cell phone cases manufactured by the client's plant. The painted cases are sent to Japan to be fitted with electric parts to become finished products. The surface preparation consists of degreasing, acid washing, and formation of a chemical conversion coating. Therefore, this process produces an alkali wastewater, acid wastewater, wastewater containing phosphorus and one containing hexavalent chromium (Cr^{6+}). The painting process produces a wastewater containing organic compounds.

At first, the administrative office of the industrial estate managing company demanded Company D to analyze and conform to all the 33 items of the B level standards. However, the Department of Science, Technology and Environment (DOSTE) of Hanoi, to which the analytical results are reported, said that Company D had only to control the wastewater on the 11 items shown on Figure 2-2-6. The items for which an industrial establishment should control its wastewater vary depending upon the type of industry.

Figure 2-2-6 Wastewater Effluent Standards Set on Company D

(Units: mg/liter except for pH and coliform group number in MPN/100ml)

Item	pH	COD	BOD	SS	Oil	Cr^{3+}	Cr^{6+}	T-P	F	T-N	Coliform
Standards	5.5 - 9.0	100	50	100	1.0	1.0	0.1	6	2.0	60	5000

The COD value of the standards, 100mg/liter, corresponds to 30 to 40mg/liter if the Japanese measurement method is used, as is mentioned previously (refer to Section 4 of Chapter 1), and is much stricter than the Japanese national standard, or 160mg/liter. Also, the value for hexavalent chromium, 0.1mg/liter, is by far the stricter, compared to the Japanese national standard value of 0.5mg/liter.

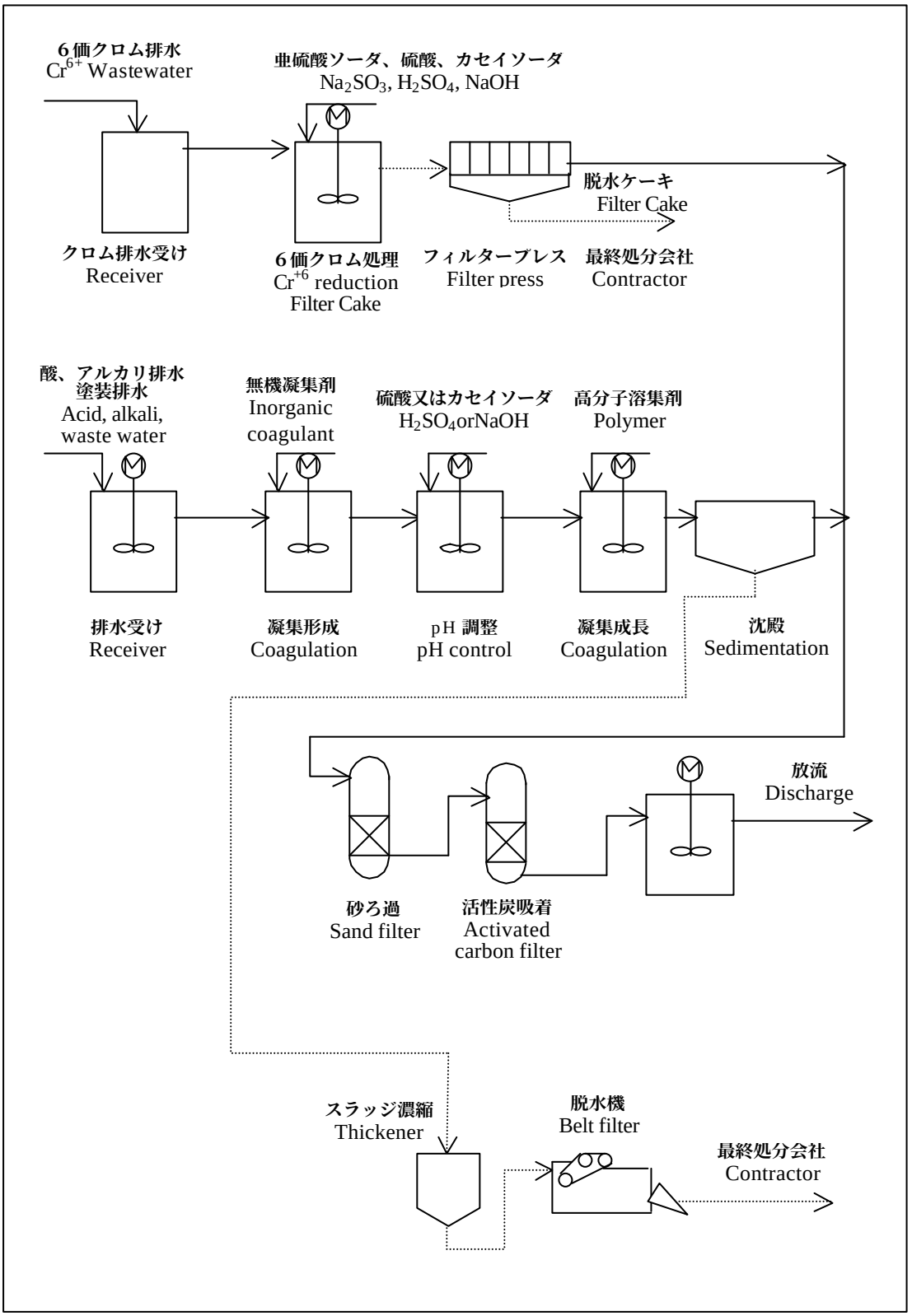
In order to conform to all these standards, the company installed a wastewater treatment facility as shown in Figure 2-2-7. The wastewater treatment facility reduces hexavalent chromium to trivalent chromium. The acid, alkali and painting wastewaters are subjected to neutralization followed by sedimentation by

coagulation. The two trains of wastewater streams thus treated are rid of fine suspended materials by sand filtration, followed by adsorption by activated carbon to remove COD that has passed the sedimentation by coagulation. The wastewater treatment facility conforms to the strict standard of COD through such a process. The capacity of the facility is 4.3tons/day but the actual throughput is smaller, because the plant has become operational just recently, and the plant uses only part of its capacity. The treated water is analyzed by a certified company every month, and the results of the analysis are reported to the administrative office of the industrial estate managing company. The results are also reported to the Department of Science, Technology and Environment (DOSTE) of Hanoi as requested. A Japanese group company designed this wastewater treatment facility and a Thai company of Japanese capitals for wastewater treatment facility constructed it. The wastewater treatment facility cost 7 to 8% of the total plant cost.

b. Waste Treatment

Cardboards, wood frames, empty paint cans are sold to agents who come to buy these things. The Hanoi Urban Environmental Company (URENCO) comes to collect the wastewater sludge and garbage twice a month, 2tons/each and at a cost of 3,200yen/ton. The collected wastes are simply land filled. URENCO declined to receive the paint debris that deposited in a pit of the painting line from the beginning. The Company found another waste treating company, which now receives the paint debris.

Figure 2-2-7 Wastewater treatment facility of Company D



Section 3
Cases of Establishing an Environmental Management System

The principle of giving priority to and the methods for environmental conservation developed in Japan should be transferred and established in the plants in Vietnam where awareness of the importance of environmental conservation is not high enough yet. It is simply impossible for a few Japanese management staffs to cover everything for environmental conservation matters. Therefore, much of the work on environmental conservation must be delegated to the Vietnamese executive members. To cope with the situation, a number of Japanese companies are keenly enhancing the awareness of Vietnamese executives of the importance of environmental conservation.

There are cases where Japanese companies try to enhance the awareness of Vietnamese executives through education and training courses held in Japan or nearby Asian countries in such movements as planning and promotion for acquisition of the ISO14001 certification, or intra-company enlightening activities

Case 5 Example of Acquisition of the ISO14001 Certification First in Vietnam

1) Outline of the Company

Company E
Business line: Manufacture of automobiles
Number of employees: 402
Start of operation: 1995
Location of the plant: Vinh Phuc Province 30 km to the northwest of Hanoi
Japanese equity ratio: 70%

2) Background

Company E's parent company is a world-famous automobile manufacturer. The government of Vietnam showed a keen interest when the Company planned to advance to Vietnam. The government strongly requested the parent company to advance to the Northern region, which was lagging behind the Southern region in industrial development. Company E was required to take environmental conservation measures equivalent to those taken by the parent company in Japan, based on the principle of the parent company for environmental conservation.

With such a background in mind, Company E considered it imperative from the beginning not to cause any environmental problem, and therefore the Company planned to acquire the ISO14001 certification, a step effective in promoting a comprehensive environmental conservation measure, from the very initial stage of the plant construction.

The manufacturing process consists of all steps from pretreatment and painting of outer plates to assembling except for press works. The plant produces such wastes as plant wastewater, wastewater sludge, and paint debris. The Company formulated its ISO14001 environmental plan with countermeasures for these wastes.

