Chapter 2

Environmental Conservation

by Japanese Companies in Malaysia

: Case Studies of Corporate Practices and Policies

Japanese companies in Malaysia are actively addressing environmental issues and have adopted sound environmental practices as an integral part of their corporate activities. As well as implementing pollution controls in compliance with the regulations, many companies are taking voluntary measures that go beyond legal requirements, such as phasing out trichloroethylene and other pollutants. Japanese companies in Malaysia are also strongly driven to build environmental management systems; almost all are aiming at ISO 14001 certification and many are already certified. Chapter 2 presents thirteen real-life case studies of the environmental practices of Japanese companies, most of which belong to the manufacturing sector in Malaysia, based on the findings of on-site survey of a dozen or more corporate members of the Japanese Chamber of Trade and Industry in Malaysia (JACTIM). Section 1 gives an overview of the various environmental practices of these companies. The case studies presented in Sections 2 to 4 are arranged under three topics: five cases of meeting strict wastewater standards (Section 2), four cases of establishing an environmental management system (Section 3), and four other examples of innovative environmental practices (Section 4).

Section 1
Japanese Companies in Malaysia and their Environmental Conservation

The on-site survey for this report was conducted between September and November 1999, and covered a dozen or more Japanese manufacturers and other companies in Malaysia. In each case, we visited the actual factory premises and gathered information about the companies' production processes and their efforts to implement environmental controls. The site visits took place at a time when Malaysia had surmounted the worst of the economic and currency crisis by self-imposed regulations on capital transactions and by a fixed exchange rate system. Most Japanese companies, which are predominantly export-oriented manufacturers in the electrical and electronic sector, were also well on the way to recovering their past production levels. The next sections of this chapter discuss thirteen examples of specific environmental practices put in place by Japanese companies in Malaysia. All of these companies are implementing pollution controls to the same or to a greater extent than at home, particularly in regard to industrial waste management and effluent standards, which are stricter in Malaysia than in Japan. It was evident, too, that most of the companies that we visited for this survey are taking various initiatives to develop voluntary environmental practices, such as building environmental management systems, for example.

1. Corporate Approaches to Environmental Issues

(1) Sustained efforts toward sound environmental practices

Almost all of the Japanese companies in this survey were manufacturing industries, except for one company that carries out surface treatment of metal plating. The surveyed companies have been operating in Malaysia for different lengths of time, from about 30 years ago to just a few years ago, and although they also differed in size. They, however, shared a common awareness that "implementing environmental controls is an daily corporate activity; we intend to maintain environmental efforts in advance of any new regulatory requirements."

Many of the Japanese companies operating in Malaysia are manufacturers, primarily in the electrical and electronics sector, and their production processes generally do not generate any major pollution load. Nevertheless, these companies are willing to incorporate proper environmental practices as part of business management is obviously prompted in part by the global environmental strategy of the parent company in Japan, which encourages the implementation of environmental controls wherever possible and wherever the host country may be. There also is a major background factor, the companies' own awareness of environmental controls and practices as a matter of course within their business activities. In addition, many Japanese companies in Malaysia view environmental practices from the perspective of cost effectiveness, and see that building an environmental management system can reduce energy costs and production costs. These various factors have together resulted in excellent environmental practices being adopted by Japanese companies as their daily business activities.

Malaysia's approach to environmental matters is another factor influencing corporate environmental policies. That approach is distinguished by very strict regulations on effluents and solid waste, and by greater administrative performance to make those regulations effective in practical terms than other Southeast Asian nations. Industries must therefore be vigilant in ensuring that routine pollution controls are properly carried out. Moreover, most Japanese companies in Malaysia are global corporations that have a high profile internationally, and the product brands they manufacture are household names to Malaysian people. The business activities of Japanese companies, including their environmental practices, are closely watched and any failure in regard to environmental matters would severely damage their brand image. This is another reason for the serious effort that Japanese companies are putting into environmental practices.

The basic direction of the environmental policies of Japanese companies in Malaysia is to control pollution, primarily effluents and industrial waste. However, some companies in this survey were going beyond mere compliance with the regulations and are aiming to reach stringent effluent standards of their own. One company, for example, is voluntarily monitoring the groundwater in the factory environs because of concern about environmental risks. Most Japanese companies are also initiating measures in advance of regulatory requirements, including the banning of CFCs, which deplete the ozone layer, and organochlorine chemical substances such as trichloroethylene. There is also a strong drive among Japanese companies to obtain ISO 14001 certification, the international standard of environmental management. Almost all companies are already certified or are preparing to obtain ISO 14001 certification. There was even a case where an affiliate in Malaysia was accredited a year ahead of the deadline set by the head office in Japan.

It should be noted, however, that the companies covered in this survey were not typical representatives of Japanese companies operating in Malaysia in general. In fact, the majority of companies fit the following description: (1) affiliate financed by a well-known large corporation in Japan; (2) manufacturing industry in the electrical and electronic sector; and (3) factory site located in the environs of Kuala Lumpur. In this survey, we were unable to obtain precise information about the environmental practices of small companies, or of companies in industries other than manufacturing.

(2) The difficulties of dealing with industrial waste

The environmental issue of gravest concern to Japanese companies in Malaysia is the problem of dealing

with the solid waste generated from production processes and wastewater treatment.

As discussed in Section 6 of Chapter 1, the industrial waste regulations in Malaysia are based on a raft of rules and orders governing scheduled wastes, formulated in 1989 under the provisions of the Environmental Quality Act 1974. The regulations stipulate that scheduled wastes may only be finally disposed of at a disposal facility designated by the Director General of the Department of Environment (DOE). However, when the regulations came into effect in 1989, no such designated disposal facilities existed in Malaysia. Thus, for the next decade or so, until 1997 when a scheduled waste disposal facility became partially operative, Japanese companies wishing to dispose of their waste in accordance with the law were forced to store all waste within their own premises. As a result, many Japanese companies exceeded the permissible limits for the amount of scheduled wastes stored on-site, and it was not unusual to see factories with every spare corner overflowing with drums packed with scheduled waste. In a desperate attempt to remedy the situation, some Japanese companies used to export waste to the United States and elsewhere, ostensibly for the purpose of resource recovery from sludge containing valuable metals. Export of wastes is now virtually prohibited since Malaysia became a signatory to the Basel Convention.

The designated disposal facility run by Kualiti Alam Sdn. Bhd. became partially operational at the end of 1997 and fully operational in June 1998. However, treatment and disposal fees are relatively higher than that in Japan, and charges for scheduled waste treatment and disposal have a huge impact on the environmental costs of Japanese companies. Moreover, over the past year or more since the Kualiti Alam plant was commissioned, most Japanese companies have gathered up their many years' worth of accumulated scheduled wastes and sent them to the disposal plant, having to pay treatment and disposal fees amounting to millions of yen in many cases.

Even today, Malaysia still has only one officially approved disposal facility where scheduled wastes can be treated and disposed of in accordance with the laws and regulations. Also, there is no competition in the industry because the Malaysian government granted Kualiti Alam an exclusive right, effective for 15 years from 1995, to conduct scheduled waste treatment and disposal operations nationally (in Peninsular Malaysia). Japanese companies have pursued negotiations about the expensive charges through the Japanese Chamber of Trade and Industry in Malaysia (JACTIM) and other organizations, and present prices are about 10 % lower than the original schedule of fees. DOE officials also acknowledge that the fees are high, and are reportedly conducting research on international comparisons and the economics relating to treatment and disposal fees.

At present, however, Japanese companies are obliged to rely on the monopoly company, Kualiti Alam, for scheduled waste treatment in accordance with the law. They will need to bear a continuing cost burden, greater than borne in Japan, for the foreseeable future. Consequently, some companies in this survey had installed dryers for drying treated wastewater sludge in order to reduce the weight of solid wastes, or were trying various ways of reducing the amount of waste generated in the factory.
Other than scheduled wastes, industrial wastes that have some market value in Malaysia are mostly collected by private recycling contractors. To this end, Japanese companies generally have stockyards in the factory so that wastes can be properly separated and sorted. They are also trying to reuse and recycle the different types of waste with a view to reducing waste volumes.

(3) Pollution controls based on compliance with strict effluent standards

Along with the question of scheduled wastes, meeting the requirements of Malaysia's strict effluent standards is central to the pollution controls of Japanese companies. Most of the general parameters in Malaysia's effluent standards, such as BOD and COD, are stricter than in Japan, and there are some regulated heavy metals, such as nickel, which are absent from the Japanese standards. In addition, Malaysia's standards apply not only to industrial effluent but also to household wastewater. This means that Japanese companies, which typically have relatively large factories that may employ several hundred or up to a thousand workers or more, cannot neglect the treatment of domestic and human wastewater.

Also, although most Japanese companies are located in industrial estates, industrial estates in Malaysia, unlike other Southeast Asian countries, do not have central wastewater treatment facilities. Further, the simple administrative system of cumulative fines or "compounds" for offenses against environmental regulations relating to air pollution or industrial wastes, for example, do not apply to violations of the effluent standards, and offenders are promptly charged and prosecuted. For this reason too, Japanese companies cannot afford to be lax in treating their wastewater.

To comply with the effluent standards, all the Japanese companies we surveyed had needed to tackle advanced wastewater treatment themselves, and had invested large amounts of money in building treatment systems with extra facilities that add to running costs, such as sand filtration and activated carbon adsorption systems. As well as installing treatment equipment, the companies are also paying close attention on a daily basis to the proper management of factory operations and to water quality monitoring, for example. Some of the companies we visited were aiming at an even higher level of wastewater treatment, based on self-imposed effluent standards even more stringent than the regulatory limits.

Although Malaysia does not yet regulate groundwater contamination, a number of Japanese companies were regularly monitoring the groundwater in areas surrounding their factories, and taking other preemptive measures to avoid groundwater contamination by heavy metals or organochlorine compounds such as trichloroethylene.

In regard to other forms of pollution, such as air pollution, for example, there were no factories with desulfurizing units or other large-scale air pollution control equipment since most of the companies visited for this survey were manufacturing industries involved mainly in machinery assembly, industries that contribute little to the air pollution load. However, all the companies were trying in various ways to prevent discharge of pollutants or particulate matter from factory buildings, by installing scrubbers or other pollution control equipment at air vents and outlets, or by using fuels with a low air pollution load for boilers and other fuel-burning equipment.

Another dominant trend, particularly in the electronics industry, is the move to substantially eliminate lead from manufacturing processes and products, in response to regulatory trends in Europe and in order to improve the working environment. The ultimate aim is to shift to lead-free solder and to phase out lead completely.
As a developing country, Malaysia is still permitted to use CFCs controlled under the Montreal Protocol. However, the government is aiming at early reduction of ozone depleting substances and has brought forward its CFC reduction program to coincide with the Protocol's control schedule for advanced nations. Most Japanese companies have already ceased using CFCs.

2. Corporate Sharing of Environmental Information and Contribution to Malaysia's Environmental Programs

The sharing of environmental information by initiating contacts across corporate boundaries is an evident trend among Japanese companies in Malaysia.

Many of these companies belong to the Japanese Chamber of Trade and Industry in Malaysia (JACTIM), whose Management Committee oversees environmental matters and plays a major role in making environmental information available to members. In 1995, JACTIM published a "Handbook on Environmental Law in Malaysia," which summarizes the regulations on scheduled wastes and other environmental legislation. As well as helping to distribute environmental information to Japanese companies, JACTIM also lobbies the relevant government departments and agencies to press for lower fees for the treatment and disposal of scheduled wastes.

In addition to JACTIM-initiated activities, some of the corporate groups operating in Malaysia have joined forces to gather information about obtaining ISO 14001 certification. Some large group

companies are exchanging environmental information outside of their own organization, by holding meetings with the presidents of other Japanese companies located in a particular industrial estate.

The Malaysian government recommends that industries build environmental management systems and obtain ISO 14001 certification. As the accrediting organization, the Standard and Industrial Research Institute of Malaysia (SIRIM), a federal enterprise with private-sector involvement, supports industries wishing to obtain ISO 14001 certification. The first company certified in Malaysia was a Japanese company which achieved certification by working jointly with SIRIM, and subsequently helped to build a support framework in Malaysia for obtaining ISO 14001 certification. In addition, some Japanese companies are taking part in a staff exchange program involving private-sector industry and the DOE, and are making the innovative environmental information held by their own companies available to other program participants.

Japanese companies are also contributing to human resource development in the Malaysia's environmental sector. In many Japanese companies, a Malaysian staff member is responsible for environmental matters. In fact, there have been cases where a Malaysian, having learned a variety of environmental techniques at a Japanese company long established in Malaysia, later takes charge of the environmental management system in a different Japanese company, or works on promoting pollution controls in a local company. Although this raises difficult questions about companies losing personnel that they have trained themselves to another company, viewed from a broad perspective, staff mobility helps to raise the whole level of environmental practices in Malaysia.

One company in Malaysia is the local subsidiary of a leading water treatment manufacturer in Japan. This company undertakes the design, construction, control, and water quality monitoring of water treatment facilities for Japanese companies in Malaysia, and provides them with a variety of environment-related information.

3. Regrettable Pollution Episodes and the Need for Better Communication with Environmental Authorities

In 1985, local residents fought a legal battle to shut down Asian Rare Earth, a joint venture chemical company in Malaysia in which a Japanese company held a 35 % stake. The company was accused of having mismanaged its radioactive waste and of causing health damage in the plant vicinity. The incident was widely reported at the time, both in Malaysia and in Japan, as a case of "pollution export" by Japan. Although the company won the initial court case, it ultimately had to close the plant in 1994. The incident remains an unavoidable topic in any discussion of the environmental practices of Japanese companies in Malaysia, and it is well remembered by companies that have been longest in the country.

Partly because of this incident, most Japanese companies operating in Malaysia have incorporated environmental measures as part of their normal business activities, and are pursuing sound practices in regard to pollution control, as discussed above.

Unfortunately, however, during the course of this survey, a Japanese company was prosecuted for a pollution offense, and the incident was widely reported in Malaysian newspapers. It involved a Japanese metal finishing reagents dealer, which, in May 1999, illegally dumped scheduled wastes containing heavy metals within its premises. The court ruling passed down in October 1999 imposed a fine of 100,000 ringgit and the company was ordered to transport all of the waste to Kualiti Alam and to treat and dispose of the waste in accordance with the law.

Referring to this episode, the Director General of the DOE, Rosnani Ibrahim, whom we visited in the course of the survey, commented that some Japanese companies in Malaysia, in endeavoring to obtain ISO 14001 certification, for instance, are performing well above the level required by the DOE. "We're very happy with the environmental practices of Japanese companies. The present incident is a regrettable exception," Rosnani said. Since the incident was exposed in July 1999, it has been

publicized on a grand scale in the English newspaper published by Malaysia's governing party, the United Malays National Organization (UMNO). The episode has served as ammunition in the government's campaign to promote its scheduled waste policies by imposing punitive damages as a warning to potential offenders. But that does not alter the fact that the violation occurred.

There have been subsequent violations too. During the survey we visited the DOE branch office that has jurisdiction over Selangor, the state next to Kuala Lumpur where the majority of Japanese companies have their factories. We were told that several of the pollution offenses in 1999 were committed by Japanese companies. Of the 99 prosecutions resulting in fines, four cases involved Japanese companies. Three of those cases were violations of the effluent standards, and the other was related to scheduled wastes. Of the 80 cases in which companies were ordered to pay compounds, five involved Japanese companies. Further, we were told that environmental offenses by foreign companies other than Japanese companies apparently occur at about the same frequency as by Japanese companies, particularly among small and midsize companies. In reality, most offenses occur at the hands of small and medium-size local Malaysian companies. But in fact, offenses by Japanese companies are being prosecuted, and Japanese companies are expected to make a greater effort in environmental matters.

The Director of the DOE State Office in Selangor made some worrying statements in the course of discussions about the problem. He said firstly that Japanese companies rely too much on their Malaysian managers to carry out routine environmental practices, and suggested that Japanese top executives "fail to grasp the real situation." He said also that although the Selangor State Office would like to exchange information and opinions about factory environmental regulations with Japanese management, it is difficult to find the opportunity. "If there were such opportunities, there would be room for negotiation before things got as far as a court case," he said.

Since we were unable to visit any DOE State Offices elsewhere in the country during this survey, it would not be fair to say that the Selangor DOE Director's statements represent the general opinion in Malaysia, but his words certainly cannot be ignored. In the future, while continuing to put environmental practices firmly in place, Japanese companies should also be working toward much closer communication between their managerial staff and environmental administrative authorities.

This survey included interviews with Japanese companies in Malaysia about how each company's environmental practices were affected by the Asian currency and economic crisis that occurred in summer 1997. Most Japanese companies in Malaysia are export-oriented, and although some companies said that the crisis had economic repercussions such as falling sales, they all agreed that the crisis had no effect on corporate environmental practices. With the package of capital and foreign exchange policies introduced in September 1998, Malaysia fixed the ringgit currency at 3.8 to the U.S. dollar, but this turned out to be a comfortable level. Unlike Indonesia and other Southeast Asian countries, the currency and economic crisis does not appear to have had much effect on the environmental practices of Japanese companies in Malaysia.