3) Measures Taken by the Company

a. Acquisition of the ISO14001 Certification

Since around 1997 when the operation became stabilized, the special team for the ISO14001 was established in the Maintenance Department to prepare for acquisition of the ISO14001 certification. In April 1999, Company E became the first company to acquire the ISO14001 certification in Vietnam. In 2001 the Company start working for renewal of the certification with environmental conservation measures and energy saving as main themes. In fiscal 2001 the Company started a project to collect spent engine oils through the car dealers and to recycle it to grease. The Company also promotes environmental education to the employees.

b. Wastewater Treatment

The wastewaters may be broadly broken down into an acid and alkali wastewaters from the pretreatment of steel sheets, a wastewater containing organic substances from the painting booth, and a general wastewater and a sanitary wastewater. These wastewaters are treated by a wastewater treatment facility, of which the flow is shown in Figure 2-3-1. The acid and alkali wastewaters are neutralized at sources and are received in a wastewater pit. The combined acid and alkali wastewaters are mixed with the painting wastewater in the painting wastewater pit. To the mixed wastewater stream is added an inorganic and polymer coagulant to sediment suspended matter, which is separated by precipitation in a form of floc in the primary sedimentation tank. The supernatant clean water is biologically treated in the aeration tank to decompose BOD and COD components. The general wastewater and the sanitary wastewater are directly fed to this aeration tank. The treated water is sent to the final settling tank to separate flocs of microorganisms by settling. The supernatant clean water is temporarily held in a storage tank and is discharged, after its pH value is confirmed, to a river flowing nearby through a sewer. The sludge from the primary sedimentation tank and final settling tank is condensed in the thickener, followed by dehydration by filter press. The dehydrated sludge is filled in drums and stored in the plant premises, because there is no designated disposal facility in Vietnam. The capacity of the wastewater

treatment facility is 600m^3/day, but the actual throughput is 150m^3/day.

The effluent water from this plant is required to satisfy all items of the Standard B, which are normally applied to water streams discharged to waters used for agriculture. The plant was required to report results of effluent water four times a year at first. In view of the good past performance, now the authority allows the plant to report only once a year, omitting values for the items which have been very low every time. It costs as much as 2,000 U.S. dollars to have a sample analyzed by an authorized analysis company for all 33 items of the Standard B. Reduction of the reporting frequency and items represent a significant saving of cost.

The staff of analysis companies comes to the plant to take samples and analyzes them. The samples are taken at the outlet of the wastewater treatment facility and at the point where the treated water leaves the plant premises. The results of analysis are reported to the Department of Science, Technology and Environment (DOSTE) of Vinh Phuc Province. For control of the wastewater treatment facility, the effluent water is analyzed every day for such basic items as BOD, COD, pH and SS at the plant laboratory. If any abnormality is found with the quality of treated water, discharge of the effluent water is suspended and necessary corrective actions are taken.

A Japanese water treating company constructed the wastewater treatment facility. The acids and alkalis are procurable in Vietnam, but the polymer coagulant is imported.

c. Wastes

The plant generates such wastes as wood frame, wastewater sludge, and paint debris. A dealer takes out the wood frames, the largest in volume of all wastes. The wastewater sludge and paint debris, which contains heavy metals, are filled in drums and voluntarily stored in the plant premises, in the absence of a disposal site authorized by the government. With the increase in the automobile production, the sludge stored in the plant premises increases at an increasing rate. The stored sludge amounted to 100 tons as of the autumn of 2001, after 5 years operation from 1997. Company E is negotiating with a cement company of Japanese capitals for incineration of the wastewater sludge. The Company has also asked DOSTE of the province for early establishment of an authorized disposal site.

d. Social Contribution

At the five-year anniversary of the plant in 2000, Company E started a biogas project with a fund donated by the Japanese parent company's foundation. The plant intends to convert agricultural wastes from nearby farm households into methane to contribute to energy supply. The Company has consigned a university with experiments and R&D.

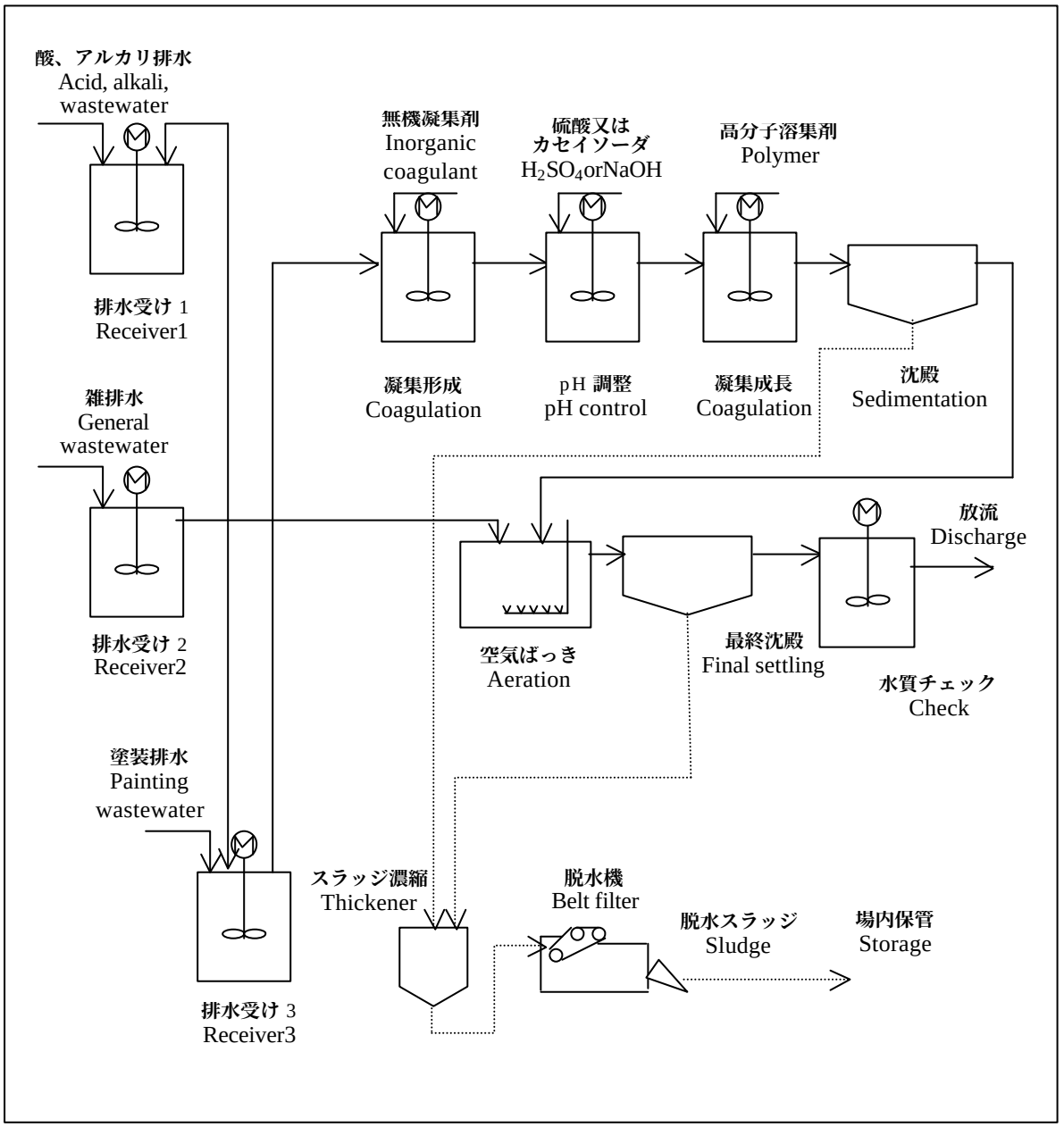
To develop experts of environmental conservation among the central and local government officers, Company E held seminars on environment under the auspices of the above-mentioned foundation. 50 persons participated in the first seminar held in 2001.

e. Others

The emission gas is controlled by the ground level concentrations of pollutants. The stack height is determined by the sulfur concentration of the fuel. The plant uses a diesel fuel containing sulfur at 1%, and the stack height is determined to be 20m. This method of regulation will be reportedly revised.

The plant consults with DOSTE of the province on anything unclear about laws and regulations on environment.

Figure 2-3-1 Flow of Company E's Wastewater treatment facility



Case 6 Example of Enhancing Awareness of the Executive of the Joint-venture Partner

1) Outline of the Company

Company F
Business line: Manufacture of switch board
Number of employees: 95
Start of operation: 1999
Location of the plant: In Hanoi (20 km to the southwest of the city center)
Japanese equity ratio: 51%

2) Background

The Japanese parent company of Company F is a world-famous electronic equipment manufacturer. The Japanese parent company demands thorough environmental conservation on its overseas affiliates. The Company plans to acquire the ISO14001 certification in 2003, two years afterward. However, the chairperson and the vice-chairperson of the 49% joint venture partner company are not much keen about environmental conservation. It was therefore found necessary to enhance awareness of and interest in the environmental conservation of the executive members of the partner company.