Section 2
Cases of Meeting Strict Effluent Standards

Sections 2 to 4 summarize the findings in their environmental measures by the visits at the subject companies and interviews with of their persons in charge. The report contains information on such items as discharges of pollutants and their concentrations in the effluent and emission to the extent the interviewees disclosed. In Malaysia, public wastewater treatment plants are insufficiently provided. Therefore, wastewater is discharged directly from plants and factories to such public waters as rivers. For this reason the Malaysian government imposes strict effluent standards on each industry. The standards are stricter on most items than the nationwide standards of Japan. The Malaysian government applies the same strict standards to the household wastewater. This section presents cases in which the Japanese companies in Malaysia generally adopt highly advanced facilities, technologies and precise operations to cope with such strict effluent standards. These companies have established company standards much stricter than those imposed by the government. They may be regarded as quite positive and innovative in their attitude toward the issues of environmental conservation.

Case 1 Example of a Plant Executing Comprehensive Wastewater Treatment to Neutralize Poisonous Hexavalent Chromium

1) Outline of the Company

Company A
Business line: Manufacture of the components of shock absorbers and power steering of automobiles and motored bicycles
Number of employees: 378
Start of operation: 1985
Location of the plant: Industrial Estate in Selangor State about 25 km to the southwest of Kuala Lumpur
Japanese equity ratio: 100%

2) Background

Company A has opted to establish the plant in this industrial estate because of the location of this industrial estate being close to a port facility which would provide convenience in transportation of the products and procurement of labor, for example. The industrial estate was developed by the government of the State of Selangor. The industrial estate does not have a central wastewater treatment plant; therefore, all the tenant companies are required to treat their wastewater clean enough to satisfy the wastewater effluent standards before they discharge their wastewater to outside of the estate. The plant has a facility for chromium plating which produces wastewater containing hexavalent chromium ion (Cr^{6+}). The standard for hexavalent chromium imposed by the Malaysian government is much stricter than their Japanese government counterpart. The company established a complete wastewater treatment plant and has operated the plant minutely to satisfy the chromium standard.

3) Measures Taken by the Company

a. Wastewater Treatment

The plant generates a coolant wastewater stream containing cutting oil, a paint wastewater stream containing paints and a wastewater stream containing zinc phosphate, in addition to the chrome wastewater stream from the chromium plating. The wastewater must satisfy all items for the Standard B of effluent standards set by the Malaysian government before the wastewater can be discharged to the public waters. Actually, however, the company needs to report the compliance with the standards shown in Figure 2-2-1 to the Department of Environment (DOE), in view of the chemical substances the company handles.

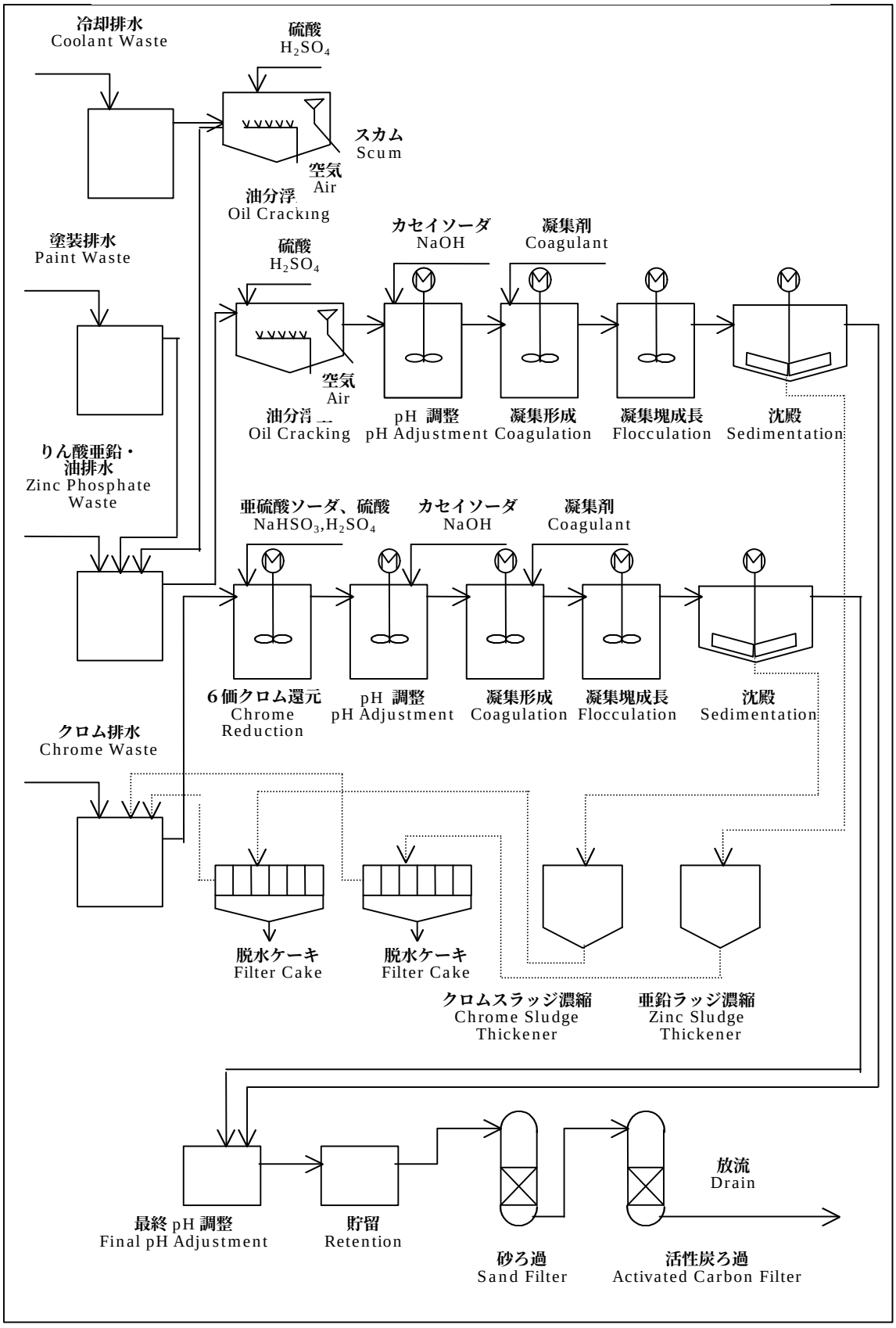
Figure 2-2-1 Effluent Standards for Company A (Unit: mg/liter)

Item	pH	COD	BOD	SS	Oil	Cr^{3+}	Cr^{6+}	Fe	Zn
Standard	5.5-9.0	100	50	100	10.0	1.0	0.05	5.0	1.0

The standard for hexavalent chromium, 0.05mg/liter maximum, is one-tenth as strict as the Japanese government standard for nationwide application, or 0.5mg/liter maximum. Hexavalent chromium ion is not amenable to neutralization followed by sedimentation applicable to removal of most other heavy metals. Hexavalent chromium ion must first be reduced into trivalent chromium ion under strict control of the pH value of the solution and oxidation-reduction potential, before it is made amenable to neutralization followed by coagulation sedimentation. A small mistake in pH control and oxidation-reduction potential could increase hexavalent chromium concentration over the standard, or 0.05mg/liter.

The company constructed a wastewater treatment plant consisting of the facilities shown in Figure 2-2-2 in 1994 to satisfy all items of the standards. The coolant wastewater is first treated by dissolved air flotation to remove oil by flotation. Thereafter, the coolant wastewater, the paint wastewater and zinc phosphate wastewater are mixed. The mixed wastewater is subjected to dissolved air flotation to complete oil removal, followed by addition of caustic soda to sediment heavy metals in the form of hydroxides. Then, a coagulant is added to the water to settle the suspended materials to the bottom for removal. The sedimentation tank allows the content to be separated into clear supernatant water and sludge containing heavy metals. The supernatant clear water is sent to the final pH adjustment tank.

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



The chrome wastewater is made acidic, to the pH value of around 2, by addition of sulfuric acid and sodium sulfite. The hexavalent chromium is reduced to trivalent chromium under such a condition. During this time oxidation-reduction potential is maintained between 250 and 300 mv by adjustment of addition of sodium sulfite. Then, sodium hydroxide is added to make the solution alkaline to sediment chromium in the form of trivalent chromium hydroxide. The trivalent chromium hydroxide is made to coagulate and settle by addition of a coagulant. The treated clear supernatant water is sent to the final pH adjustment tank to be mixed with the above-mentioned supernatant clear water. The combined clear supernatant water is discharged to public waters after being sand filtered and treated with activated carbon bed. The purpose of sand filtering is to remove fine suspended matter, which has escaped the upstream sedimentation process. The purpose of the use of activated carbon is to adsorb and to remove organic compounds which could increase COD and BOD.

In the treatment of hexavalent chromium, control of the addition of sodium sulfite is very important. The addition of sodium sulfate should neither be too much nor too small in order to keep the hexavalent chromium concentration less than 0.05mg/liter. Engineers who have majored in environmental science in university are exclusively responsible for the operation of this system. This system requires a team of two persons for the operation, and it's in operation for 24 hours a day. The plant laboratory measures pH, COD and hexavalent chromium concentration every day to confirm satisfactory operation of the wastewater treatment plant. If abnormality is found in the analysis of the treated water, corrective measures are immediately taken. Figure 2-2-3 shows an analysis of the treated water.

Figure 2-2-3 Analysis of Treated Wastewater of Company A

Item	Standards	Date				
		August 9	August 10	August 11	August 12	August 13
pH	5.5-9.0	6.78	6.90	7.13	6.75	6.98
COD	100 mg/liter	41	24	75	40	37
Cr^{6+}	0.05 mg/liter	0.01	0.02	0.01	0.01	0.02

The effluent water satisfies every item of the standards shown. It is worth noting that hexavalent chromium concentrations are lower than the standards by large margins.

Analysis of the treated water is compiled by the week and the result is submitted to the Manager of the Department through the immediate supervisor and the section manager. The Manager of the Department and concerned Malaysian managers jointly check the result of analysis. They put down their comments on the report and return the report to the analysts. Such a system of feeding back the results to the persons in charge helps bring together the Malaysian workers in the combat against the environmental problems surrounding the company.

b. Solid Waste Treatment

The scheduled wastes for which methods of treatment and disposal are strictly controlled by the government include wastewater treatment sludge, wastewater from metal cutting process, and trichloroethylene. Production of these wastes amounts to about eight tons a month. Presently, these wastes are consigned to Kualiti Alam, an official disposal agent of Malaysia. The treatment and disposal fee is 27,000 yen/ton. Formerly, Company A was obliged to stock them in the premises of the company. Therefore, the company had a huge pile of drums containing these scheduled wastes.

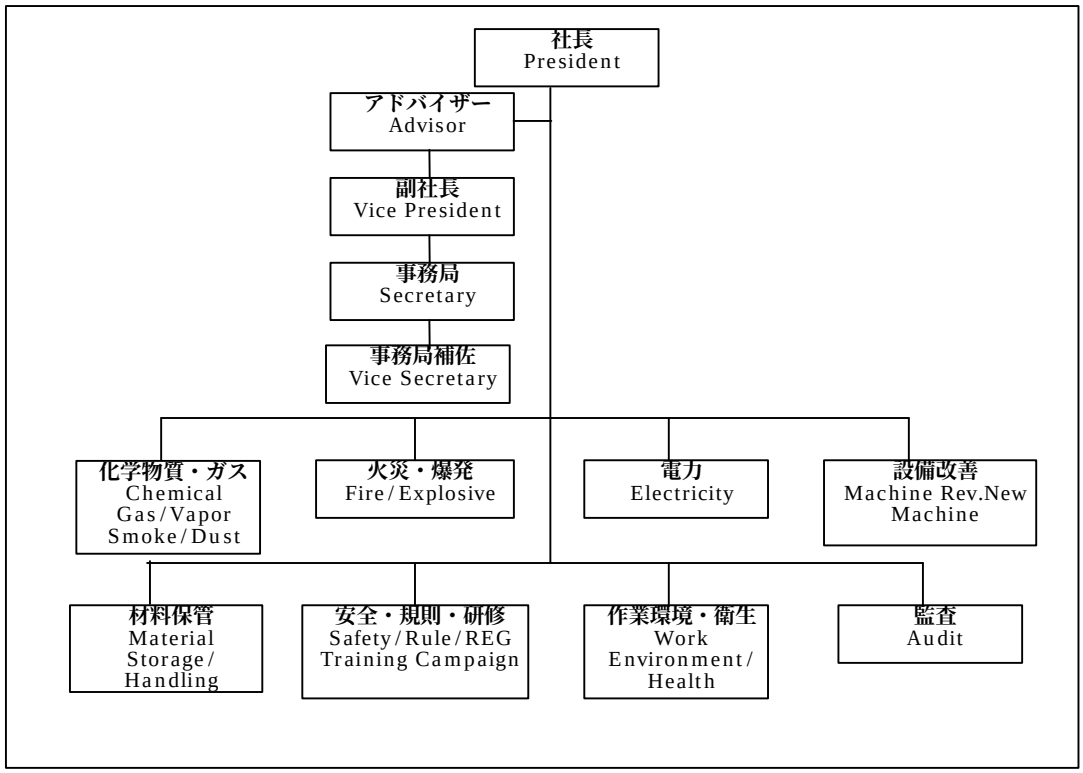
The stock reached 1990 drums, or 547 tons, in 1998. It was found that the treatment would have cost the company 15 million yen if these would had been consigned to Kualiti Alam. The company then opted to introduce a dryer. The drying operation successfully reduced the weight of the waste to one-third the original weight. The disposal cost of the waste was saved accordingly.

c. Establishment of the Environmental Management System

Figure 2-2-4 shows Safety, Health and Environment Organization of the company. This organization consists only of Malaysian managers except for the chief operating officer, or the president of the company. There are eight field branches covering various natures of the company's operation, take Chemical Gas/Vapor Smoke/Dust, for example. Representatives of the workplaces concerning these eight operations participate in the field branch activities. This Safety, Health and Environment Organization is the central one preparing for acquisition of the ISO14001 certification.

The Japanese parent company sends a director in charge, together with a couple of assistants, to Company A once or two times a year to conduct two-day environmental auditing. The auditing covers 20 items including whether environmental policy, plan and organization are well organized, whether wastewater is adequately treated, whether items previous pointed out have been duly taken care of. When this auditing started in 1994, Company A's overall rank was C with 19 items pointed out. The performance improved every year. The company's overall rank was A in 1998.

Figure 2-2-4 Safety, Health and Environment Organization of Company A



Case 2 Measures Equivalent to Those in Japan Are Taken to Meet Future Effluent Control

1) Outline of the Company

Company B
Business Line: Manufacturing of air conditioners
Number of employees: 1,000
Start of operation: 1990
Location of the plant: Industrial Estate in Selangor State 30 km to the south of Kuala Lumpur
Japanese equity ratio: 100%

2) Background

The products of the group companies, of which Company B is part, are consumer products used by general consumers. Business of the group companies is globally spreading in marketing their products and in having production plants. With increasing awareness of environmental issues throughout the world, Company B needs to improve its corporate image as a company giving due environmental consideration. Japanese parent company of Company B has an environmental performance principle consisting of nine clauses, including the following two clauses, oriented towards overseas operation; namely,

- Company's overseas operations and product exports should always consider their impacts upon the local environment and should endeavor to respond rightly to the needs of the local communities, and to take necessary countermeasures.
- In addition to observing environmental standards of the international communities, nations and local governments, the company should set up its own standards as found necessary to conserve environment.

The metal surface treatment process of the plant produces wastewater effluents containing metallic ions, paint debris and alkalis. Its degreasing process used to employ trichloroethylene and therefore its diffusion into wastewater and ground water has been carefully watched. The discharge point of its effluent water is located upstream of the intake point of the drinking water; therefore, the Standard A, the very strict standards, are applied to the plant. The plant naturally has to exercise right control on its wastewater. Although Malaysia does not have a regulation on trichloroethylene in underground water, the company has decided to monitor trichloroethylene contamination of underground water by trichloroethylene as is done in Japan.

3) Measures Taken by the Company

a. Wastewater Treatment

Figure 2-2-5 shows the schedule of wastewater control of Company B. Electric conductivity, turbidity and pH were measured by the plant laboratory staff on the samples taken everyday on 10:00 a.m. and 3:00 p.m. at nine sampling points. These three items can be easily measured on the spot by portable instruments, the data on these items are very effective in diagnosing the operating conditions of the wastewater treatment plant. The sampling points have been laid out along the movement of the wastewater in the treatment plant from the wastewater receiver to the sewer outside the plant downstream of the discharge point. The measurement of these three items enables Company B to take immediate corrective measures. Thus, the plant may be able to prevent the discharge of wastewater which fails to satisfy the standards.

The treated wastewater is analyzed for 16 items once a week. The sample is taken at the discharge point and is analyzed in the plant laboratory. The treated water is also analyzed for all the 22 items once a month by a registered testing company not associated with the company. So far, the wastewater of the company has satisfied the level of all these items. The results of these analyses are compiled and submitted to the Department of Environment (DOE) once a month.

Figure 2-2-6 shows the flow of the wastewater treatment facilities. The plant separately treats two types of wastewater: the highly contaminated wastewater that is periodically produced, and not highly contaminated wastewater that is regularly produced. Those types of wastewater containing metallic ions are reacted with caustic soda to convert these metallic ions into coagulates of water-insoluble hydroxides to facilitate their sedimentation. These particles of hydroxides are made to form large flocs by the combined actions of poly aluminum chloride (PAC) and a high-polymer coagulant. The flocs are allowed to settle in the settling basins. The downstream process beginning with neutralization consists of one process train where the clear supernatant effluents of the upstream meet and are treated together. The treatment consists of a biological treatment in the aeration tank where organic substances are decomposed and removed. The clear supernatant separated from the sludge in the sedimentation tank is sand filtered followed by activated carbon treatment for removal of remaining organic compounds before discharge.

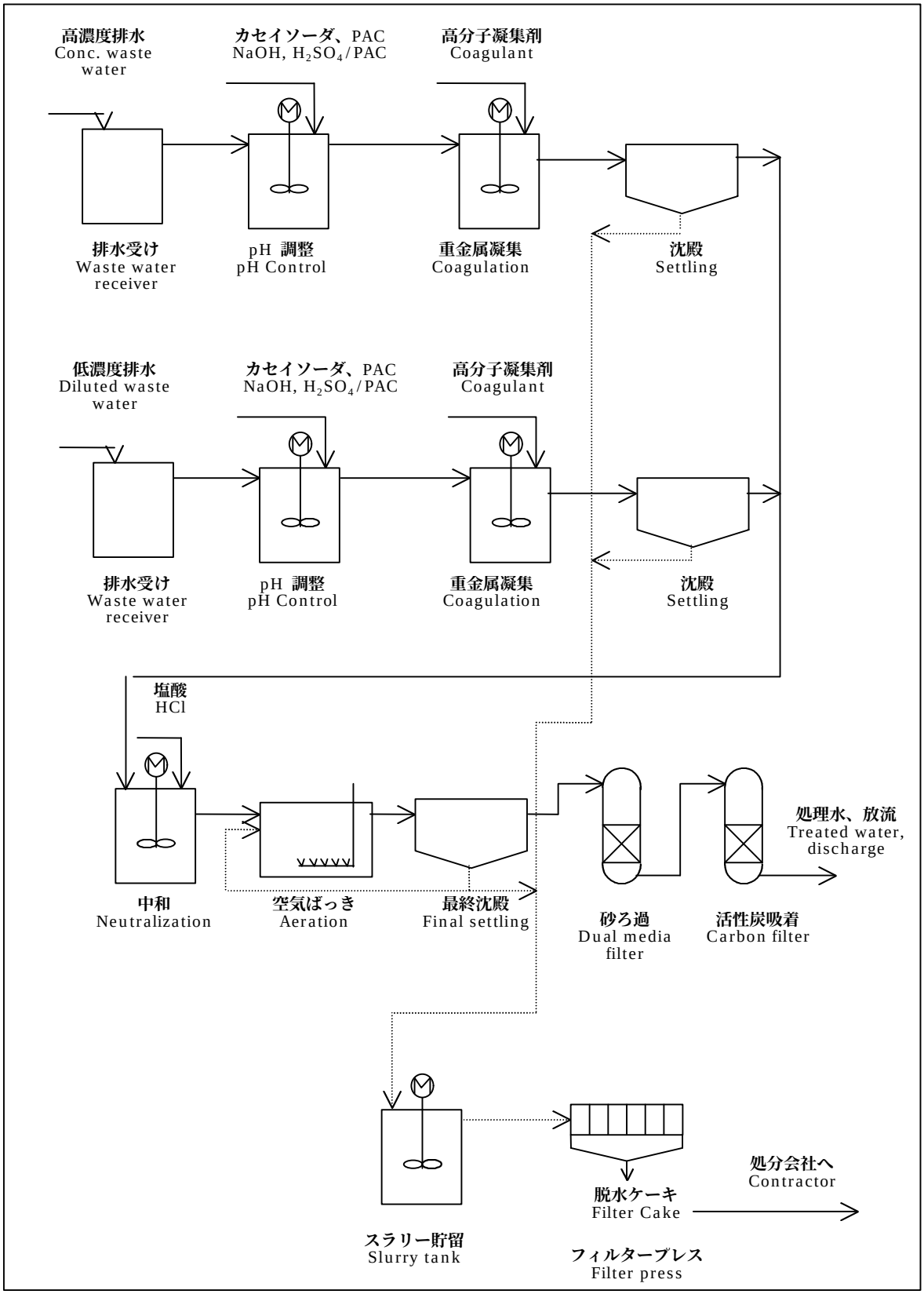
Figure 2-2-5 Items and Frequency of Analysis

Item	A Standards	Analysis frequency, sampling points, place of analysis		
		2 times/day 9 points Plant laboratory	Once/week 2 points Plant laboratory	Once/month 5 points Registered testing companies
Electric conductivity	-	X		
Turbidity	-	X		
pH	6.0 - 9.0	X	X	X
COD	50		X	X
BOD	20			X
Arsenic/As	0.05			X
Boron/B	1.0		X	X
Total suspended solids/TSS	50		X	X
Cadmium/Cd	0.01		X	X
Trivalent chromium/Cr^{3+}	0.20			X
Hexavalent chromium/Cr^{6+}	0.05			X
Copper/Cu	0.20		X	X
Lead/Pb	0.10		X	X
Iron/Fe	1.0		X	X
Manganese/Mn	0.20		X	X
Nickel/Ni	0.20		X	X
Mercury/Hg	0.005			X
Tin/ Sn	0.20			X
Zinc/Zn	1.0		X	X
Free Chlorine/Cl	1.0		X	X
Cyanides/CN	0.05		X	X
Sulfides/S^{2-}	0.5		X	X
Phenols	0.001			X
Oil & grease	ND		X	X
Phosphate/PO_4^{2-}	-		X	

b. Monitoring of Underground Water

The Malaysian government has not put restrictions on the use of trichloroethylene. Nevertheless, Company B has voluntarily discontinued using this solvent since 1996 and converted the degreasing process into one used in Japan. The company has since monitored underground water trying not to overlook possible contamination by trichloroethylene.

Figure 2-2-6 Flow of the Wastewater Treatment of Company B



A vertical well has been drilled for sampling underground water at one of the corners of the plant premises. The location of the well was identified at the time of geological survey done for the plant construction as the furthest downstream of the underground water flow. If trichloroethylene had ever leaked in the plant premises, the trichloroethylene would pass this place before leaving the plant premises. The company has set its own standard at 0.03 mg/liter, equivalent to the Japanese standard, and has checked water for trichloroethylene once in every six months. Trichloroethylene has never been detected since start of the monitoring.

c. Solid Waste Treatment

The wastewater treatment plant produces sludge. To reduce production of sludge in the treatment process, the plant has replaced ferric chloride with a polymer coagulant for a coagulant. Thus, production of sludge has been reduced from 18 tons/month to 5.9 tons/month. The company plans to introduce a dryer to further reduce the production of sludge. The company consigns once in two to three months disposal of the sludge to Kualiti Alam, the only authorized waste treatment and disposal agent in Malaysia. The fee for disposal by Kualiti Alam depends upon organic carbon content of the sludge. The sludge containing organic carbon at 10 % or less is landfilled while that containing more than 10% is incinerated. The fee for landfilling is 495 RM/ton (or about 15,000 yen/ton) but that for incineration is much higher at 2,700 RM/ton (or about 81,000 yen/ton). Kualiti Alam plans to lower in a stepwise fashion the criterion for incineration down to 3% of organic carbon. This could result in increase of disposal cost. Although transportation of the sludge to Kualiti Alam is consigned to a registered contractor, the company traces its sludge to see that the sludge has been duly delivered to Kualiti Alam.

Until 1997 when Kualiti Alam started treating and disposing of the sludge, the plant was obliged to keep the sludge on the premises of the plant.

d. Others

The waste from Company B includes copper and aluminum pipes. These are now sold to dealers for recycling. The company endeavors to increase the number of items to be recycled. The number of items recycled was 16 in 1996. This has increased to 25 by 1998 including reuse of printed circuit boards. The company also has been trying to reduce electricity consumption, with the target set for the year 2000 at 3 % reduction from the consumption of 1997.

Wastewater streams from each plant in the industrial estate gather at a pond before the water is discharged to a river. The quality of effluent water is voluntarily checked once in every six month and the results of analysis are reported to a meeting of the presidents of the tenant companies in the industrial estate. It has been agreed that when the quality of the effluent water is found contaminated at an alarming level, the tenant companies should jointly take necessary corrective measures. Such a situation has never occurred so far.

To prevent the noise arising in the industrial estate from annoying the people in the surroundings, 13 monitoring stations have been installed at the peripheries of the industrial estate. Although the national standards for noise have not been set in Malaysia, voluntary standards, 65dB in the daytime and 50 dB at night, have been set for noise control. Once it was found necessary to reduce the noise level of an exhaust fan. This was resolved by providing measures to hold down noise from the duct. No noise problem has occurred since then. Today, noise monitoring within the industrial estate is routinely done after the monthly environmental committee meetings.

The positive attitude of the company toward environmental conservation reflects itself in acquisition of the ISO14001 certification in 1997 and also in the award for best environmental conservation in the State of Selangor for 1998. In 1994 Company B was awarded by the Ministry of Energy, Communications and Multimedia the Energy Efficiency Award for installation of electric power measurement system and activities to enhance awareness of the employees for the importance of energy conservation.

Case 3 Example of Controlling Heavy Metals in the Wastewater Based on its Own Strict Standards

1) Outline of the Company

Company C
Business line: Manufacture and sale of transistors and linear ICs
Number of employees: 1,700
Start of operation: 1976
Location of the plant: Industrial Estate in Selangor State 20 km to the south of Kuala Lumpur
Japanese equity ratio: 70%

2) Background

The brand name of Company C's products is internationally well known. The products of this plant are exported to South and East Asian Countries including Japan. With the rising awareness of environmental conservation, the users of the products are demanding increasing environmental consideration in the manufacturing processes of the company.

The effluent standards for waste waster are stricter than those of the government of Japan in many of the items. The manufacturing process produces wastewater containing heavy metals; therefore, the wastewater has to be treated to satisfy the strict standards for heavy metals. In order to be certain that the treated water meets the standards, the company has voluntarily set up its own standards which are even stricter than the government standards.

3) Measures Taken by the Company

a. Wastewater Treatment

The process of washing after soldering, the laboratory for chemical analysis, and the cleaning of jig and tools produce wastewater containing heavy metals. Figure 2-2-7 shows both the government standards imposed on Company C and Company C's own standards. Its own standards have been set at 70 % of the government standards.

Figure 2-2-7 Government and Own Effluent Standards of Company C

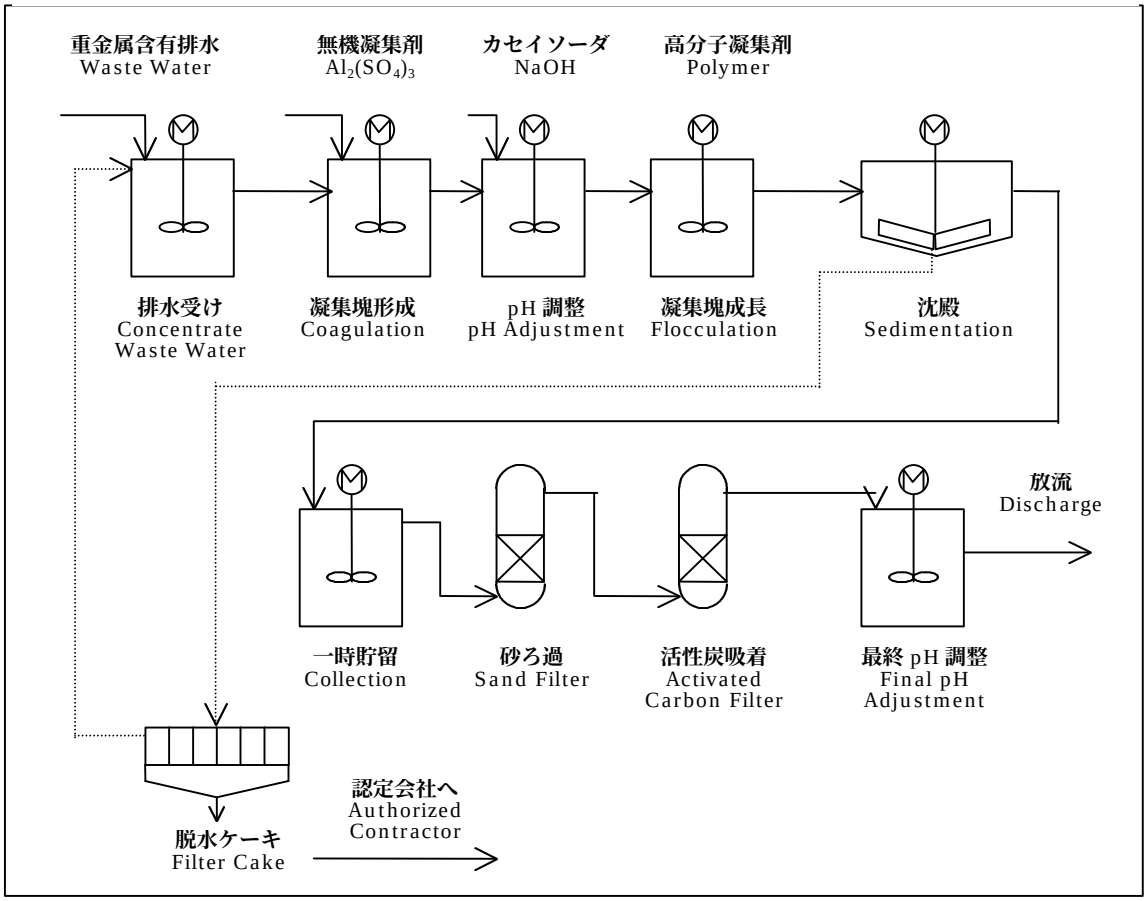
(Unit: mg/liter)

Items	pH	BOD	COD	SS	Pb	Cu	Ni	Sn	Zn	B	Fe
Government standards	5.5-9.0	50	100	100	0.5	1.0	1.0	1.0	1.0	4.0	5.0
Company's standards	6.0-8.0	35	70	70	0.35	0.7	0.7	0.7	0.7	2.8	3.5

Ni (nickel), Sn (tin) and B (Boron) are not specified in the Japanese effluent standards. The values of the standards except for pH and Pb (lead) are stricter than their Japanese counterparts. The value for Zn (zinc) for Company's standard, 0.7mg/liter, is particularly strict compared with the Japanese standard of 5 mg/liter, or one-seventh of the Japanese standard. Zinc is an amphoteric metal, soluble in both acidic and strong alkaline solutions. Accordingly, pH of the wastewater must be controlled in a very narrow range in order to reduce zinc concentration in water to this level by removing zinc as a water-insoluble hydroxide.

A wastewater treatment plant as shown in Figure 2-2-8 was constructed in 1983 to meet these standards. To the wastewater containing heavy metals is added aluminum sulfate as a coagulant to flocculate heavy metals. A high-polymer coagulant is then added to the wastewater to form large and stable flocs. The wastewater is separated into clear supernatant water and settling sediment in the sedimentation basin. The supernatant water is sand filtered to remove heavy metal particles that still remains after the upstream treatment, followed by treatment by activated carbon to remove by adsorption organic substances to make the effluent satisfy the COD standard. The treated wastewater is finally checked for pH before being discharged to the public waters. The discharged water is analyzed by the company's laboratory once a

Figure 2-2-8 Flow of the Wastewater Treatment of Company C



week to confirm that the quality satisfies the standards. Every month, the company let a non-affiliated registered testing company analyze the effluent water. Once in every three month, the company reports to the Department of Environment (DOE) the results of the analysis by the registered testing company. Presently, the treated water satisfies every item of the company's own standards to indicate that the wastewater treatment plant operates quite satisfactorily. The sludge separated from the sedimentation basin is dehydrated into filter cake to be delivered to an authorized disposal company for treatment and disposal.

b. Exhaust Gas Treatment

Contaminated exhaust gas generated at this plant are a fume of lead and the flux from the soldering process and gas generated at the laboratory. The standards shown in Figure 2-2-9 is set for these gas streams.

Figure 2-2-9 Effluent Gas Standards for Company C

(Unit: mg/Nm^3)

Item	Pb	Zn	Cu	H_2SO_4	HCl
Standards	25	100	100	200	400

The contaminated gas streams are aspirated into the duct from the places of origin. The gas is washed with water in a scrubber where the contaminants move to the water phase. The washed gas is sampled immediately upstream of the discharge point for analysis of contaminants to ensure that the gas meets the standards. The water used for scrubbing is sent to the wastewater treatment plant for normal treatment.

c. Establishment of Environmental Management System

Company C began very early taking measures to prevent its own activities from adversely affecting the environment. Company C established the Environmental Committee as early as in 1988 for specifically studying environmental issues throughout the company. In 1992 the company established the Environment Control Section, solely responsible for environmental issues. The company obtained the certification of ISO14001 in 1998.

The Environmental Committee, after having gone through several changes, now has an organization shown in Figure 2-2-10. The chairman and Vice Chairman are the president and a director of the company, respectively, both being Japanese nationals. The management representative and below are all Malaysian managers. The committee has eight acting groups such as Legal Requirements/Environment Section Group and Chemical Management Group.

The organization of the Environment Control Section is shown in Figure 2-2-11, and the section is conducting environmental activities such as observation of laws and regulations, operation management of the wastewater treatment plant, staged campaigns for enhancement of environmental awareness, activity promotion of ISO14001. The manager of the Environment Control Section took environmental science as his major in University.