3) Measures Taken by the Company

a. Various Events on Environmental Conservation

Company F has their employees participate in activities for international cooperation in environmental conservation promoted by the Japanese parent company. The Company explains the purposes of such activities to the executives of the joint venture partner, and the employees who have participated in such activities explain the merits of these activities to the executives. In 2000, the Company sent its employees to a symposium held in Bangkok, Thailand, for group companies in Asia for environmental conservation measures, and let them present Company F's environmental report. In 2001, the Company had its two employees participate in a reforestation campaign for Vietnam, with two parent company members who came to participate in the campaign. Company F bore the expenses for participation in these two events. The Company endeavored to deepen their understanding in environment by explaining the merits of letting the employees participate in these activities to the joint venture executives and to the Administration and Personnel Departments. Since the executives of the joint venture partner have finally admitted the merits of such activities for enhancing environmental awareness, their understanding of the importance of environmental conservation may be regarded as deepened to some extent. The Company is now in the process of establishing an organization in charge of environmental conservation, while negotiating with the Administrative and Personnel Departments.

Some of the environment reports presented at the symposium held in Bangkok were excellent. The report from Company F was a simple one, because it was Company F's first report, and because Company F is engaged only in assembling and therefore does not discharge wastes. The report concerned introduction of the plant, the source of industrial water, the warehouse for storing industrial wastes, and energy saving which consisted in turning the switches off when the electricity was not used. The Company intends to prepare a more solid report for the next symposium, dealing with its activities in energy saving and resource recycling.

The Japanese parent company requires its overseas affiliates' plants to submit its environment report every month. The report should contain data on several tens of items including quality and quantity of wastewater discharged, kinds of wastes and amounts generated, social contribution, electric power consumption. These data are analyzed and summarized in the environment report of the parent company.

b. Others

The plant uses well water. The well water contains iron and manganese at high contents and therefore not suited as industrial water as directly pumped. The water is filtered to remove these elements.

The solid wastes include cartons used as container, plastic sheets for cushioning, removed adhesive tapes. These are sold to dealers except for the tape. The garbage from the canteen is collected by people nearby as animal feed. The wastewater from the dining room is discharged without treatment, and the sanitary wastewater from the toilet is discharged after being treated in a septic tank, to a river.

As a social contribution, Company F makes a donation to the youth RIM activity promoted by young communist party members. This is a volunteering activity in which young people in their late twenties distribute school supplies to schoolchildren in local villages.

Case 7 Example of Transferring Environmental Management to Vietnamese Executives through Acquisition of ISO14001 Certification

1) Outline of the Company

Company G
Business line: Manufacture and sale of color TV sets and audio products
Number of employee: 237
Start of operation: 1996
Location of the plant: In Ho Chi Minh City (10km to the east of the city center)
Japanese equity ratio: 60%

2) Background

The Japanese parent company of Company G deploys its group companies throughout the world. The parent company leads its affiliates in their environmental conservation works as one of head office functions. The parent company established a division exclusively in charge of environmental conservation in the Asia Oceania area general managing company; the Company holds once a year a conference of officers in all overseas affiliates in charge of environmental conservation; the Company collects information on environment throughout the world. These are some of the examples the initiatives taken by the parent company. The parent company requires all its group companies to acquire the ISO14001 certification as vindication of their sincere efforts for environmental conservation. Company G is behind most of the group companies in the Asia Oceania group companies. Accordingly, Company G had to prepare urgently for acquisition of the ISO14001 certification.

In addition, it was necessary to awaken the Vietnamese executives, with insufficient recognition of the environment, to the importance of environmental conservation. It was just impossible for only a few Japanese executives to manage everything; therefore, the works of environmental conservation must be delegated to the Vietnamese executives. The measures for environmental conservation being done by the Japanese side must be duly transferred to and established in the Vietnamese executives. Company G therefore has decided to educate the Vietnamese executives for environmental conservation through the activities for acquiring the ISO certification.

3) Measures Taken by the Company

a. Awakening of Vietnamese Executives to Environmental Conservation

Company G was instructed by the Japanese parent company to acquire the ISO certification by the end of 2000. In May 2000, the Company invited experts from the training center in Singapore for the group companies to explain the ISO14001 certification. The Vietnamese executives did not fully understand the ISO14001 certification at that occasion. Given that, the Company decided to start from the basic education and enlightening activities, and put off the target date for ISO14001 acquisition by one year to the end of 2001.

Last year, Company G let for the first time the Vietnamese executives participate in the Asia Oceania Environment Committee, in which group companies from nine Southeast Asian countries participate, and in a conference for persons responsible for environmental conservation held by the Environmental Management Committee by Country. The participants from the Southeast Asian countries presented their accomplishments in environmental conservation one after another. The Vietnamese executive, the participant from Vietnam, explained that the government of Vietnam did not understand the importance of environmental conservation well, and that the Company's measures were not enough either. The Vietnamese executive also participated in a seminar held in Japan and learned from local staff members of group companies throughout the world the environmental measures at their plants. These two conferences impressed the Vietnamese executive very much and convinced the executive that Company G was far behind other group companies in environmental measures. After returning to Vietnam, the executive explained the difference between Company G and the rest of the group companies, and positively promoted acquisition of the ISO14001 certification.

b. Project for Acquisition of ISO14001 Certification

The preparation for acquisition of the ISO14001 certification started in January 2001. The preparation started by appointing a person in the Technical Section to be in charge of ISO14001. The appointed person promoted understanding of the environment management system (EMS) to the concerned persons in the plant. In starting the project, the operation of the plant was suspended for one day and a Vietnamese executive explained to all employees the purpose, content, objective of EMS. Figure 2-3-2 shows the action plan for acquisition of the ISO14001 certification from April.

At first, the environmental policy, consisting of the following five items, was established.

(1) Observance of environment-related laws,
(2) Saving of energy, water and paper to protect nature and environment,
(3) Reduction of solid and liquid wastes and emission gas to reduce environmental loads,
(4) Promotion of education and dialogues with the employees and suppliers to enhance environmental awareness, and
(5) Periodical reviews and revisions of objectives and targets

Subsequently, the environmental aspects to be promoted in EMS were reviewed, and items and targets for these items were established. The plant is engaged mainly in assembling works; therefore, the plant does not produce industrial wastewater, hazardous wastes, or combustion waste gas that place heavy burdens on the environment. Therefore, the plant decided the environmental objectives mainly on energy saving and resource saving, to which were added reduction of fume of lead from the soldering process and noise level. The numerical targets for 2001 were as follows.

Resource saving and electric power saving:	Manufacture of TV sets at energy consumption of 3.4 kW/unit
Saving of office paper:	3% reduction from the level of 2000
Load on the atmospheric environment:	Reduction of lead in the effluent air to a maximum of $0.005mg/m^3$
Noise:	Punching room to a maximum of 85dB and the surroundings to a maximum of 60dB

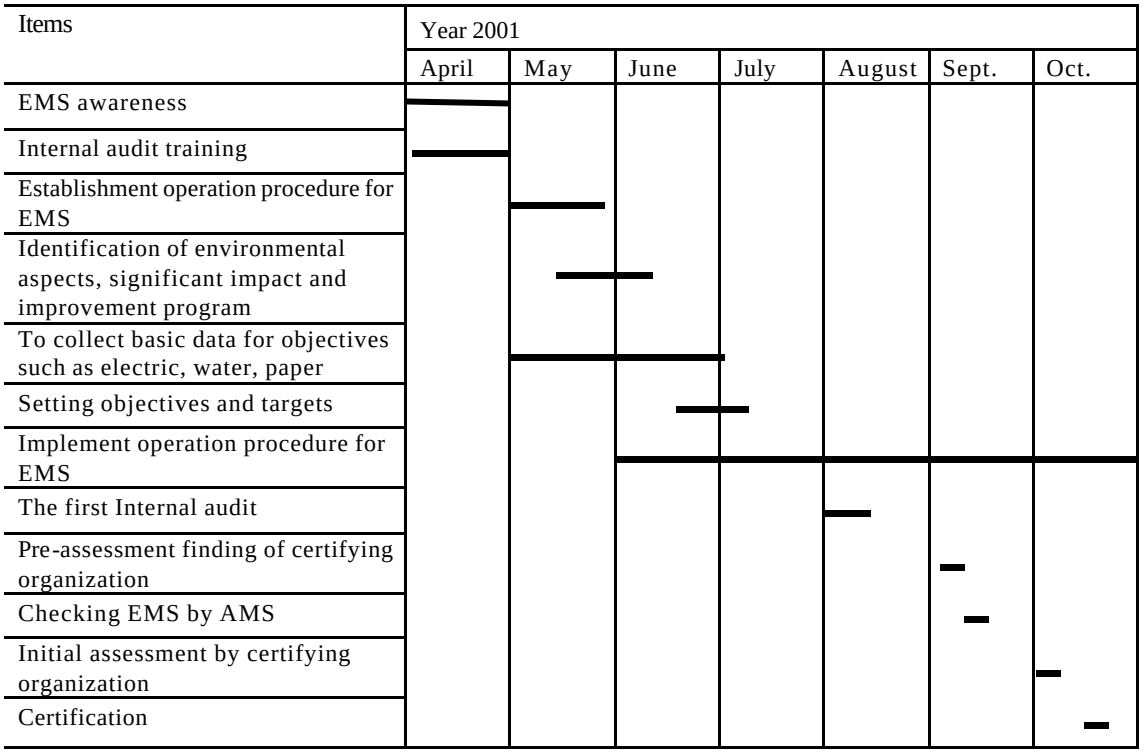
In order to realize these numerical targets, the person in charge collected data at each workplace and analyzed them, with the following results.