The company started in August 1996 preparing for acquiring the ISO14001 Certification. The company began training of personnel in managerial level and started a steering committee for ISO14001 certification acquisition. The company completed necessary documents in January 1997. In September and November of 1997, the company received the preliminary review and provisional review, respectively, by an accredited certifying organization. The company received compliance audit in January and verification audit in March 1998, then it was awarded the certification in April 1998. In February 1999, the company had the first surveillance audit.

Figure 2-2-10 Environment Committee of Company C

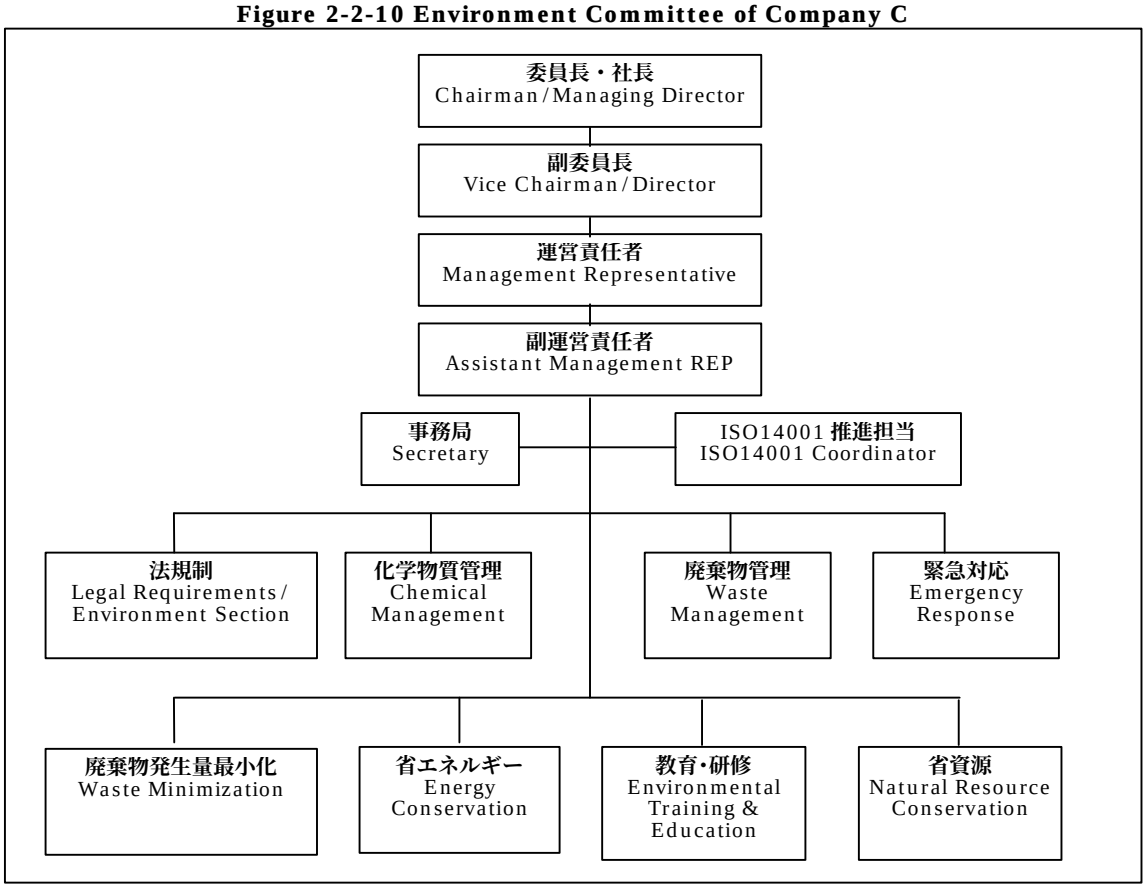
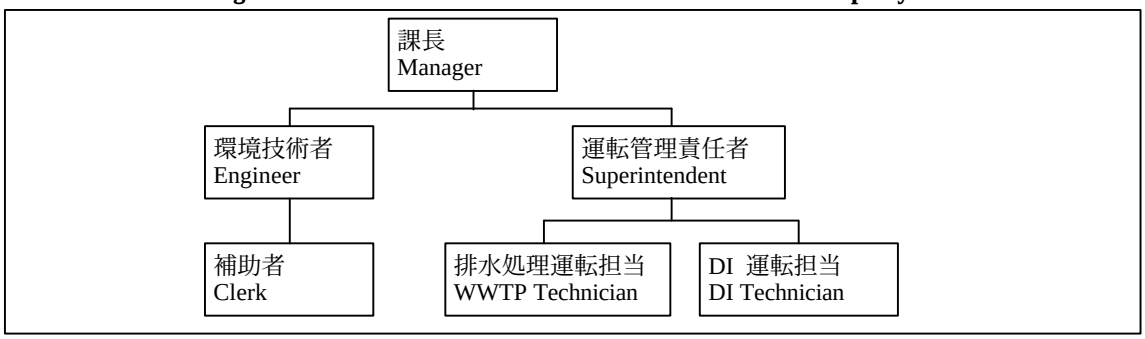


Figure 2-2-11 Environment Control Section of Company C



The following are examples of targets for the company's 1998 ISO14001 activity goals for reduction of environmental loads:

Reduction by 40 % of the use of flux in soldering process,
Reduction of paper consumption by 5 %,
Reduction of electricity consumption for lighting in No. 3 Building by 45 %, and
Termination of the use of CFCs.

The company has successfully achieved all the goals. Now in 1999 the company works hard to reduce electricity consumption in other buildings.

d. Others.

The plant generates about 1.5 tons of scheduled wastes for which methods of treatment and disposal are specified by the government. The sludge from waste treatment is consigned to Kualiti Alam. The recyclable wastes such as spent oil are consigned to the authorized treating companies for reuse or recycling.

As social contribution, the company supported construction of a care facility for people with Down's syndrome. The company first formed the parents' organization for peoples with Down's syndrome and worked for the government for the construction of the care facility. The company provides a financial support to the care facility to cover the managerial and equipment costs. The company also encourages its employees to participate in volunteers' activities for supporting the physically handicapped. The company pays special bonuses to employees with remarkable performances in the volunteers' activities.

Case 4 Example Coping with a Strict Standard for Cyanide Compounds in Wastewater

1) Outline of the Company

Company D
Business line: Surface treatment and metal plating of electric and electronic parts
Number of employees: 80
Start of operation: 1990
Location of the plant: Industrial Estate in Selangor State 20 km to the west of Kuala Lumpur
Japanese equity ratio: 100%

2) Background

A large number of Japan-based electric manufacturers have advanced to Malaysia. Local companies are generally not technically well prepared to provide plating on their products. Therefore, a couple of Malaysian arms of Japanese companies, including Company D, provide metal plating on the products of Japanese companies in Malaysia. To avoid a worst situation in which the company is obliged to stop operation due to poor environmental conservation measures, the company has taken a thorough measure in its environmental measures, wastewater treatment in particular.

The processes of copper plating and nickel plating produce wastewater, containing nickel and cyanide compounds, respectively. The Malaysian standard for cyanide compounds is much stricter than its Japanese counterpart. Besides, there is no standard for nickel in the Japanese government effluent standards. Under such a circumstance, the company was forced to build a highly advanced wastewater treatment plant.

3) Measures Taken by the Company

a. Wastewater Treatment

Figure 2-2-12 shows the effluent standards imposed on Company D. The standards are B Standards, which are considered generally mild; however, its standard for cyanide compounds (CN), 0.1 mg/liter, is as strict as one-tenth the Japanese standard of 1 mg/liter. Its standard for nickel (Ni) is also strict at 1.0 mg/liter.

Figure 2-2-12 Effluent Standard for Company D

(Unit: mg/liter)

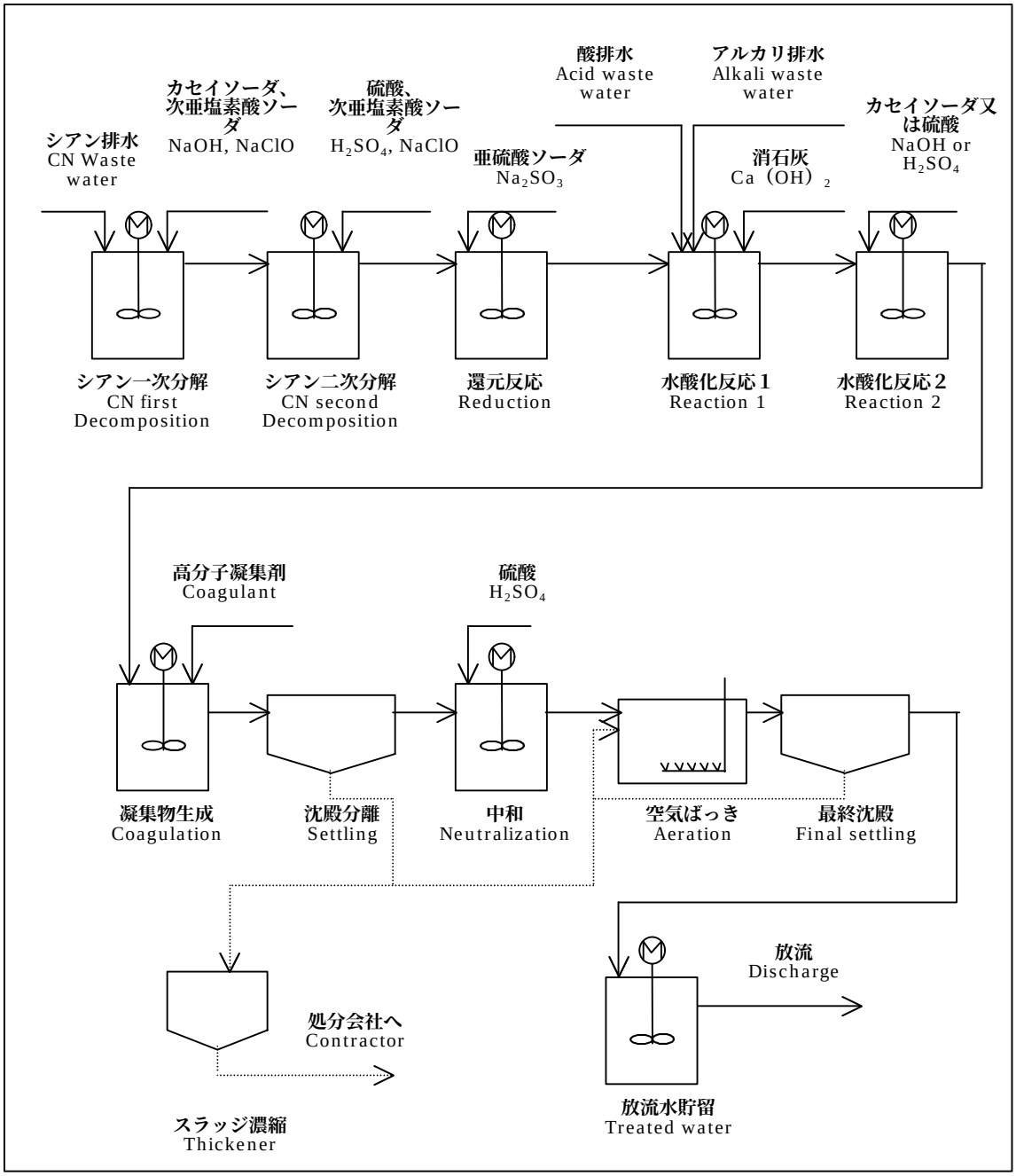
Item	pH	COD	BOD	SS	Cu	Ni	Zn	CN
Standards	5.5 to 9.9	100	50	100	1.0	1.0	1.0	0.1

A wastewater treatment plant shown in Figure 2-2-13 has been constructed to satisfy these standards. The construction was contracted to a Japanese company of reliable technology, although the Japanese company was much costlier.

The CN wastewater is received in the CN First Decomposition Tank where caustic soda is added to bring the pH value to 11. While the pH value is maintained at 11 sodium hypochlorite is added to oxidize and decompose the cyanide compounds. In the CN Second Decomposition Tank sulfuric acid is added to lower the pH value to 7 and sodium hypochlorite is further added to promote oxidation decomposition.

The control of oxidation of cyanide compounds is very difficult and can be dangerous. Either decomposition is insufficient or a deadly poisonous hydrocyanic gas is generated if the solution is made too acidic by addition of an excessive amount of sulfuric acid. The oxidation agent must be added carefully and in the right quantity while monitoring oxidation-reduction potential. After the cyanide compounds have been completely decomposed, the residual sodium hypochlorite is decomposed by addition of sodium sulfite, a reducing agent.

Figure 2-2-13 Flow of the Wastewater Treatment of Company D



For the removal of such heavy metals as iron, nickel and copper, the solution is again made alkaline with the pH value of around 10 by the addition of slaked line, $Ca(OH)_2$, to convert these heavy metals into water-insoluble hydroxides. Then, a polymer coagulant is added to form large flocs out of metal hydroxides to let them sediment in the setting basin. The polymer coagulant is purchased from a Japanese water treating equipment manufacturer.

The clear supernatant water now made free from heavy metals is neutralized to a pH value of about 7 and is subjected to a biological treatment to decompose dissolved organic compounds. The treated water is temporarily stored in a retention tank and is discharged to the public waters after it is confirmed that the

water satisfied the effluent standards.

Nickel hydroxide, unlike hydroxides of other metals, tend to adsorb water-soluble nickel salts. After the hydroxide is settled, the hydroxide gradually releases the adsorbed water-soluble nickel salts in the solution. This unique nature of nickel hydroxide makes it extremely difficult to bring down nickel concentration to lower than the value specified as the standard. To cope with such a tendency of nickel, this plant has two consecutive reactors to complete treatment of nickel.

Company D confirms by it own laboratory testing that the treated water satisfies the standards for pH, cyanide compounds, nickel, COD. Once in a month the company asks two authorized testing company to analyze the treated water and check their results with their own results.

This wastewater treatment is operated by local employees who have done their work right for more than seven years. The Malaysian operators have never caused any problem.

b. Solid Waste Treatment

The two types of sludge, one from the sedimentation of metal oxides and the other from that of the wastewater biological treatment, are concentrated in the thickener. The concentrated sludge transported by registered contractors to the only authorized waste treating and disposal agent, Kualiti Alam, for treatment or disposal. Until Kualiti Alam started operation in 1997, the sludge had been stored in the premises of Company D to the capacity of the plant. The company exported nickel containing sludge to the United States for nickel recovery.

c. Others

The plant has discharged its household wastewater to the sewerage system. The Indah Water Konsortium, IWK, operates the sewerage treating system. IWK used to a government sector entity but now it has been privatized. When IWK was a government sector entity there was no charge for discharge but IWK began charging treating fees upon becoming a private company. At first IWK charged the company the fee based on the amount of running water the plant received. Company D asked for a reduction of the fee corresponding to the wastewater portion that the company discharges to river after treatment to clear effluent standard, then this request was accepted. Presently, sewerage treatment charge from IWK is calculated based on the number of employee at the plant.

Case 5 Example of Managing its Household Wastewater Based on its Own Standards

1) Outline of the Company

Company E
Business line: Manufacture and sale of such electronic parts as tip capacitors and thermisters
Number of employees: 1,650
Start of operation: 1989
Location of the plant: Industrial Estate in Negeri Sembilan State 50 km to the south of Kuala Lumpur
Japanese equity ratio: 100%

2) Background

The Malaysian government has set strict standards upon household wastewater. Very strict standards are imposed particularly when the discharge point to the public waters is located upstream of the intake point of the drinking water. The plant of Company E is located upstream of the intake point of the drinking water and therefore the plant has to observe these strict standards.

The plant is an assembly industry; therefore, its manufacturing processes do not produce wastewater. However, a large number of people working in the plant produce a large quantity of household wastewater. The company has set up its own standards stricter than the government standards so that the government standards may never be exceeded.

The Japanese parent company has declared its environmental charter as enumerated in Figure 2-2-14 and requires its overseas affiliates to behave according to this charter. Clause 2 of the Guideline for Activity sets forth observation of laws and regulations. In line with this guideline, the company has a thorough organization to observe the standards indicated by the Malaysian government.

The electronic parts this plant produces are delivered to assembling plants of electric appliances of Japanese and European capitals in Malaysia.

Figure 2-2-14 Environmental Conservation Charter of the Japanese Parent Company of Company E

Basic Principle
The Company E group declares as its basic principle for environmental conservation activities that everyone in the company recognizes that the global environment nurtures every living thing and joins to act to hand down the favorable environment of the Earth to the next generation.
Basic Policy
The company, in its business activities, opts to choose activities compatible with the recycle-oriented society, with due consideration given to the global environment, of which environmental conservation, energy conservation and resources conservation are key elements.
Guideline for Activity
The Company E group will remain to be a good corporate member of the society. The company will strive to realize its Company Charter by promoting corporate activities while paying sound attention to the global environmental issues and resource preservation. The company determines the Guideline for Activity as set forth below.
Article 1 The company has an organization, with the director in charge as the head, to promote environmental conservation activities. The company ever strengthens this organization and promotes its activities.
Article 2 The company observes law and regulations. At the same time, the company upgrades levels of environmental management.
And Six other articles.

3) Measures Taken by the Company

a. Wastewater Treatment

Figure 2-2-15 shows the standards indicated by the Department of Environment (DOE) to Company E

together with the company's own standards.

Figure 2-2-15 Government and its Own Effluent Standards of Company E

(Unit: mg/liter)

Items	BOD	COD	SS	Oil and grease
DOE's standards	20	50	50	N.D.
Company's own standards	15	40	40	N.D.

The standard indicated by DOE are A Standards applicable to effluent water located upstream of a drinking water intake point. The A Standard has 23 items and the effluent water has to normally satisfy all 23 items. However, since this plant does not discharge heavy metals and hazardous substances, the company has only to satisfy the above four items. The above standards for household wastes are no less severe than those of Japan, North America and Europe and can only be met with highly advanced treating facilities operated under strict controls.

The company has set its own standards more stringent than the official ones in order to be sure to meet the official standards. The plant takes corrective actions immediately when the BOD value is found to exceed the standard value of 15 mg/liter, thus preventing it from exceeding the official standard value.

The company has the effluent water analyzed by a registered testing company once in every two months and reports the results of test to DOE. So far, the wastewater has satisfied all items of the standards.

b. Establishment of Environmental Management System

Company E acquired the ISO14001 certification in April 1998. Since the company has been devoting itself to environmental activities, rightly doing what should be done in the field of environmental conservation has lead to acquisition of the ISO14001 certification. Activities for acquiring the ISO14001 certification helped energy conservation, enhanced yields of products and reduction of production costs as results. The company has well recognized the fact that the investment in preventive environmental measures pays off compared to taking corrective measures after problems have emerged.

In order to let the Environmental Conservation Charter of the parent company work in the plant activities, Company E has established its own Environmental Policy based on the principle of the ISO14001 but more specific suited to the operation of the company. In addition, the Environmental Policy has announced eight articles including energy conservation, resources conservation, promotion of recycling, internal auditing, review of environmental management, contribution to the local community. The Environmental Policy has set forth practical targets, of which the following three items are targeted to be achieved within the three-year period starting from March 1998:

Reduction by 50 % of defective products,
Reduction of electricity consumption by 40 %, and reduction of water consumption by 25 %, and
Increase in the rate of recycling of paper to 40 %.

The company has four committees relating to environmental management activities; namely, the Environmental Management Committee, the 5S (an operation management slogan consisting of five Japanese words which start with "S" in romanized spelling) Committee, the Canteen Committee and Internal Audit Committee. Each of the four branches of the plant has its own environmental management committee, with its own chief. The environmental management committees measure volume of inputs (materials) and outputs (products), thereby controlling production of wastes. The Department of Quality Control and Guarantee works as the secretariat of the activities and coordinates and promotes the total activities. This department is instrumental in promotion of environmental management program. The assigned job of the department includes; improvement of yields and associated reduction of wastes, enhancement of productivity with energy saving, reduction of electricity consumption by right lighting and air conditioning in the plant buildings, reduction of water consumption by right use of water at the canteen, reduction of consumption of paper by more intensive use of e-mails,

and so on. Each branch of the plant announces its own targets and reviews degrees of achievement in every six months.

c. Solid Wastes Treatment

The plant produces the following three kinds of scheduled waste, for which the methods of treatment and disposal are officially specified:

- Ferrite sludge (generated when the raw material ferrite is treated),
- Spent solvent (generated in the soldering process), and
- Spent epoxy resin (generated in the sealing process).

Formerly, these kinds of waste had to be stored in the premises of the plant. The plant had a ten-year stock of drums containing these kinds of waste. Since establishment of Kualiti Alam, the only authorized final treatment and disposal agent, the company has consigned treatment and disposal of the waste to Kualiti Alam.

It is obligatory to report stock of spent solvent to the DOE every month.

d. Exhaust Gas Treatment

The exhaust gas from the soldering process is analyzed for the four items shown in Figure 2-2-16 once a year by a registered testing company. The sample is taken at a point immediately upstream of discharging to atmosphere.

Figure 2-2-16 Exhaust Gas Standard for Company E

Subject substances	Standard (mg/Nm^3)
Acetone	400 (Company's own standard)
Iso-propyl alcohol	405 (Company's own standard)
Rosin	98.0 (Company's own standard)
Lead	25.0 (Government standard)

Of the above standards, the standard for lead is the government standard and other three standards are company's own standards set for voluntary monitoring after Japanese standards.

Section 3
Cases of Establishing an Environmental Management System

The International Organization for Standardization (ISO) issued in September 1996 the ISO14001 standards for environmental management system. The acquisition of the ISO14001 certification means much to indicate that the subject company conducts its business activities with due environmental conservation. Acquisition of the certification should also be advantageous in international businesses. As of the end of 1999, 116 plants or factories in total have acquired the ISO14001 certification in Malaysia. These plants and factories are mostly of Japanese capitals. The first to acquire the ISO14001 certification in Malaysian is a Japanese company. Some of these companies have well established the system of ISO14001 in their companies and scored remarkable accomplishments during the three-year period under the ISO14001 standards. Some Malaysian experts, with experiences gained in the process of acquiring ISO14001 certification in Japanese companies in Malaysia, have moved to other companies where they are playing instrumental roles in acquisition of the ISO14001 certification. This could be considered as a contribution by the companies of Japanese capitals to human resources development of Malaysia.

Case 6 Example of Steadily Growing under the ISO14001 System

1) Outline of the Company

Company F
Business line: Manufacture of main components of television sets
Number of employees: 3,800
Start of operation: 1988
Location of the plant: An industrial estate in Selangor State about 20 km to the south of Kuala Lumpur
Japanese equity ratio: 100%

2) Background

Company F's parent company in Japan has established the basic environmental policy as shown in Figure 2-3-1 that is applicable to its all group companies in overseas. The parent company assists its group companies throughout the world in promoting their environmental activities according to this basic policy. A group company in Singapore plays a role of coordination for business communication from Japan and for information exchange among group companies in Southeast Asia

Company F established the Environmental Protection Committee as early as 1992 and started education for employees on environmental conservation so that every employee could be environmentally conscious. These efforts made the employees easily respond to the ISO14001 standards when the company acquired the certification in 1997. During the three-year period since the acquisition of the ISO14001 standards, the Malaysian managers have played important roles in assessing achievements and reviewing objectives. The company has already set up practical goals for the year 2002 and the movements for achieving these goals are effectively integrated in the environmental conservation system of the company. The company's business is mainly engaged in assembling works and therefore does not produce industrial wastewater. Naturally, the company's environmental load is only emission of the vapor from an organic solvent and a fume containing lead used as flux in soldering.

Figure 2-3-1 Environmental Policy of Japanese Parent Company of Company F

Principle
Our company believes that conservation of the global environment is one of the most important issues that commonly affect human beings, and gives sound consideration to environmental conservation in all aspects of our corporate activities.
Policies
1. Our company will improve all necessary structures within the group companies throughout the world to effectively promote their environmental conservation activities.
2. Our company will rightly assess environmental impacts of our corporate activities, set environmental targets or objectives to the extent technically and economically possible, and continuously improve quality of our activities for environmental conservation.
3. Our company will abide by all laws, rules and regulations, and agreements on the issues of environment, furthermore, will set our own standards to improve our activities for environmental conservation.

And Other 10 articles

3) Measures Taken by the Company

a. Establishment of the Environmental Management System

Major events since 1992 regarding environmental management system are as follows.

1992 - The company established the Environmental Protection Committee.
- The company promoted planting of trees in the premises of the plant. The company was awarded the grand prix in Hulu Langat District and was awarded the second prize in Selangor State for "Plant with beautiful sight."

1993 The company established a strict procedure for monitoring chemical wastes and household wastes in line with the laws and regulations.

1994 The company prepared an environment lobby where the employees can receive education on environmental conservation.
The company installed a compressing compactor and reduced by half the number of truck traffics for bringing out wastes. Thus, the company contributed to the reduction of fuel consumption and the emission of carbon dioxide.

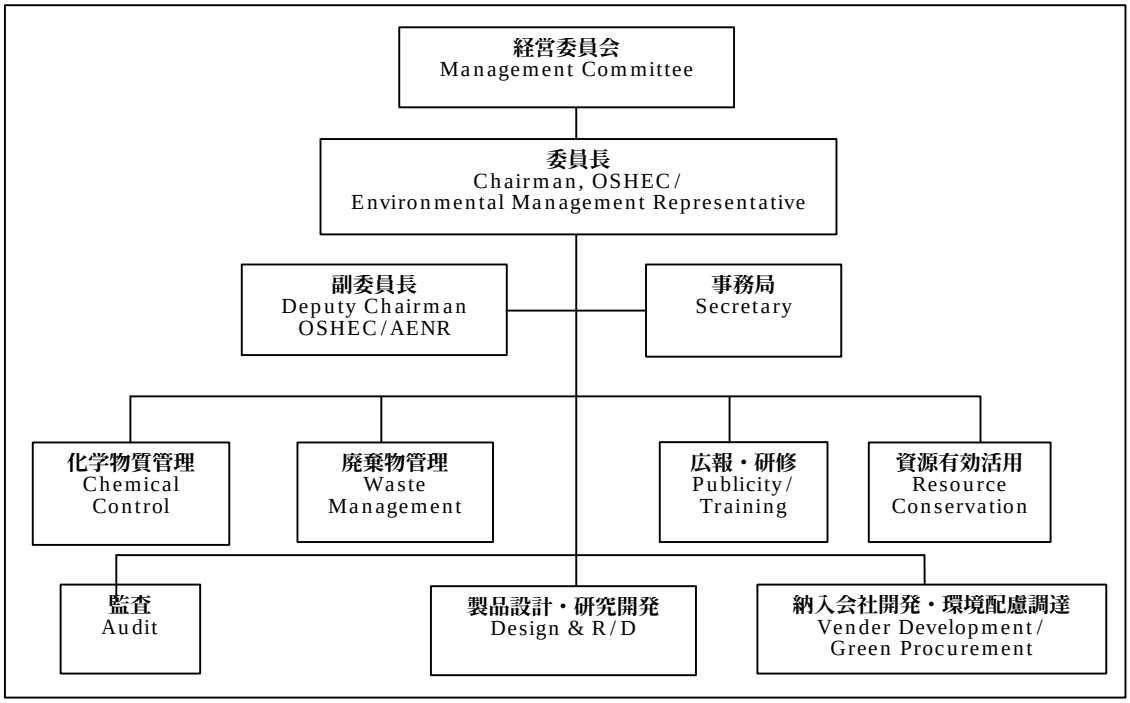
1995 The company reorganized the Environmental Protection Committee as a step for preparation for acquisition of the ISO14001 certification.

1996 The company established a special department in charge of occupational safety, health and environment.
The company set an objective of acquiring the ISO14001 certification within one year and started working for this objective.

1997 The company acquired the ISO14001 certification from a Malaysian accredited certifying organization.
The company established the Occupational Safety, Health and Environmental Committee (OSHEC) to be exclusively in charge of these issues.
The company held seminars to 21 chemical suppliers on enhancement of environmental consciousness and environment-related laws and regulations.
The president of the company was appointed a member of the Committee for Environmental Labeling and the vice president a member of the Committee for Life Cycle Assessment, both being the government committees.

OSHEC reports to the Management Committee chaired by the president of company F. The chairperson of OSHEC is a Malaysian manager. As is shown in Figure 2-3-2 this committee has seven acting subcommittees of which one is the Chemical Control Group. Each group consists of 4 to 5 persons representing workplaces related to the assignment of the group. In the company, this committee takes comprehensive measures towards environment that includes the related issues such as safety and human health to realize synergetic effects.

Figure 2-3-2 Opccupational Safety, Health and Environment Committee (OSHEC) of Company F



The Chemical Control Group controls spent chemicals as well as raw material chemicals so that these may be adequately consumed. The Waste Management Group controls such general wastes as paper and kitchen wastes. The Publicity/Training Group is in charge of enhancing environmental awareness within the company and promoting social contribution in environmental aspects. The Resource Conservation Group is engaged mainly in reduction of electric power consumption. The Audit Group appraises degrees of achievements of goals set by various workplaces not limited to the ISO14001 goals but including safety and human health. The Design & R/D group, recently instituted, incorporates environmental measures from the stage of design to effectively produce new products of minimum environmental load. The Vender Development/Green Procurement Group works together with the suppliers of raw materials and parts so that their manufacturing processes may be improved to minimize their adverse impacts on the environment.

b. Achievements of the Environmental Management System and Objectives (Goals)

The activities promoted by OSHEC since acquisition of the ISO14001 certification have made remarkable accomplishments. The past achievements are evident in the number of items requiring improvement pointed out by the internal and external ISO14001 audits, each done twice a year. The number of items requiring improvement pointed out by the internal audit was 151 in May 1997 but it decreased to 13 in January 1999. Similarly, the number of items requiring improvement pointed out by the external audit was nine in June 1997 but it was none in February 1999.

The company embarked on an aggressive program called Green Management 2002 aimed at achieving the objectives explained below by the year 2002. Each group of OSHEC has formulated the following objectives and is working hard to achieve them. The degrees of achievement of these objectives are evaluated every year and the objectives are modified depending upon the past progresses.

Chemical Control Group

The objective is to achieve zero emission of volatile organic compounds and the fume containing lead.

Waste Management Group

The objective is to reduce consumption of printing and copying paper by 15 %.

Publicity/Training Group

This group enhances employees' awareness on the issue of environmental conservation. This group also works for betterment of the community's environment including planting of trees. In 1997 this group executed the Organization Community Relation Project jointly with the Bureau of Development of the state government. In this program this group took part in cleaning of roads, pruning and planting of trees. The Malaysian manager of OSHEC has acquired qualification of auditor for ISO14001 from the Standards & Industrial Research Institute of Malaysia (SIRIM). In this capacity this manager gives lectures at seminars and training courses of group companies or non-related companies.

Resource Conservation Group

The objective of this group is reduction consumption of electric power by 15 % compared to that of 1997. The measures taken to achieve this objective include such daily practices as, turning off the lights of the room where no work is being done, installing curtains at the inlets and outlets of rooms to prevent cooled air from escaping the air-conditioned rooms, and placing of light shielding screens on window panes to prevent direct sunlight from entering rooms. Another objective is 40 % reduction of wastes that are either incinerated or landfilled.

Design & R/D Group

The group set eight objectives including reduction of the standby electric power to less than one watt, reducing the consumption of polystyrene by 60 % and increasing the rate of recycling to 60 %. Part of design function of the Japanese parent company will be transferred to this group so that design capability of this company may be strengthened to incorporate concept of environmental conservation at the design stage of new products, thereby eventually producing products of minimum environmental impacts.

Vender Development/Green Procurement Group

The objectives of this group concern the suppliers of materials and consumables. This group helps them use an increasing amount of recycled materials, reduce consumption of packaging and packing materials, realize more rational transportation, and supply more materials that do not produce dioxins when

incinerated or disposed of. This group also provides the suppliers with technical assistance in converting their processes into more environmentally compatible ones.

d. Exhaust Gas Treatment

Standards are set for Company F for emission of dust and lead. The company asks a registered testing company to conduct monitoring and analysis. The Company reports the results of analysis to the Department of Environment. Figure 2-3-3 shows one example of such data. The effluent gas satisfies the standards at all six emission points.

Figure 2-3-3 Emission Standards and Measurement Examples

(Unit: mg/Nm^3)

Items	Standards	Emission Point (within the plant premises)					
		A	B	C	D	E	F
Dust	400	1.01	1.01	5.40	0.34	0.68	0.34
Lead	25	16.86	4.22	14.33	22.77	7.60	8.45

Aside from the emission standards, concentrations in the air of lead and methylene chloride and tolerable noise level are specified from the viewpoint of maintaining safe working conditions by the Factories & Machinery Regulation of 1989. These data are also measured by a registered testing company once a year.

e. Solid Waste Treatment

The dross, a mixture of oxides of lead and tin, is produced in the soldering process at a rate of about 16 kg a month. This is sold to a registered recovering company. In the plant, waste flux is also generated, actually a degradated iso-propyl alcohol used as a flux, at a rate of about 12 kg a month. The company subcontracts a registered treating and recovering company to recover Iso-propyl alcohol from waste flux by paying a treating fee. The stained gloves produced in the soldering process, waste cloth and spent chemicals are consigned to Kualiti Alam, the only authorized final treating and disposal company of Malaysia for incineration or landfilling. The household wastes are disposed at a landfill site located outside the industrial estate managed by the local government.

Case 7 A Malaysian Manager Playing Central Roles for Preparation for Acquisition of the ISO14001 Certification

1) Outline of the Company

Company G
Business line: Manufacture of such electronic devices as variable resistors, tuners
Number of Employees: 6,300
Start of operation: 1989
Location of the plant: An industrial estate in Negeri Sembilan State 50 km to the south of Kuala Lumpur
Japanese equity ratio: 100%

2) Background

The company's products are internationally traded. With rising concern of their customers about environmental conservation, it is now inevitable for the company to acquire the ISO14001 certification. Besides, one of the management policies of the company is to give sufficient environmental consideration in its business activities. The company has to acquire the certification as an evidence of the company's policies.

The acquisition of the ISO14001 certification requires a leader with professional expertise in environmental management. On the other hand, Company G's Japanese expatriates have been reduced to only slightly more than ten who are engaged mainly in transfer of production technology as part of the rationalization program.