- Plastic bags that are discarded can be used as packing for cabinet. This enables the plant to stop buying packing, which results in a saving of 3,900 U.S. dollars a year.
- Reuse of electric wire saves 3,740 U.S. dollars a year.
- Recycling of punching materials for speakers saves 19,088 U.S. dollars a year.

Resource savings in other several items will increase the total saving to 35,000 U.S. dollars a year. The plant will keep on saving electric power as a priority theme. Regarding the lead fume, the plant will switch to lead-free solder in 2002, one year ahead of the parent company's schedule. After the switch, there will be no lead fume. The effect of resource saving is already partly evident. The plant summarized the process of achieving the saving and filed with a UK certification body a request for certification of the ISO14001. Company G acquired the certification on October 26, 2001, 9 months after the project started, through the pre-assessment and the primary assessment.

The Vietnamese executives have become aware of the importance of the environment, and operators now pay more attention to the environment than ever. This is a great achievement of these activities.

Figure 2-3-2 Action Plan for ISO14001



EMS: Environmental Management System
AMS: Asia Matsushita Management System

c. Waste

The plant produces such wastes as wood pallets containing parts, cartons, fuse debris, and defective products. These are all sold to dealers. The solder debris consists of lead oxides and solder. The plant separates the solder debris into solder and lead oxides by its own method, and consigns treatment of lead oxides only to a dealer. The plant will begin using lead-free solder in 2002; however, Company G is worried about the high cost of lead-free solder. After being sold in the Vietnamese market, use of lead-free solder does not make much sense if the products produced with lead-free solder are repaired with lead-containing solder. The Company is concerned about such possibility.

d. Others

Company G is planting trees in and around the plant premises.

Section 4
Cases of Taking Positive Measures against Industrial Wastes

The government of Vietnam has not yet established facilities to treat and dispose highly polluted wastewater or sludge containing heavy metals. Serious pollution problems have emerged in many other countries several years after disposal from wastes unduly disposed of. The Japanese companies, therefore, exercise utmost caution in the disposal of industrial wastes.
The Japanese companies convert wastes, which would normally be disposed of as waste, into usable products at some cost, or keep on storing all the wastes that may contain hazardous substances in their plant premises, or thoroughly utilize wastes. These measures by the Japanese companies are highly appraised in Vietnam.

Case 8 Example of Storing All Industrial Wastes in the Plant Premises

1) Outline of the company

Company H
Business line: Manufacture of motored bicycles
Number of employees: 916
Start of operation: 1996
Location of the plant: Vinh Phuc Province about 40 km to the northwest of Hanoi
Japanese equity ratio: 70%

2) Background

Company H (the same as Company A) manufactures motor bicycles. All the operations from press working through painting, aluminum die casting of engines, assembling to inspection are done in this plant. These processes produce such industrial wastes as wastewater sludge, paint debris, and incineration ash, those that contain heavy metals. In Vietnam there is neither laws regulating such wastes nor facility to treat or to dispose of those wastes. There are dealers who take out these wastes at some cost, but it is not clear how these dealers treat or dispose of these wastes. Company H has declared its fundamental environmental policy, of which the basic policy says the company does not use or discharge to the environment anything harmful. The Company is now doing its best to abide by the fundamental policy. On this principle, the Company would not allow pollution problems to be caused, even in the remote future, by anything that is discharged from the plant.

3) Measures Taken by the Company

a. Type of Wastes and Their Treatment

Figure 2-4-1 shows the types of wastes and treatments the plant gives to them. The wastes are broadly broken down into valuable wastes and non-valuable wastes, and these are further divided into general wastes and hazardous wastes. The general wastes of non-valuable wastes include garbage and documents that are combustible. The hazardous wastes include sludge generated with wastewater treatment, spent oil, used fluorescent lamps, spent thinners. All these except for thinner are incinerated in an incinerator installed in the plant premises to reduce the volume of the wastes. The sludge contains water so much that it does not burn by itself; therefore, LPG is burned to incinerate its organic components. The incineration ash, consisting mainly of SiO_2 and Al_2O_3, may contain heavy metals; therefore, it cannot be disposed of at any place except at designated areas where strict control is exercised on the wastes. During the survey period, the plant installed a storage facility shown in Figure 2-4-2, similar in structure to the controlled landfill facility of Japan, so that the plant would not have to worry in future about disposal of incineration ash in Vietnam where such a facility is not provided. The walls and floor of the container are of concrete structure. The container is 40m long and 15m wide, and is installed 5m deep from the ground surface. The roof is movable and designed to prevent rainwater from entering the container. The bottom is slanted and the capacity is about 1,500m^3, capable of storing 10 years of ash, produced about 0.4m^3 a day. Company H expects the government of Vietnam to install a duly controlled final disposal site before the container becomes full.

The valuable wastes are easily recyclable. The general wastes include scrap iron, materials used for packing, empty cans. The hazardous wastes include gasoline. Dealers not associated with the company come and buy these wastes.

Figure 2-4-1 Type and Treatment of Wastes of Company H

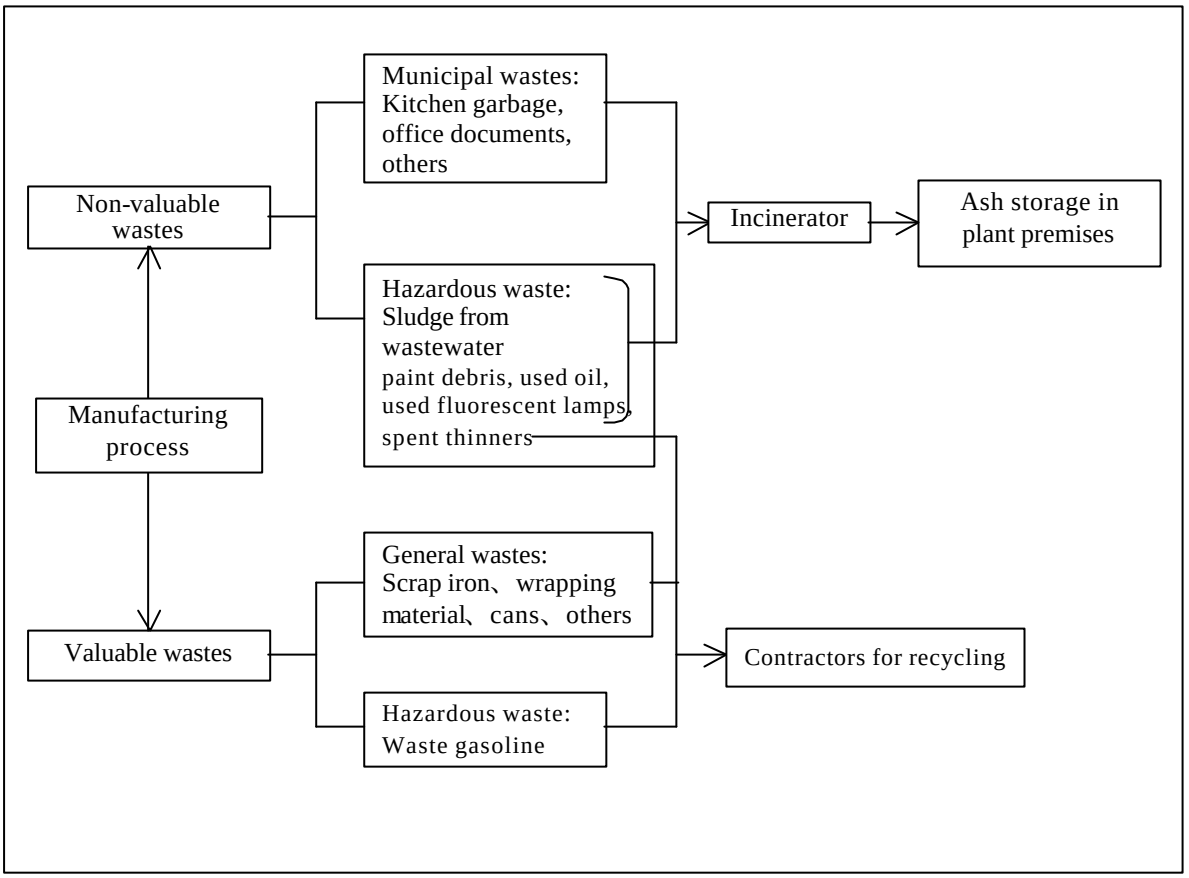
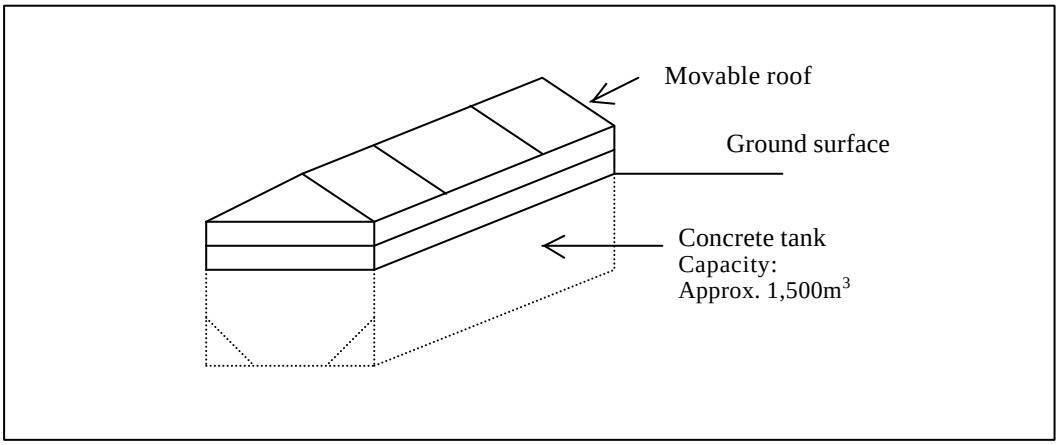