Under such a circumstance, it was considered most reasonable to find and assign experienced local expert for preparation of the ISO14001 certification. As of the end of 1999, 116 plants or factories have acquired the ISO14001 certification in Malaysia. This means that Malaysia has a good number of local experts. The company also considered that the preparation for acquisition of the ISO14001 certification would work well under a Malaysian leader. The company expected the fact that Malaysian leader tackles with environmental problems would enhance all employees' awareness on environmental conservation.

3) Measures Taken by the Company

a. Establishment of the Environmental Management System

Company G decided in 1998 to acquire the ISO14001 certification and began selecting a right person for the leader. The company decided to recruit an experienced person because it would take long time and large cost to train one of the employees to the necessary professional level. In the beginning of 1999, the company recruited a suitable expert and appointed him a manager in charge of facilities and equipment.

This manager had a degree in mechanical engineering in the United Kingdom. After returning to Malaysia, he worked for an electric utility company and a bearing manufacturer of Swedish capitals. While he was in the bearing manufacturer, he obtained qualification as environmental auditor of ISO14001 and gained experience related to the ISO14001 standards through actually working in this field. The company started preparing for acquiring the ISO14001 certification in March 2000 with placing this manager as a core person of the activities.

The company made a statement on its environmental policy in April 1999 and established the Environmental Management System (EMS) Committee. The environmental policy was a very simple and easy to understand, consisting of six clauses which include environmental consideration, reduction of waste, concerted effort of the employees for achieving the objectives. Figure 2-3-4 is the organization chart of the EMS Committee. EMS Steering Committee headed by a Malaysian director was instituted directly below the Board of Directors which is presided over by the president. The Steering Committee consists of seven members including Japanese expatriates and Malaysian executives. The position of Environmental Management Representative (EMR) was instituted to support the Steering Committee.

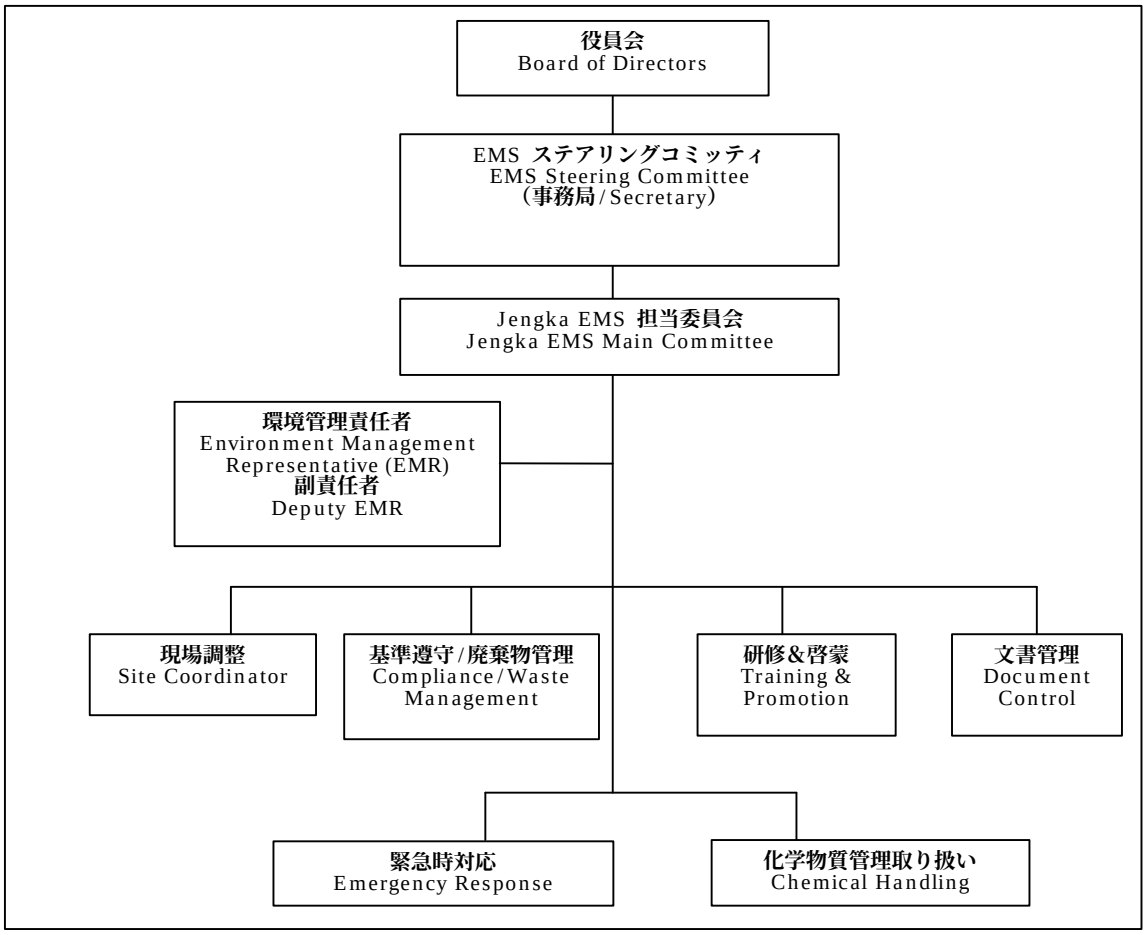
The newly recruited Malaysian expert was appointed the EMR and the secretary to the EMS Steering Committee.

The Steering Committee has six working groups; namely, the Site Coordinator Group, Compliance/Waste Management Group, Training & Promotion Group, Document Control Group, Emergency Response Group and Chemical Handling Group.

Company G has another plant in Jengka of Pahang State, which has started preparation for obtaining the ISO14001 certification before the above-described plant.

The company's environmental objectives for the ISO14001 are focused on energy saving. The objectives include improvement of the drain system, replacement of mercury lights with fluorescent lights, turning off unnecessary lights, right temperature control of air conditioners.

Figure 2-3-4 EMS Committee of Company G



b. Environmental Impacts

The plant does not discharge industrial wastewater because the plant is engaged mainly in assembling parts. The household wastewater is subject to control. The effluent gas subject to control are fumes containing lead and gas containing vapor of the flux. The household wastewater is treated by aeration in a sewerage treatment tank packed with gravel. The A Standards shown in Figure 2-3-5 of the Malaysian government is applied to the treated household wastewater. The A Standards are very strict ones applied to effluent water discharged upstream of the intake point of the drinking water.

Figure2-3-5 Effluent Standards for Company G

(Unit: mg/liter)

Item	Temperature, °C	pH	BOD	COD	SS	Oil & Grease
Standard	40	6.0 - 9.0	20	50	50	N.D.

There are four sewerage treatment tanks to each building. Each sewerage treatment tank has it own discharge point to the river independent of other sewerage treatment tanks. The company commissions a registered testing company to take samples from every discharge point, and to analyze them every three months. The results of analysis have been below the standards so far. The company has been reporting the results of analysis to the Department of Environment.

The wastes the plant discharges include solder debris, spent oil and bottles for chemicals produced at the soldering process. The solder debris is sold to a licensed treating and recovering company. The plant discharges as much as 250 drums of spent oil which is also sold to a licensed treating and recovery company.

c. Others

The company promotes in the plant the 5P movement, the Malaysian equivalent of the Japanese 5S movement promoting good organization, orderliness, cleanliness, standardized cleanup and discipline. The company finds it difficult to have the employees understand cleanup as part of their works. It is their common understanding that cleanup is a job for those who specialize in it. They also have a tendency not to regard such naturally degradable things as wood chips and cigarette ends as subject of cleanup, though they consider plastics and glass debris refuses to be picked up.

Case 8 Example Trying to Acquire the ISO14001 Certification with Energy Conservation as a Main Objective

1) Outline of the Company

Company H
Business line: Manufacture and sale of flush toilet seats with warm water cleansing function
Number of Employees: 359
Start of operation: 1997
Location of the plant: An industrial estate in Negeri Sembilan State 60 km to the south of Kuala Lumpur
Japanese equity ratio: 100 %

2) Background

Company H produces typical consumer goods, and it needs to give consumers with a good impression about environmental conservation for its manufacturing processes. The company has therefore decided to obtain the ISO14001 certification as a means of enhancing the public image of the company.

The company had set up objectives for reducing the environmental load. However, the manufacturing processes are mainly assembling lines; therefore, their environmental load is basically very low since the beginning, with very little wastewater and waste gas being emitted. So, the company has decided to concentrate on reducing consumption of electric power, which leads to reducing emission of carbon dioxide, a substance causing the global warming.

The company has chosen this industrial estate for the location of the plant to give a good corporate image in another way. This industrial estate is called “Industrial Park” instead of “Industrial Estate.” As the name implies, this industrial estate really gives an impression of a park with lot of greens with no poles to support cables. Cables are all laid underground. This industrial estate is designed to harmonize with the surrounding residential areas.

3) Measures Taken by the Company

a. Establishment of the Environmental Management System

All the 16 group plants located in Japan have been instructed by the head office to acquire the ISO14001 certification by the end of the year 2000. This instruction is not necessarily applicable to overseas plants. Nevertheless, Company H has decided of its own to proceed with the schedule applied to the Japanese plants. The company started in October 1999 preparing for acquiring the ISO14001 certification. The company has decided to send their 21 Malaysian managers for training and seminars for ISO14001. As objectives, the company chose the reduction of electric power consumption and household waste amount.

The company plans to adopt a measure particularly effective in the tropical zone. This measure is to fully cover the roofs with a heat insulating paint developed by NASA as one of the technologies for space exploration. This paint is very effective in reflecting the intense direct sunlight of the tropical zone and helps prevent the building temperature from rising, thereby reducing electric power consumption for air conditioning. It has been found that exposure to direct sunlight is the greatest factor in raising the building temperature. This measure should be very effective in this area where air conditioning accounts for the greater part of electric power consumption. This measure is reported to have lowered the inside temperature of a building in Singapore by 5°C. The cost is estimated at 1,700 yen/m^2 but this cost would be paid back in two years.

Reduction of paper consumption is planned to reduce household wastes. The company will introduce a new system of managing orders through internet instead of sending paper vouchers both inside and outside the company. Every Malaysian manager is equipped with one portable note-type computer, for promoting paperless business transactions.

b. Wastewater Treatment

The plant does not dispose of industrial wastewater, exhaust gas nor hazardous wastes because the plant is

mainly engaged in assembly works. The household wastewater is only subject to control. The wastewater is discharged to a river running near the plant. The discharge point is located upstream of the intake point of the drinking water; therefore, the very severe A Standards of the government are applied to the wastewater from the plant. The wastewater has to meet all the standards specified in 23 items. The company has been asked to regularly monitor the following six items shown in Figure 2-3-6. The standard for BOD, 20 mg/liter, is as strict as one-eighth the Japanese standard of 160 mg/liter.

Figure 2-3-6 Effluent Standards for Company H

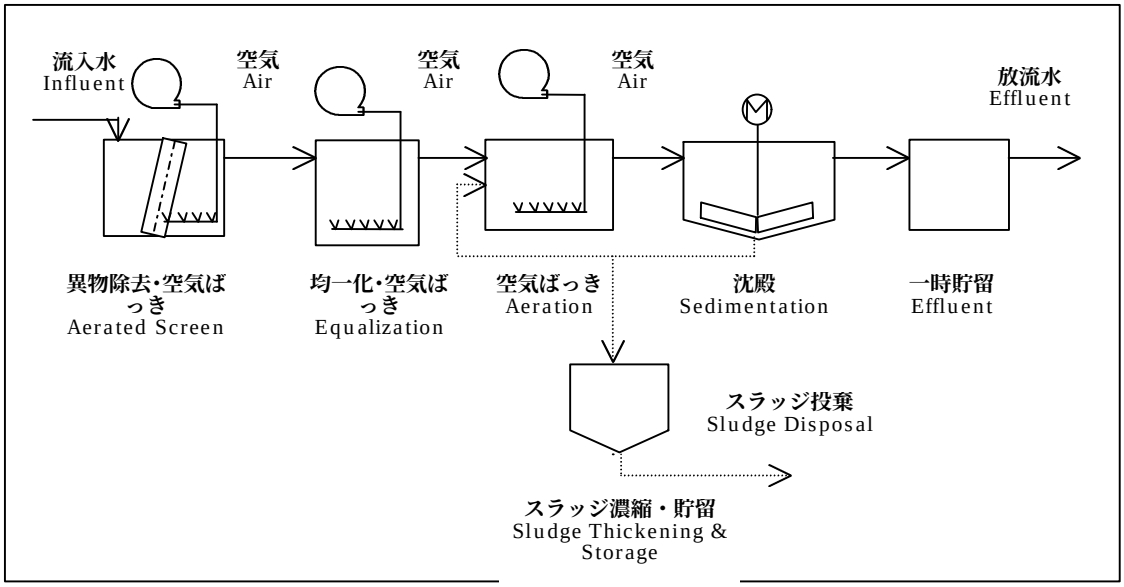
(Unit: mg/liter)

Item	Temperature, °C	pH	BOD	COD	SS	Oil and grease
Standard	40	6.0 - 9.0	20	50	50	N.D.

The company operates two trains of the wastewater treatment plant shown in Figure 2-3-7. The wastewater entering the plant goes through an aerated screen to remove such foreign materials as plastic bags. Then, the wastewater enters the equalization tank where water is agitated by aeration to be homogenized. Subsequently, the wastewater is subjected to activated sludge treatment whereby organic substances are decomposed by biological treatment while being aerated. The bio-treated water is fed to the sedimentation basin where the water is separated into clear supernatant water to be discharged and sludge. The sludge is recycled back to the aeration tank to be used for biological treatment. A portion of the sludge withdrawn from the sedimentation basin is taken out of the system as excess sludge. The excess sludge is concentrated in the sludge thickening & storage tank. The concentrated sludge is treated and disposed of by the authorized disposal company.

The unique feature of this treating system is intense aeration. Normally, aeration is limited to biological treatment. This system starts aeration from the beginning at the point of receiving. The extended period of time during which the wastewater is intensely in contact with air promotes decomposition of organic substances. The company asks a testing company to measure BOD, COD and pH of the treated water every three months and reports the results of tests to the Department of Environment. The two trains have a combined capacity to treat the household wastewater for 574 people. The two units have allowance of capacity for the present number of people working in the plant. The allowance of capacity and intense aeration combined make the effluent water clean enough to satisfy the standards.

Figure 2-3-7 Flow of Household Wastewater Treatment for Company H



c. Solid Waste Treatment

The plant produces such wastes as plastics, cardboard boxes, used paper, kitchen wastes and defective products. The plant treats them in the following manners.

Plastics: 4 tons/month of plastic waste is generated such as runner channel rejects and defective plastic products. The plastic waste is sold to a recovery company at a price of 0.60 yen per kilogram. The recovery company grinds the waste into small chips and reuses them. In June 1999, the company remodeled portion of excess quality of the products and reduced the rate of defective products, with the help of the Japanese parent company.
Cardboard boxes: The plant sells the used cardboard boxes to a recycling company at a price of 0.10 yen per kilogram.
Used paper: The plant discharges about 500 kg of used paper a month, though the plant uses both sides of paper. The industrial estate managing company, an affiliate of the public corporation which has developed this industrial estate, periodically collects used paper.
Kitchen wastes: The industrial estate managing company periodically collects the kitchen wastes.
Defective products: Since this industrial estate is designated as bonded area, even the defective parts are not allowed to be in market. The defective products are handed over to disposal company in the presence of customs officials. The disposal company comes once in every three months in a three-ton truck to pick up the defective products and landfills them at the disposal site designated by the customs.

d. Others

When the laws and regulations about environment are revised, such information is obtained from the Industrial Coordination Council. The council members are local representatives of the Malaysian government and representatives of the business companies. The council acts as a place for information exchange on such issues as requests from industries and revisions of laws and regulation. The council has a yearly schedule and holds a meeting every month. The latest government information, for example, was informed at the monthly meetings by the Department of Environment in August 1999 and by the customs in June 1999. In the meetings, members feel free to make any inquiry.

Case 9 Example of Making Remarkable Achievements in Energy Conservation and Resources Conservation under the ISO14001 Standards

1) Outline of the Company

Company I
Business line: Manufacture of electric circuit parts
Number of Employees: 1,250
Start of operation: 1974
Location of the plant: An industrial estate in Selangor State 16 km to the west of Kuala Lumpur
Japanese equity ratio: 100%

2) Background

Company I and its overseas group companies export their products to many countries in the world including Europe. Therefore, its brand name is world-famous. Their head office in Japan gives instructions on their environmental measures to its all overseas subsidiaries including the acquisition of the ISO14001 certification by the end of 1998. Since the Malaysian government also has asked the industries to reinforce their measures for environmental conservation, the company needed to positively respond to the request of the government though the acquisition of certification.

Company I started preparation for acquiring the ISO14001 certification in November 1997 and successfully obtained the certification in December 1998. Since the plant is engaged mainly in assembling electronic parts, it has very little environmental loads with no industrial wastewater or industrial waste gas. The company, however, has made remarkable achievements in reducing raw material consumption and electric power consumption, effectively working under the ISO14001 environmental management system.

3) Measures Taken by the Company

a. Establishment of Environmental Management System

November 1997	Invite a consultant from Japan for training people at manager level on the concept of the ISO14001
December 1997	Company's own evaluation of the Environmental Management System
January 1998	Application to an accredited certifying organization and establishment of the Steering Committee Declaration of company's environmental policies Identification of the problems in the environmental aspect and setting up of environmental objectives Preparation of the documents for environmental management system
April 1998	Voluntary auditing by the company
November 1998	Auditing by the accredited certifying organization
December 1998	Acquisition of certification

Company I's environmental policies cover the most important and basic rules. They are, for example, trying not to generate emitting substances from the company's activities that have environmental impacts rather than taking measures for emissions after any problem appears, and continuously enhancing environmental consciousness at all levels of the company's organization.

In an effort to identify problems in the environmental aspect, the company distributed questionnaires to all workplaces so that people in each workplace may find out problems.

b. Performance of the Environmental Management System and Future Targets

Since the plant discharges very little of industrial wastewater or hazardous wastes that has direct impacts on environment, the company set up objectives for reducing the raw material plastics and electric power consumption which would indirectly reduces the environmental load. Figure 2-3-8 shows degree of achievement of each objective for fiscal 1998 and fiscal 1999.

The company has set the unique environmental targets so that achievement may be easily evaluated. Reduction of plastics consumption, yields of defective products and electric power consumption are expressed in terms of achievement per one piece of product. Reduction of office paper consumption is expressed in terms of one million pieces of products sold. The figures for 1999 represent the achievement up to August. The unit used for the office paper, rim, represents 500 sheets.

Figure 2-3-8 Environmental Targets and Degree of Achievement

Item	Targeted reduction	Fiscal 1998	Fiscal 1999 (up to August)	Achievement
Reduction of plastics consumption	5.0 %	3.03 %	6.06 %	121 %
Defective products yields	0.97 %	1.02 %	0.96 %	101 %
Reduction of office paper consumption	14.5 rims	15.3 rims	12.0 rims	121 %
Reduction of electric power consumption	0.15 kWh	0.19 kwh	0.21 kWh	71.4 %
Use of trichloroethylene	Terminated	Terminated by end of March		

Regarding consumption of plastics, yield of defective products and consumption of office paper, the targets were achieved by the end of August 1999. By that time, reduction of electric power consumption was achieved to the extent of 70 % and is expected to be achieved by the end of March 2000, or the end of fiscal 2000. The company promotes reuse of spent plastics produced in the manufacturing processes. Presently, the rate of recycling is low; however, it could be raised more to further reduce plastics consumption.

Use of trichloroethylene, a solvent formerly used in the degreasing process, is not prohibited in Malaysia. Notwithstanding, the company terminated the use of trichloroethylene in March 1998 in line with the policy of the Japanese parent company.

The company considers the following objectives for the year 2000 and onward.

- Reduction of the consumption of stamping oil
- Reduction of the use of hazardous chemicals
- Reduction of generation of metal scraps
- Use of adhesives with a low environmental load
- Use of lead-free solder

There is an increasing pressure, particularly in Europe, on reduction of lead-containing solder use. The Japanese parent company has decided to replace the lead-containing solder by lead-free solder by the end of March 2001. Tentatively, Company I plans to cut by half the consumption of lead by the end of September 2000. Company I participates in the R&D of the parent company to develop substitutes for lead-containing solder. The R&D program also include development of metal-to-metal joining technologies without depending on solder.

c. Others

The plant discharges stained waste cloth and spent oil. These are handed over to a registered contractor, which eventually brings them to Kualiti Alam, the only authorized waste disposal company, for treatment and disposal.

Section 4
Other Examples of Innovative Environmental Practices

Most of Japanese companies in Malaysian take voluntary measures for environmental problem in addition to those requested by the Malaysian government. The cases reported in this section include treatment of wastewater containing fluorine, measures against trichloroethylene, and monitoring the quality of underground water by checking water contamination by heavy metals.

Case 10 Example of Taking Measures in Anticipation of Regulations on Fluorine

1) Outline of the company

Company J
Business activities: Manufacture and sale of quartz crystal units
Number of employees: 2,100
Start of operation: 1979
Location of the plant: Industrial Estate in the State of Selangor 20 km to the west of Kuala Lumpur
Japanese equity ratio: 100%

2) Background

Company J has 23 % share of quartz crystal products in the world market. The products are exported to many countries in the world including Europe, where people are particularly sensitive to environmental issues. Company J makes every effort not to cause any environmental problem in order to avoid significant damage on its management. The process of etching quartz blanks employs fluorine (F), which is included in the wastewater from this process. Although there is no wastewater standard on fluorine in Malaysia now, the company has decided to take necessary measures to prevent fluorine discharge from the plant in anticipation of future official regulations on fluorine discharge.

3) Measures Taken by the Company

a. Wastewater Treatment

The manufacturing process generates wastewater containing fluorine, heavy metals, acids, alkalis, and abrasion powder slurry. Figure 2-4-1 shows the wastewater standards indicated by the Malaysian government. Although the government standards do not include fluorine, the company has voluntarily included it in the standards in anticipation of regulations to be imposed on fluorine in the future. The company's standard, 8 mg/liter, is stricter than the Japanese government standard, 15 mg/liter. The company has adopted this standard, because the Malaysian government tends to establish standards stricter than the Japanese government standards.

Figure 2-4-1 Effluent Standards for Company J

(Unit: mg/liter)

Item	pH	F	BOD	COD	SS
Standards	5.8 to 8.6	8	50	100	100

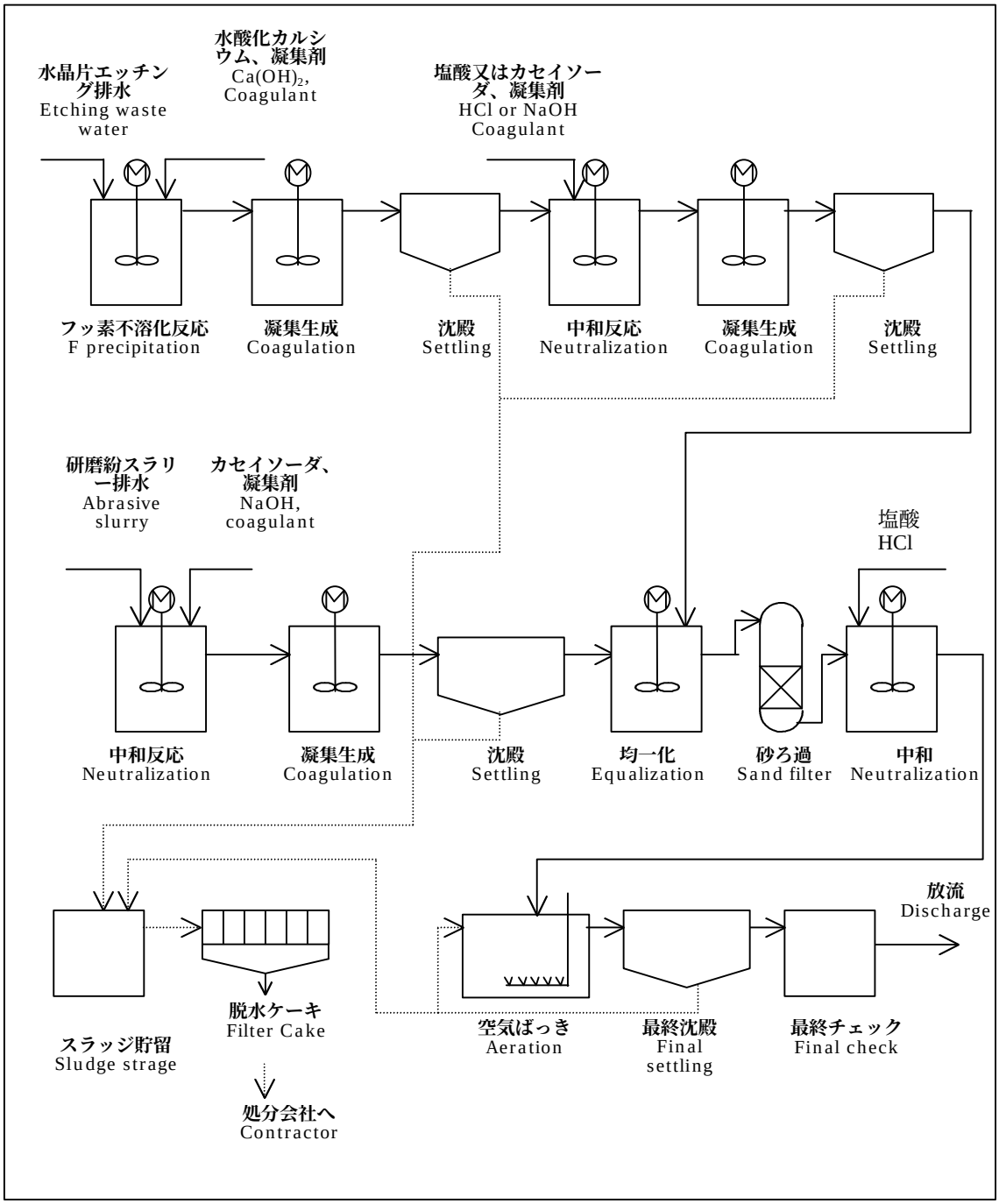
The company installed a wastewater treatment facility shown in Figure 2-4-2 to satisfy the above wastewater standards. There are two wastewater streams originating from two systems. One is the etching process of quartz blanks which generates wastewater containing fluorine and the other is the cutting and grinding process of quartz blanks which generates wastewater in the form of slurry of abrasion powder.

First, calcium hydroxide is added to the wastewater containing fluorine to convert fluorine into water-insoluble calcium fluoride. A coagulant is added to the wastewater to coagulate fine crystals of calcium fluoride to large aggregates. The aggregates are settled in the settling basin, and highly alkaline supernatant is generated. This supernatant is neutralized by adding hydrochloric acid. As the supernatant is neutralized, more coagulated masses are produced, which settle and more supernatant is generated.

A coagulant is added to the slurry wastewater containing abrasion powder to coagulate suspended abrasion powder, and to separate them from water by leaving in the settling basin. The supernatant thus generated is blended with that from the above etching process. The blended supernatant is homogenized and sand-filtered to remove fine coagulated masses, which have not been removed by settling. Subsequently, the wastewater is aerated to decompose organic substances by the help of microorganisms. Sludge is removed from the biologically treated wastewater by settling in the final settling basin to produce treated water. The treated water is discharged after its pH value is checked. The company has

a contract with a government-registered analysis laboratory for testing all items except fluorine once a month and the company reports the results of the test to DOE. Currently, all tested items satisfy the standards. The company will soon begin analyzing fluorine.

Figure 2-4-2 Flow of the Wastewater Treatment of Company J



b. Solid Waste Treatment

The manufacturing processes generate scheduled wastes such as wastewater treatment sludge, oil-containing sludge, waste oil, and abrasion powder slurry. The company had been obligated to store them in its own premises until Kualiti Alam (KA), an only final waste disposal company in Malaysia, was established in 1997. The sludge stored in the premises reached 1,400 tons, almost exceeding the limit of its storing capacity. Since KA started its operation, the company has asked KA to landfill the wastewater treatment sludge and the sludge containing abrasion powder, and to incinerate the oil-containing sludge. The landfill and incineration costs for the company amounted to 10.23 million yen and 42.35 million yen respectively, causing a heavy financial burden on the company. The wastewater treatment sludge, containing heavy metals, used to be exported to the USA for heavy metal recovery, but now the export is prohibited.

c. Others

Other than the measures explained above, the company monitors noise, fume dispersion of acids such as hydrofluoric acid, hydrochloric acid, nitric acid, and sulfuric acid, atmospheric concentrations of these acids, oil mist, and dust. The measured values of these items are all well under the standards.

The company has started preparation for acquisition of the ISO14001 certification targeted for October 2001.

Case 11 Example of Hexavalent Chromium Removal by Ion-exchange Resin and Recycling of Water

1) Outline of the Company

Company K
Business line: Manufacture and sale of automotive parts
Number of Employees: 1,100
Start of operation: 1983
Location of the plant: An industrial estate in Selangor State 30 km to the south of Kuala Lumpur
Japanese equity ratio: 81%

2) Background

Company K supplies automotive parts to a local automobile manufacturer and has a large share in the parts supplying market. The Malaysian government has set very strict effluent standards for the industrial wastewater from manufacturing plants. Under such a circumstance the company has paid all precautions to environmental conservation.

The effluent stream from the chromate process, which gives corrosion resistance to the metal surface, contains hexavalent chromium (Cr^{6+}). Formerly, the company treated this wastewater in a wastewater treatment plant, equipped with the conventional reduction process, to lower the hexavalent chromium concentration to the level meeting the strict standard set by the government. However, with increasing output of the products, the amount of chromium-containing wastewater increased to the level more than what this old wastewater treating system could adequately cope with. There was another reason for justifying a change in the treatment method. The disposal fee of sludge from the plant paid to Kualiti Alam, the only final treating and disposal company of Malaysia, would become more than three times if a large amount of sludge contains even a trace of hexavalent chromium. For this reason, the company introduced the ion-exchange resin method to give a complete treatment of hexavalent chromium on one hand and to separate the two kinds of sludge, one from the chromium treatment and the other from other sources, on the other.

3) Measures Taken by the Company

a. Wastewater Treatment

The wastewater of this plant may be broadly classified into two kinds: wastewater from the painting process containing paint debris, and that from the metal surface treatment process containing acids and alkalis. The latter wastewater contains chromium. Before the plant can discharge the wastewater to public waters such as rivers, the wastewater must meet the strict A standards specified by the Malaysian government as shown in Figure 2-4-3.

Figure 2-4-3 Effluent Standards for Company K (Unit: mg/liter)

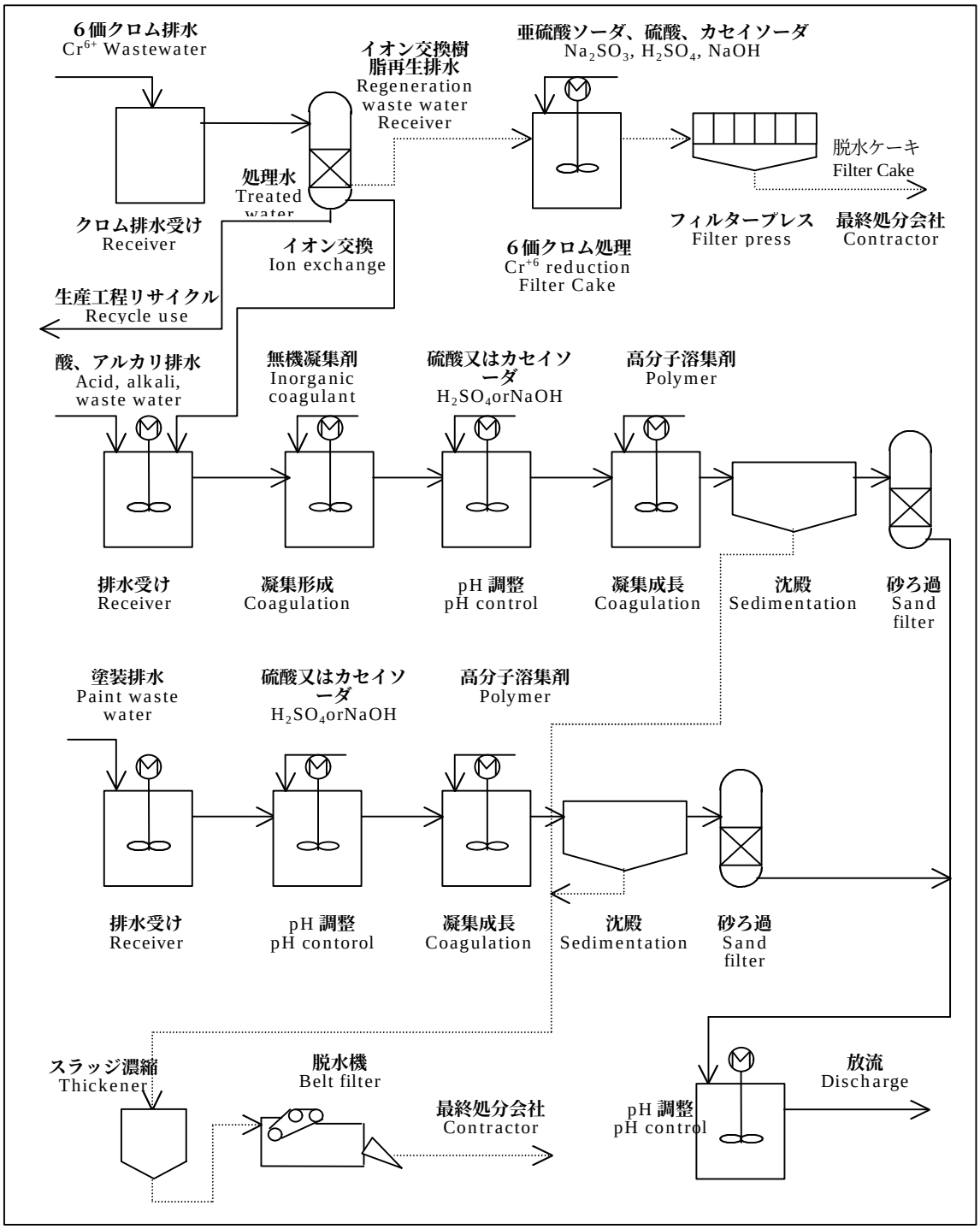
Item	pH	COD	F	Cu	Fe	Zn	Pb	T-Cr	Cr^{6+}
Standard	6 - 9	50	15	0.2	1	1	0.1	0.2	0.05

The standard for hexavalent chromium, 0.05 mg/liter, is one-tenth as strict as the Japanese government standard, or 0.5 mg/liter. The standard for fluorine (F) was not specified by the central government but was orally indicated by the Selangor State Office of Department of Environment (DOE). The company has installed a wastewater treatment plant shown in Figure 2-4-4 to meet these standards.