Figure 2-4-2 Structure of Incineration Ash Storage Container of Company H



Case 9 Example of Returning Byproducts to Farmland at Cost

1) Outline of the Company

Company I
Business line: Manufacture of chemical seasoning agent
Number of employees: 527
Start of operation: 1993
Location of the plant: An industrial estate in Dong Nai Province about 20km to the east of Ho Chi Minh City
Japanese equity ratio: 79%

2) Background

The parent company of Company I deploys its group companies in various countries of the world, and is world famous. The parent company has set its basic environment policy for itself and for its group companies. Clause 1 of the basic environment policy states that its overseas group companies should always watch environmental policies and regulations of their respective countries and should adequately respond to them, and to establish their own standards so that they may systematically promote their environmental policies.

The process of manufacturing the chemical seasoning agent produces a large amount of liquid byproduct containing organic substances. If discharged to rivers, the liquid byproduct causes water pollution. If the Company causes an environmental problem, it runs counter to the basic environment policy of the parent company. Besides, it seriously damages image of all group companies. The Company then decided to return the liquid byproduct to farmland to utilize its fertilizer effects. The existence of farm households in the surrounding, or a secure route for returning the liquid waste to farmland, is one of the reasons for locating the plant in this industrial estate.

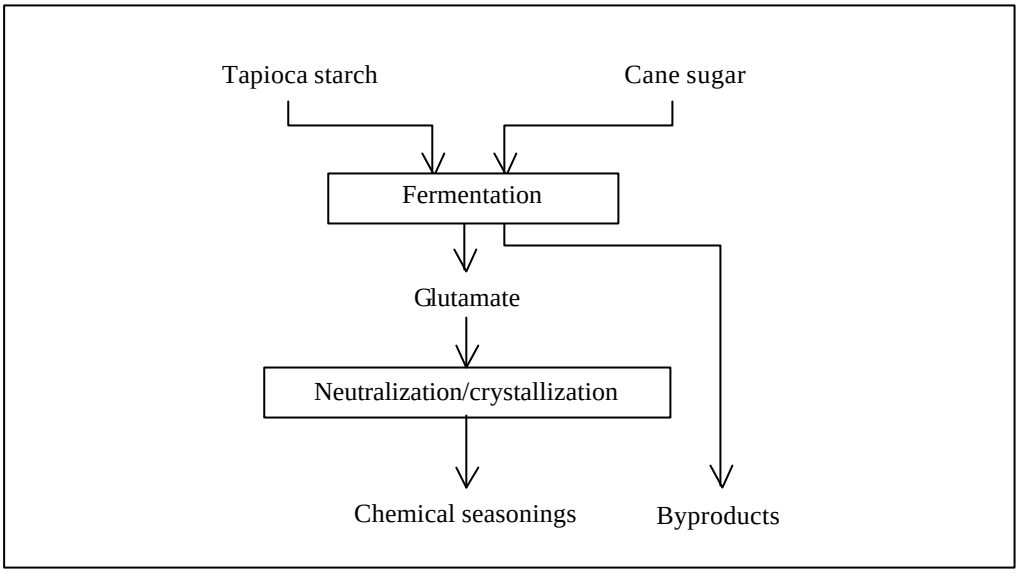
The industrial estate in which the plant is located is an old one and it does not have a central wastewater treatment facility. The wastewaters from plants in the industrial estate are discharged to a river flowing nearby. The wastewater effluent standards set for Company I are A level standards, the standards applicable to effluent waters discharged to sources of drinking water. Company I decided to conform to the standards by installing an advanced wastewater treatment facility rarely seen even in Japan.

3) Measures Taken by the Company

a. Generation and Utilization of the Byproduct

Figure 2-4-3 schematically outlines the process to generate the byproduct. The plant feeds tapioca starch and molasses, the latter being a residue left after sugar is produced from sugarcanes. These raw materials are fermented and the glutamic acid generated is extracted as product. The extraction residue is the byproduct. The production of the byproduct, of which water content is more than 90%, is 80,000 tons a year. The byproduct contains organic substances at high concentrations; therefore, it causes water pollution if discharged to a river untreated, a waste difficult to deal with. The byproduct contains nitrogen, an effective ingredient as fertilizer, at 5% and some minerals that are added during the process of fermentation. However, the contents of effective ingredients are lower compared with those of chemical fertilizers, and its very high water content makes commercial transportation prohibitive. Accordingly, this byproduct is not salable as fertilizer as it is.

Figure 2-4-3 Process to Generate the Byproduct of Company I



The company took the following measures.

- The byproduct is acidic as generated. Company I adds alkalis to neutralize it so that it may not do any harm after administered to farmland.
- Company I asked an agricultural research institute to study its effect as fertilizer and to confirm that it does not exhaust soil fertility. After having confirmed these, the Company registered it as a fertilizer.
- Company I developed a staff of experts exclusively for this byproduct and has stationed one person in each province. The expert visits farm households by motored bicycle to explain its fertilizer effects and right methods for use. The byproduct is effective particularly to sugarcanes and rubber trees.
- Company I delivers the liquid byproduct by tank truck and sprinkles it on the farmland.

Company I sells the liquid byproduct as fertilizer to farm households in the above manner. However, the sales revenue is far below the cost for the above measures. The major cost items are neutralization cost and transportation cost. The Company loses about 80 million yen a year. Nevertheless, the Company returns this byproduct to the farmland, because this is the only way to use the byproduct without causing environmental contamination.

b. Wastewater Treatment

The plant produces a combined volume of 600m^3/day of wastewater from the raw material treatment, fermentation, neutralization and decolorizing processes. The strictest standards of the government of Vietnam, Standard A, are applied to this wastewater. These standards are normally applied to waters discharged to sources of drinking water. Basically, Company I should conform to all items of A level standards; however, the Company is required to report on the items given in Figure 2-4-4. Figure 2-4-4 also gives specified values for these items.

The standards are stricter than the Japanese national standards for almost all items. Of these, the standard for ammonia nitrogen (NH_3-N), 0.1mg/liter, which the quality of the plant's wastewater concerns, is very strict in view of the fact that the river water to which the treated wastewater is discharged, contains ammonia nitrogen close to 1mg/liter. The effluent standards of autonomous bodies of Japan, stricter than the national standards, are not as strict as this with respect to ammonia nitrogen.

Figure 2-4-4 Wastewater Effluent Standards for Company I

(Unit: mg/liter except for temperature, pH and coliform group number in MPN/100ml)

Item	Temp.	pH	BOD	COD	SS	As	Hg	Pb
Standards	40℃	6-9	20	50	50	0.05	0.005	0.1
Item	Cu	Fe	CN	Oil	T-N	NH_3-N	Res.-Cl	Coliform
Standards	0.2	1	0.05	N.D.	30	0.1	1	5000

The plant installed a wastewater treatment facility equipped with the nitrification and denitrification process to conform to this standard to the extent possible. The nitrification and denitrification process converts ammonia dissolved in the process wastewater into nitrate nitrogen by the action of aerobic bacteria, followed by reduction of the nitrate nitrogen by the action of anaerobic bacteria into nitrogen gas to be released to the atmosphere. The process requires minute operation control technologies. Even with nitrification and denitrification it was found difficult to reduce the ammonia nitrogen content to 0.1mg/liter; therefore, Company I obtained a tentative relax of this standard to 4mg/liter from the Department of Science, Technology and Environment (DOSTE) of Dong Nai Province. Presently, the concentration of ammonia nitrogen in the treated wastewater is 1mg/liter, conforming to the tentative standard by a good margin.

The wastewater is analyzed twice a year on the samples taken at 4 locations; namely, the discharge point to the river, outlet of biological treating facility, well water near the wastewater treatment facility, and the river water. The officers of DOSTE come to take samples. The plant measures pH, COD, and SS at its laboratory for its own control purpose once a week. The laboratory produces wastewater containing chromium and other hazardous substances, which is very little but not to be discharged. This laboratory wastewater is stored in plastic bottles. The plant will treat the laboratory wastewater according to the government policy on treatment and disposal of hazardous wastes, and the company is now waiting for the government to decide on this issue.

c. Waste

The plant produces such wastes as gypsum generated from neutralization of the raw material, activated carbon used for decolorizing the product, wastewater sludge. Gypsum is produced at a rate of 300tons/year, all of which is used as soil conditioner by farm households free of charge. Activated carbon, produced also at a rate of 300tons/year, is used as fuel for brick burning. Both gypsum and activated carbon are supplied to the users free of charge but the transportation fees are borne by the users. The wastewater sludge contains nitrogen; therefore, it is blended into the byproduct fertilizer product.

d. Exhaust Gas

The plant operates a fuel-oil-burning boiler. In Vietnam, a fuel oil containing sulfur at 3% is the only fuel oil commercially available. It is difficult to conform to the sulfur oxides emission standard of 1,000mg/m^3 with this fuel. Through negotiations with the Department of Science, Technology and Environment (DOSTE) of Dong Nai Province, non-compliance to the standard is tolerated on condition that the plant will take such measures as procurement of a fuel oil of lower sulfur content by 2005. The DOSTE of Dong Nai Province deals with difficult problems rather practically.

e. Others

The plant acquired the ISO14001 certification in January 2001. The plant was able to obtain the certification relatively easily, because the plant selected the routinely conducted environmental measures as the theme for ISO14001 application.

Company I assigns a person to routinely monitoring information on the Internet regarding the 18 items of the laws that may affect the operation of Company I so that the company may take prompt measures.

Case 10 Example of Selling all Wastes as Resources

1) Outline of the Company

Company J
Business line: Manufacture of automotive wiring units
Number of employees: 900
Start of operation: 1997
Location of the plant: An industrial estate to the east of Hanoi
Japanese equity ratio: 70%

2) Background

Company J produces automotive wiring units, of which more than 80% is exported to Japan. The manufacturing process is labor intensive. Accordingly, the company was established in Vietnam where labor cost was low; however, the Company is forced to reduce the cost in the face of harsh competition. Under such a condition, the Company sells as resource copper wire scraps and coating materials produced at the manufacturing process. The industrial estate is in which Company J is located is of Vietnamese capitals.

3) Measures Taken by the Company

a. Waste

The copper wire scraps, cardboards and waste paper, wood chips produced at the manufacturing process are all sold to a dealer. The dealer is not the Hanoi Urban Environmental Company (URENCO) but a private company. The dealer buys copper wire at 10,000 Vietnamese Dong/kg (about 90 yen/kg), cardboards and waste paper at 1,000 Vietnamese Dong/kg (about 9 yen/kg) and wood chips at a much lower price.

b. Wastewater Treatment

The plant produces sanitary wastewater only. The night soil and wastewater from the canteen are discharged respectively through a simple septic tank and directly to a river. There are no standards for these kinds of wastewaters. Since the industrial estate does not have a central wastewater treatment facility, the wastewaters from plants are discharged directly to the river.

c. Expropriation of Land by the Industrial Estate

The plant obtained a piece of land in the expanded portion of the industrial estate to expand the plant. The industrial estate reportedly had a hard time obtaining neighboring farmland and the expropriation took very long. In Vietnam, all the land belongs in principle to the state and the people have the rights to use the land for a period of 30 years. Actually, however, one's rights to use land is virtually his/her ownership of the land, his/her rights can be sold or inherited. Business enterprises can depreciate the cost of obtaining the rights to use land. The industrial estate obtained the land from farm households on condition that the farmers could become employees of the tenant companies.

d. Others

In Vietnam solid wastes are collected without being sorted previously. Such recyclable wastes as glass bottles, cans, and waste paper are manually sorted after collection. At the present low cost of manpower in Vietnam, recycling of waste can be promoted by manual sorting.

Case 11 Example of Converting All Wastes into Resources

1) Outline of the Company

Company K
Business line: Manufacture of sanitary ware
Number of employees: 250
Start of operation: 1998
Location of the plant: 10km to the east of Hanoi city center
Japanese equity ratio: 70%

2) Background

Company K makes molds with gypsum, pours porcelain clay into the molds to form ceramic ware of right shape, dries them, applies glaze on them, fires them in a kiln to make the sanitary ware, and inspects the products. Company K has all processes for manufacturing sanitary ware. These processes produce such wastes as obsolete gypsum molds, defective porcelain ware, and packing materials. The plant produces 36,000units/month, representing a largest share in Vietnam, or 40%. The amount of wastes is correspondingly large. Sanitary ware is meant to improve environment; therefore, the Company was in a position to avoid causing environmental problems with its wastes. The Company therefore sought to recycle wastes into resources by all means. The Company sells everything that is salable to reduce cost.

3) Measures Taken by the Company

a. Recycling of Wastes into Resources

The gypsum mold normally breaks after it has been used 120 times. The plant crushes broken molds into pieces, and broken fragments are sold as cement raw material. The crushed mold fragments are further ground and mixed with other raw materials to be burned in the cement kiln. Defective sanitary ware products are crushed into small pieces and sold as aggregates for cement concrete.

The wastewater produced in the manufacturing processes contains particles of porcelain clay. The wastewater is rid of clay particles by sedimentation by coagulation. The supernatant clean water is used for cleaning the plant. Basically, wastewater dose not mean to be discharged outside the plant premises. In case the amount of wastewater is large, however, the wastewater can temporarily overflow the sedimentation tank and flows outside the plant premises. The sludge from sedimentation is sun dried in a concrete pit. The dried sludge is sold to a ceramic industry nearby as a raw material clay for insulators. Since the sludge contains a flux, sludge helps melt the raw materials at lower temperatures and is convenient to use, according to the ceramic industry.

The plant uses glazes imported only from Japan, which do not contain hazardous substances. The glaze left in vessels is collected and used again. None of the glazes becomes a waste.

b. Others

The plant uses 6,500m^3/month of groundwater, which is hard water and is used after demineralization.

The plant burns 125,000liters/month of kerosene and 7,000kg/month of LPG. Their sulfur contents are very low and their effluent gases do not cause environmental problems.

The wood used for wood frames is sold. Such packing materials as plastic tapes are burned in the incinerator in the plant premises.

The plant manufactures water-saving type sanitary ware, which consumes only 4.5 to 6 liters of water per flushing, compared with 8 to 9 liters per flushing of the traditional type. In Vietnam, people are becoming to buy water-saving type sanitary ware.

Section 5
Cases of Innovative Environmental Conservation Measures

Other than those previously mentioned, there are a number of Japanese companies taking various innovating measures, on the principle that Japanese companies should never cause environmental problems to foreign countries where they have advanced, and should show good examples of environmental conservation. Some industrial estates of Japanese capitals have a termination clause in their tenant contracts enabling the industrial estate to terminate the tenant contract with a tenant if the tenant violates environmental standards. A certain industrial estate includes alkyl mercury and PCBs, substances strictly controlled in Japan but not included in the Vietnamese standards, in its autonomous wastewater effluent standards. Another Japanese company has installed its wastewater treating facility underground, considering aesthetic appeal of the plant in addition to meeting the effluent standards.

Case 12 Example of Including Termination Clause in its Tenant Contract of Industrial Estate for a Non-conforming to Environmental Conservation

1) Outline of the company

Company L
Business line: Industrial estate management
Number of employees: 30
Start of operation: 1998
Location of the industrial estate: Dong Nai Province 30km to the east of Ho Chi Minh City
Japanese equity ratio: 60%

2) Background

Japanese parent company of Company L is an internationally known commercial company. However, the parent company had had no experience in direct management of industrial estates before this industrial estate. Some of its European clients, manufactures of sporting goods, demand its suppliers to take serious measures for environmental conservation. The Company considers it necessary to take effective environmental measures, fully involving its affiliates, in order to protect and enhance the public image to the company's brand, and that this is a firm trend in the world. If a tenant causes an environmental problem, other tenants also suffer. Besides, it would have adverse effects on the sale of estate's plots. Therefore, the industrial estate managing company makes it clear in the termination clause in the tenant contract that the Company reserves the right to retire the tenant if it repeats violating the environmental rules.

3) Measures Taken by the Company

a. Environmental Items to Observe

The tenant contract is composed of three parts. One part is similar to the land leasing contract, on which the tenant applies to the government for permission of plant operation. On obtaining the permission, the industrial estate managing company and the tenant proceed with the formal contract. The environmental items to observe are contained in the internal rule on which both parties must agree as a supplemental agreement. The termination clause states that the tenant must rectify the situation within a given period if the tenant fails to observe the environmental items, and that if the tenant cannot rectify the situation, the tenant contract is terminated and the tenant must leave the industrial estate. Actually, the supply of electricity and water is suspended to shutdown the tenant's operation to execute the termination clause.

Company L consigned a British law firm to prepare the contract, which was instrumental in securing observance of the environmental items. When the Company receives an inquiry, the Company explains this termination clause and endeavor to persuade the potential client to accept the termination clause. Japanese companies usually accept this termination clause.

b. Others

Tenants were required to prepare detailed environmental impact statements around 1997 when they planned to build plants. Recently, the process has been simplified. All they have to do are to state kinds and amounts of pollutants they will produce, the methods of treatment for the pollutants, and to submit registration forms stating that they will abide by the law. Company L assists the tenants to obtain permissions using the standard forms for registration.

The A level effluent standards are applied to the effluent water discharged from the estate's central wastewater treatment facility to the river. Company L also applies the A level standards to the effluent streams from tenants except for BOD and COD, to which more lenient standards are applied. The central wastewater treatment facility treats BOD and COD only by a biological treatment, leaving treatment of such other hazardous substances as heavy metals, cyanides to the tenants, before sending wastewaters to central wastewater treatment facility. Officers of the Department of Science, Technology and Environment (DOSTE) of Dong Nai Province come to take samples of effluent water once a year.

The Company receives instructions from DOSTE for improvements.

Regarding solid wastes, Company L refers a public treating company to the tenants, but let the tenants seal contracts with the treating company. Some private dealers come to buy valuable wastes.

The Ministry of Construction instructs Company L to secure green area at 20% in the common area and tenants' premises.

Case 13 Example of Setting Additional Standards of Alkyl Mercury and PCBs for the Tenants in an Industrial Estate

1) Outline of the Company

Company M
Business line: Industrial estate management
Number of employees: 30
Start of operation: 1997
Location of the industrial estate: In Hai Phong City, 85km to the east of Hanoi
Japanese equity ratio: 70%

2) Background

Japanese parent company of Company M is a famous developer, with plenty of experience in overseas industrial estate development. It is the parent company's motto to give sufficient environmental consideration in the management of industrial estates; therefore, Company M instructs the tenants to abide by the regulations on environmental conservation. Company M asks the tenants to understand that it is important for the industrial estate not to cause environmental problems in order to protect the tenants. One of the parent company's basic policies is that the company does not relax environmental standards overseas compared with those of Japan.

Alkyl mercury and PCBs in the effluent water standards are known to be chemical substances that have caused the Minamata disease and Kanemi oil symptoms, respectively. These substances are therefore strictly controlled in Japan; however, the Vietnamese official standards do not regulate them.

3 Measures Taken by the Company

a. Effluent Water Standards Applied to the Tenant

This industrial estate has a biological treating facility. The effluent water from the industrial estate meets all the requirements of the B level standards that the government imposes on this industrial estate, and is discharged to a river. Since the biological treating facility can cope with a limited number of items, the tenants have to treat their wastewaters for heavy metals and other hazardous substances, which the central wastewater treatment facility cannot eliminate, before sending their wastewaters to the central wastewater treatment facility. Figure 2-5-1 shows values for the standards applied to the tenants.

Figure 2-5-1 Wastewater Standards Applied to the Tenants

(Unit: mg/liter except for pH and temperature)

Item	pH	Temp.	BOD	COD	SS	heavy metals, other hazardous substances	Alkyl mercury	PCB
Standards	5-9	45℃	500	500	600	Limitation values of Standard B regulated by Vietnamese Gov.	N.D.	0.003
(ref.) Standard B (Vietnam)	5.5-9	40℃	50	100	100	see figure 1-4-1	—	

The standards for BOD, COD and SS (suspended solids) are much more lenient than the government standards, because these pollutants can be treated by the central wastewater treatment facility of the industrial estate. The tenants are required to treat heavy metals and other hazardous substances to the values meeting the B level standards before sending their wastewaters to the central treating facility. The standard for alkyl mercury specifies "not detected" as is the case with the standard of the government of Japan. The standard for PCBs specifies 0.003mg/liter, the value equivalent to the standard of the government of Japan. Presently, no tenant directly handles alkyl mercury; however, inorganic mercury is present in the surroundings as in fluorescent lamps. It is established that inorganic mercury is converted into alkyl mercury by the action of microorganisms; in other words, alkyl mercury can occur at

unexpected places. This industrial estate gives consideration to such contingencies.

Company M collects reports on analytical results of wastewaters from the tenants at intervals ranging from once in six months to once in three months depending upon the type of industry. All the tenants should report analyses on 5 items; namely, temperature, pH, COD, BOD, and SS. Tenants are required to report on other additional items depending upon the type of industry. The effluent water from the central wastewater treatment facility satisfies all the items of Standard B of the government of Vietnam. The results of analysis of effluent water are kept always ready for submission to the Department of Science, Technology and Environment (DOSTE) of Hai Phong. The City of Hai Phong is the joint venture partner of Company M, and the city trust the company so much that the city authority has never demanded results of analysis or conducted an on-site inspection.

If a tenant violates the standards, the tenant is warned. If a tenant repeatedly violates the standards, Company M and the city authority jointly force the tenant to close the plant.

b. Others

Each tenant deals with its solid wastes. The tenants' products are basically manufactured from imported raw materials and meant to be exported. Therefore, even wastes must be inspected by the customs, if the wastes are valuable. The difference in weight between the imported raw materials/parts and the products is regarded as wastes, which can be sold, if valuable, in Vietnam after due procedures for customs clearance. Such non-valuable wastes as canteen garbage are consigned for disposal to Hai Phong Urban Environment Company or private companies at some costs. Farmers in the neighborhood also come to take garbage as animal feed.

Case 14 Example of Treating Wastewater of High Pollutant Content by a Facility Installed Underground

1) Outline of the Company

Company N
Business line: Manufacture of dried vegetables
Number of employees: 232
Start of operation: 1999
Location of the plant: An industrial estate in the south of Ho Chi Minh City
Japanese equity ratio: 100%

2) Background

As much as 90% of the dried vegetables Company N produces is exported to Japan to be used for instant noodles, miso soup and other soups. Company N's products have a high share of 70% in the Japanese market; therefore, any environmental problem by Company N, if it ever occurs, would have serious impacts upon the entire food industry of Japan.

The vegetable broth produced from the vegetable boiling process contains BOD at high contents. The industrial estate has a wastewater treatment facility, with biological treating playing the major role, which can accommodate a wastewater-containing BOD up to 500mg/liter. BOD of the vegetable broth of Company N exceeds this limit. Accordingly, the plant had to install a wastewater treatment facility to give a pretreatment to the broth. In addition, the plant must be neat and clean throughout, because the plant handles food. The plant, therefore, preferred to install a compact and inconspicuous wastewater treatment facility than install outdoors an ordinary biological treating facility, with an aeration tank containing a vigorously stirred brown liquid.

3) Measures Taken by the Company

a. Wastewater Treatment

The plant subjects vegetables to a series of processes from washing, boiling, sizing, vacuum freeze drying, to manufacture dried vegetables. Wastewaters are produced from the washing process and boiling process. The administrative office of the industrial estate applies the effluent standards shown in Figure 2-5-2 to the plant. It may be noted that standards for COD and BOD are rather lenient, because the biological treatment of the industrial estate's central wastewater treatment facility is effective in eliminating COD and BOD. The B level standards of the government of Vietnam are applied to items not shown in this figure.

Figure 2-5-2 Wastewater Acceptance Standards of the Central Wastewater treatment facility of the Industrial Estate in Which Company N is Located

(Unit: mg/liter except for pH)

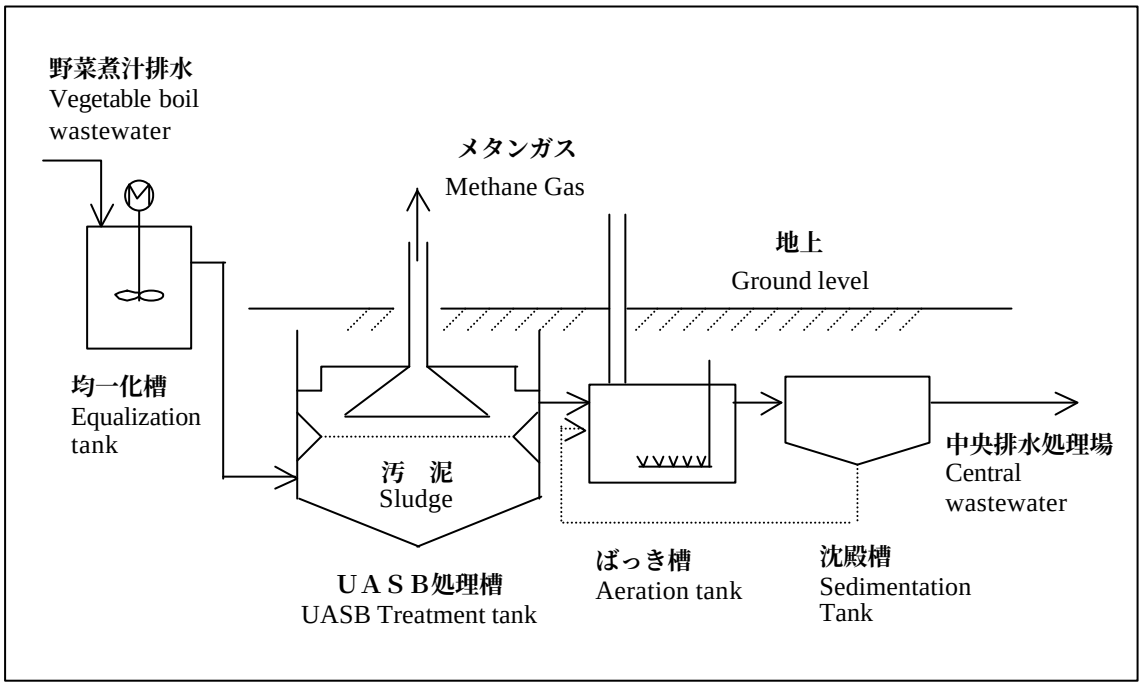
Item	pH	COD	BOD	SS
Standards	5 – 9	800	500	100

The boiling process produces vegetable broth at a rate of 150m^3/day, of which BOD content can exceed 1,000mg/liter. The plant had to install a compact wastewater treatment facility capable of reducing the BOD content to 500mg/liter. Company N consigned a private company specializing in environmental technology with the design of this facility. Ho Chi Minh University of Technology gives technical assistance to this Company. This Company has reportedly introduced Danish technologies. In addition to the vegetable broth, the plant produces 350m^3/day of washing wastewater, containing BOD at less than 500mg/liter, which is directly sent to the central wastewater treatment facility.

Figure 2-5-3 outlines the wastewater treatment facility. The wastewater from the boiling process is first retained in the equalization tank; then it is sent to the Upflow Anaerobic Sludge Blanket (UASB) tank where the high-BOD wastewater flows upward with sludge flocs of anaerobic microorganisms. There, organic compounds are decomposed by methane fermentation. The decomposition proceeds fastest at

temperatures from 53 to 55℃, enabling the compact reaction vessel to accommodate a large load. This treatment is best suited to the broth produced at high temperatures. The wastewater is further treated by an aeration tank to reduce BOD to less than 500mg/liter and is sent to the central wastewater treatment facility. These components of the wastewater treatment facility are arranged in a very compact fashion and are placed underground. There is just a small room aboveground for housing pumps and blowers, which does not in any way impair cleanliness of the plant. The wastewater sludge produced from the sedimentation tank is recycled back to the aeration tank. There is no excess sludge at normal operation to be taken out of the system.

Figure 2-5-3 Outline of Wastewater treatment facility



Case 15 Example of Positively Promoting Environmental Measures Employee's Environmental Awareness

1) Outline of the Company

Company O
Business line: Manufacture of large industrial pumps
Number of employees: 50
Start of operation: 1999
Location of the plant: In Hai Duong Proving 60km to the east of Hanoi
Japanese equity ratio: 70%

2) Background

Company O is a joint-ventured company by a Japanese company and a local company of a long experience of pump manufacturing, with technologies of the former Soviet Union, and started operation only recently. The local joint venture partner's environmental consideration was not necessarily enough. Under such a circumstance, Company O's Japanese parent company, being well known as environment-related industry, was required to give sufficient environmental consideration to the plant, and to build a model plant for environmental conservation. Since the joint venture partner provided the plant site, the plant was built next to the joint-venture partner's plant.

3) Measures Taken by the Company

a. Waste

The plant has all the operations for manufacturing pumps, from manufacture of wooden patterns for casting pump casings, or pump bodies, manufacture of sand molds, casting, assemblage, and performance tests of pumps. The casting process produces wood dust and sand dust, and that of assemblage produces metal chips from cutting and a large amount of oil-stained cloth. In order to prevent them from being scattered, the plant promotes education of employees, with the 5S movement included in the curriculum. The employees must be educated to enhance their environmental awareness, to rid themselves of the common custom of absent-mindedly throwing away wastes. The plant began sorted collection of wastes, following the precedent of the Japanese parent company, and the sorted collection proved effective. Just a visual comparison between this plant and the joint-venture partner's plant next door is enough to be convinced that this plant is much more orderly than the joint-venture partner's plant.

The wood dust and waste cloth are taken off by the Waste Treatment Public Corporation of Hai Duong Province, together with such general wastes as waste paper. The metal chips generated from cutting cast products are sold to private waste treating companies as scrap iron.

b. Wastewater Management

The plant produces virtually no industrial wastewater. The plant produces about 100tons/month of night soil. The night soil is fermented in a septic tank and the supernatant clean water is discharged, as is commonly done in Southeast Asian countries. The authority of Hai Duong Province applies Standard B to this water. The standards include 3 items, which are not specified in the government B level standards; these are transparency, electric conductivity and hardness. The provincial authority has not informed the plant of the specified values of these items. Officers of the Department of Science, Technology and Environment (DOSTE) of Hai Duong Province come to the plant to take samples of this water once a year. The officers take 6 samples from locations other than the effluent water, including pits in the plant. DOSTE informs the plant of the results of analysis. DOSTE also comes to the joint-venture partner's plant to take samples.

c. Working Environment Management

The officers of DOSTE of Hai Duong Province come to the plant to monitor the working environment once a year. The officers measure concentrations of dust, sulfur dioxide, nitrogen oxides, carbon monoxide and noise levels at 6 locations. DOSTE also informs the plant of the results of measurements.

The control of working environment is generally strict in Vietnam to protect workers in general. The officers of DOSTE of Hai Duong Province come to make measurements for both environmental management and working environment management.

d. Others

Company O promotes preparations for acquiring the ISO14001 certification. In compliance with the policy of the Japanese parent company, Company O plans to acquire the certification around 2005, or 2 to 3 years later, from the certification body from which Company O acquired the ISO9000 certification. The joint-venture partner is not at all interested in such a matter as the certification.

When an amendment is made of the environment-related laws or regulations, the Hai Duong Province authority holds a lecture. The Company has the Vietnamese in charge attend the lecture.

One of the problems Company O faces in environmental education of the employees is that none of them speaks English. The Company sends some of the employees to Japan for training for about five months. During the training period they are given training on Japanese, as a common language in the plant. Some of the best have become so fluent that they can talk in Japanese with Japanese engineers visiting the plant.

Case 16 Example of Discharging Concentrated Spent Sulfuric Acid with Strict pH Control

1) Outline of the Company

Company P
Business line: Manufacture of facilities for transporting wafers for semiconductor product manufacturing processes
Number of employees: 400
Start of operation: 1989
Location of the plant: An industrial estate in Hai Phong City, 85km to the east of Hanoi
Japanese equity ratio: 100%

2) Background

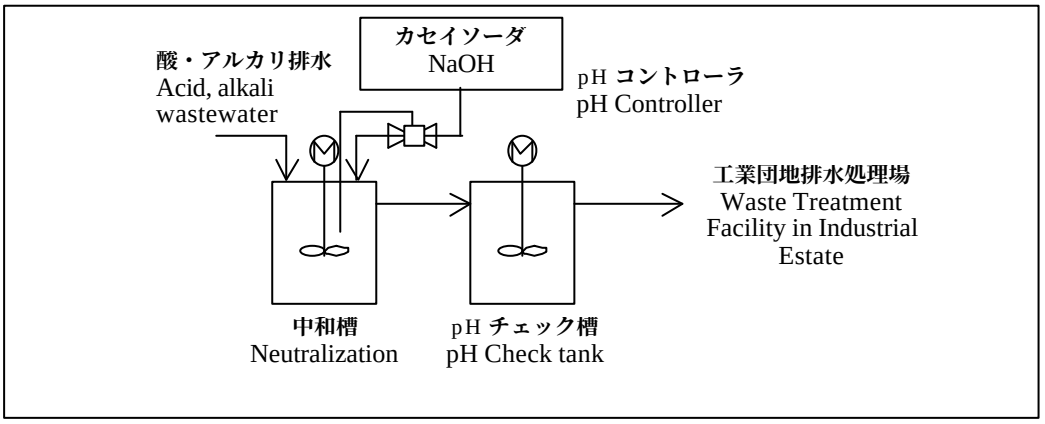
Company P gives anodizing treatment to aluminum materials to impart corrosion resistance and abrasion resistance to the aluminum surfaces. The anodizing process gives the materials an electrolytic treatment in a concentrated solution of sulfuric acid at around 25%. When the electrolytic solution has become deteriorated, the entire solution has to be replaced. The replacement produces a large amount of spent concentrated sulfuric acid. Unless the spent sulfuric acid solution is neutralized with minute care, the plant risks discharging a wastewater, of which the pH value deviates greatly from the specified value.

3) Measures Taken by the Company

a. Wastewater Treatment

The plant discharges 3 kinds of wastewaters totaling 3,000liters/month, an alkali wastewater from degreasing process of the ground aluminum parts, a weak acid wastewater from washing process of finished anodized aluminum products, and a concentrated sulfuric acid wastewater from replacement of the electrolytic solution. The pH value of the sulfuric acid wastewater is very low at or less than 0.5. This wastewater has to be neutralized to pH value from 5 to 9, the range acceptable to the wastewater treatment facility of the industrial estate. The wastewaters conform without treatment to items other than pH set by the government of Vietnam. The plant controls the pH value of the wastewater by a control system shown in Figure 2-5-4. The plant asks an analysis company to analyze the quality of the wastewater once a month, and reports the results of analysis to the industrial estate.

Figure 2-5-4 pH Controlling System



b. Others

A local dealer comes to buy aluminum and stainless steel chips produced at a rate of 5 to 8tons/month.

Company P obtains information on environment-related laws and regulations from the Hai Phong Export Processing and Industrial Zone Authority (HEPIZA), the Hai Phong City People's Committee Office, which manages the industrial estate.