The wastewater containing chromium is passed through a bed of ion-exchange resin which adsorbs hexavalent chromium. The treated wastewater rid of hexavalent chromium is returned to the production process for reuse. The ion-exchange resin has a limited capacity beyond which the resin cannot adsorb hexavalent chromium. The ion-exchange resin which has adsorbed hexavalent chromium to a certain level is washed with a chemical to be regenerated. The concentrated hexavalent chromium solution produced when the resin is regenerated is received in a tank where hexavalent chromium is converted into harmless trivalent chromium by reduction with sodium sulfite while the pH value is being minutely

controlled by addition of either sulfuric acid or sodium hydroxide. The trivalent chromium is settled in the form of a hydroxide and separated from the liquid phase as sludge. This reduction reaction is done in a batch-wise fashion and therefore can be easily and strictly controlled. The ion-exchange resin is purchased from a water treating reagent company of Japanese capital.

Figure 2-4-4 Flow of the Wastewater Treatment of Company K



The pH value of the wastewater from the painting process is adjusted at first. A coagulant is added to the wastewater to coagulate and settle the suspended solid. The fine suspended particles that still remain

after coagulation and sedimentation are removed by the sand filter. The wastewater from the sand filter is mixed with the treated acid and alkali wastewater stream and discharged after its pH value is checked.

Two sand filters were added in 1997 to cope with the increased amount of wastewater generated as a result of increased plant production. The company also added another pH guard basin in 1998 to ensure that the quality of the treated water is guaranteed before discharging. The construction of this wastewater treatment plant was done by a wastewater treating company of Japanese capital.

The discharged water is sampled and analyzed in the laboratory every day. Every month the company asks a registered testing company to analyze the discharged water. Even the yearly maximum concentration of hexavalent chromium is far less than 0.01 mg/liter, the government standard. The maximum fluorine concentration was 1.05 mg/liter, also far below the level orally indicated by DOE. The treated water discharged also satisfies all other items of the standards.

b. Solid Waste Treatment

The most noticeable industrial waste is the sedimentation sludge generated from reduction reaction of hexavalent chromium and ordinary wastewater treatment. The sludge of trivalent chromium generated as a result of the reduction reaction is placed in drums and consigned to Kualiti Alam for final treatment and disposal. In Japan there are recycling companies which willingly receive this same sludge because of its high chromium content but in Malaysia it is not allowed to give the sludge to anyone but Kualiti Alam. The sludge from the ordinary wastewater treatment is dehydrated and handed over to Kualiti Alam for final treatment and disposal. The fee for the final treatment and disposal is two to three times as high as that in Japan. Company K therefore has introduced an electric dryer to reduce its weight. The electric dryer reduces water content of the sludge from 80 % to 40 %. Even using the electric drying seems to have an economic merit because the price of electricity is nearly half of that in Japan and the fee for final treatment and disposal is relatively high.

The scheduled wastes include solder debris, spent solvent, spent oil, coolant and paint debris. The solder debris and solvent are handed over to recycling companies but other wastes are consigned to Kualiti Alam for treatment and disposal.

Until Kualiti Alam started its operation in 1997, Company K was forced to store them in the premises of the plant. After more than ten years since the company started its operation, the stock reached 414 tons and the company premises was filled with them up to almost the limit. In 1998, the company brought all stocks to Kualiti Alam for disposal, which cost the company more than 10 million yen at once.

c. Establishment of Environmental Management System

Company K was preparing for acquisition of the ISO14001 certification in January 2000. Although the company dose not receive requests from their customers to obtain the ISO14001 certification, the company decided to obtain the certification because it would help standardize the company's environmental management system and business process.

The company started preparation for acquisition of the ISO14001 certification in December 1998 when the company announced its environmental policies and formulated the ISO14001 Environmental Management Team. This team consists of 15 Malaysian people headed by a Malaysian environmental management leader. This leader, experienced in ISO14001 certification, was recruited for the purpose of acquiring the ISO14001 certification. The two persons in charge of operating the wastewater treating plant are also engaged in promoting the ISO14001 related works. Two British consultants are retained to conduct the company's works to acquisition of the ISO14001 certification. Eleven of the team members are representatives of the plant's eleven sections, one person from each section.

The environmental targets for the ISO14001 include reduction of oil-stained waste cloth, prevention of leakage of chemicals, reduction of the sludge from wastewater treatment and lowering of the noise level.

Case 12 Example of Routinely Monitoring Underground Water for Watching Its Contamination

1) Outline of the Company

Company L
Business line: Manufacture of household electric appliances, i.e., air conditioners, electric fans and refrigerators
Number of Employees: 750
Start of operation: 1991
Location of the plant: An industrial estate in Selangor State 30 km to the west of Kuala Lumpur
Japanese equity ratio: 43.1%

2) Background

In 1965, Company L has advanced to Malaysia before all other Japanese companies, and it has been operating in Malaysia for 34 years since then. The founder of the company has the strong trust from the Malaysian government and he was awarded for his contribution to industrial development of Malaysia. To respond the trust, the company has been remaining progressive in environmental conservation activities, such as acquisition of the ISO14001 certification. Actually, company L was the first in Malaysia to obtain the ISO14001 certification.

Company L has four plants in Malaysia in different locations. The case introduced here pertains to the newest of the four plants built in 1991. The plant has a painting process of the products and a pretreatment process where wastewater containing heavy metals is generated. The geological survey done for plant construction revealed that this location is prone to subside. If land subsidence should really occur and this should damage the piping near the wastewater treatment plant, this could contaminate the underground water with heavy metals. The company then decided to voluntarily monitor heavy metal contamination of the underground water around the wastewater treatment plant to guard against such unlikely events.

3) Measures Taken by the Company

a. Monitoring of Underground Water

As a pretreatment to painting, the metal surfaces are coated with zinc phosphate. In this process wastewater containing zinc and other heavy metals is generated. The wastewater streams are gathered in the wastewater treatment plant as shown in Figure 2-4-5 so that the treated water may satisfy the effluent standards. The treated water is discharged to the sewer outside the plant premises. If land subsidence should occur and should consequently damage the wastewater piping and/or the tank to receive the wastewater, the heavy metals could diffuse underground. It is feared that if this should occur, the high water table could allow underground water containing the heavy metals to seep to the sewer outside the plant premises.

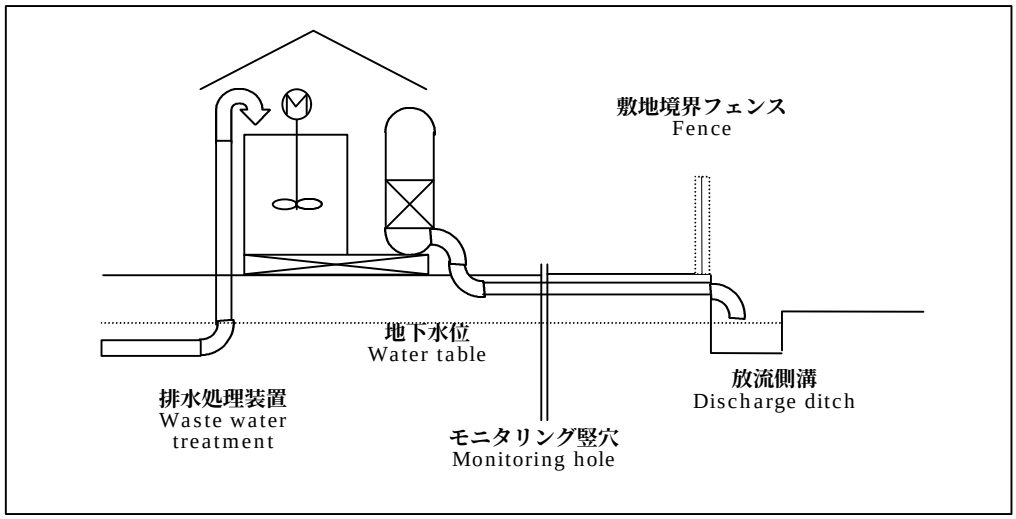
Three holes were drilled between the wastewater treatment plant and the plant border at an interval of about 7 m for monitoring heavy metal contamination of underground water. The holes are 15 cm across and 6 m deep. The water table is about 1.5 m below the ground surface. Samples of underground water are taken every month from these holes and analyzed for heavy metal contents to see whether there is contamination of heavy-metal to underground water. If there is any sign of contamination, the company will take necessary measures to prevent contamination of underground water. The company has been continuously monitoring the underground water since 1991, with no sign of heavy metal contamination up to now. As equipment ages it becomes more susceptible to damage; therefore, this monitoring will be all the more important in the future.

b. Wastewater Treatment

The B standards are indicated to this plant. To satisfy these standards the wastewater treatment plant shown in Figure 2-4-6 was installed. The wastewater is first received in the equalization tank. Then, an inorganic coagulant is added to form coagulated water-insoluble heavy metal oxides. Subsequently, a

high-polymer coagulant is added to make the flocs grow larger. The wastewater is separated into clear supernatant water and sludge in the sedimentation basin. The pH of the clear supernatant water is adjusted and the water is passed through a sand filter to remove fine particles that have not been caught in the upstream treatments. The water is then passed to a bed of activated carbon to remove by adsorption organic compound that may increase the value of COD value. There are three activated carbon adsorption towers of which one is a standby unit. The quality of wastewater always meets the standards by using one activated carbon tower as a spare even when one of other two towers is out of work while replacing saturated activated carbons. The treated water is stored in a retention tank from which the content is discharged to public water after its pH value is monitored by a pH continuous recorder. The pH recorder indicates the trend of pH change and thus enables the operator to take corrective measures before the pH value actually exceeds the standard.

Figure 2-4-5 Facilities for Underground Water Monitoring



The effluent water is analyzed by a testing company once a month for all 22 items specified in the B standards. The company reports the results of analysis to Department of Environment (DOE). The effluent water meets all specified items of the standard.

c. Solid Waste Treatment

The wastewater treating plant generates 4 to 5 tons of dehydrated sludge a month, occupying the majority of the waste. This sludge is regarded as the scheduled waste and it must be consigned to Kualiti Alam, the only final treating and disposal company in Malaysia. Its treating and disposal fee is rather high; therefore, the company installed a dryer to reduce the weight of sludge. The dryer uses electricity as heat source and can reduce the water content of sludge from 80 to about 40 %. The effluent gas from the dryer has an offensive smell. Therefore, the gas is water scrubbed before being discharged to atmosphere. The treated wastewater is used for scrubbing and is returned to the receiving tank of the wastewater treatment plant.

d. Establishment of the Environmental Management System

Company L acted very early for acquisition of the ISO14001 certification. The company organized a study group in September 1995, eager to be the first in Malaysia to obtain the ISO14001 certification. In December 1996 Company L became the first company in Malaysia to obtain the ISO14001 certification as scheduled. Since then, the company provided other group companies with information pertaining to environmental management and extended guidance to them about acquisition of the ISO14001 certification. Today, all the 22 group companies in Malaysia have acquired ISO14001 certification.

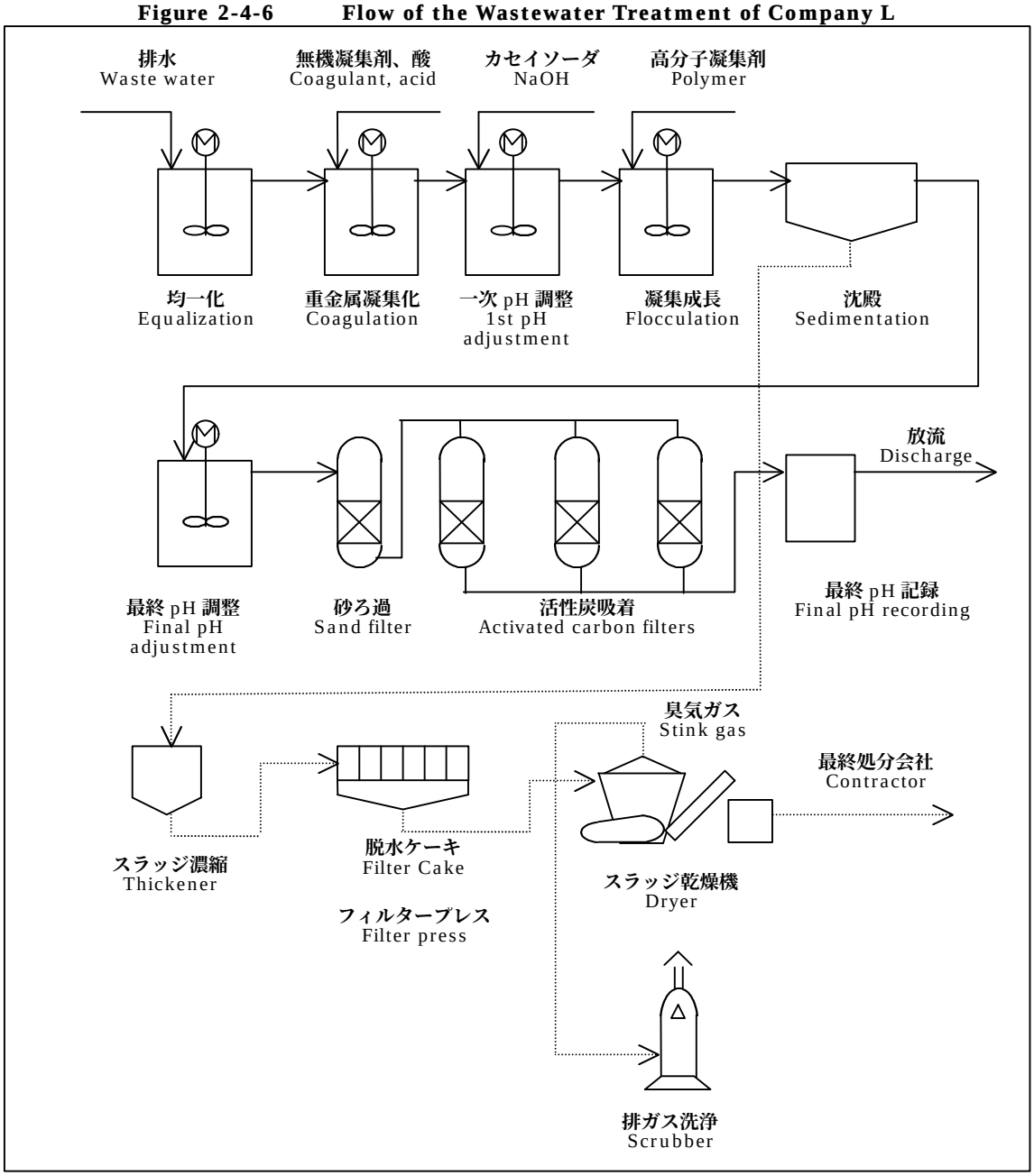
Development of products consuming less energy was made an environmental objective for ISO14001. In May 1998, the company successfully developed a refrigerator model which consumes 30 % less

electric power than the previous model. In June 1998, the company developed a new model of bathroom shower consuming 20 % less electric power than the previous model. The company's objective is to maintain continual improvement and modification of company's products under the ISO14001 system.

e. Others

The company obtains the environment-related information through such industrial associations as the Federation of Malaysian Industries and Malaysian Chamber of Commerce and Industry. When the Malaysian government plans to establish a new law, it conducts hearing opinions and comments from such associations.

Figure 2-4-6 Flow of the Wastewater Treatment of Company L



Case 13 Example of Treating Household Wastewater by Advanced Technologies

1) Outline of the Company

Company M
Business line: Manufacture and sale of optical instruments
Number of Employees: 2,369
Start of operation: 1974
Location of the plant: An industrial estate in Selangor State 16 km to the west of Kuala Lumpur
Japanese equity ratio: 100 %

2) Background

Company M has been in Malaysia for more than 25 years. This industrial estate was developed by the Malaysian Industrial Development Authority (MIDA). When the plant was built, the industrial estate was surrounded by paddy fields. Because of this location being close to Kuala Lumpur the area has become a residential and commercial area. The rivers became more polluted as population increased. Department of environment (DOE) intensifies guidance on the industries so that the effluent standards may be more faithfully observed to prevent further deterioration of the water environment.

The plant is engaged chiefly in assembling; therefore, it does not produce industrial wastewater. However, with an increasing number of employees, the plant now discharges a large quantity of household wastewater, which is treated by a simple septic tank. Recently, however, the plant finds it difficult to meet even the lenient B standards. The company acquired the ISO14001 certification in July 1998. After the acquisition, it happened to have a problem of household wastewater not meeting the standards to be solved in the ISO14001 environmental management. The company has decided to build a newest and reliable wastewater treating facility already adopted by the new international airport commissioned in July 1998.

Meanwhile, Company M's products are exported throughout the world.

3) Measures Taken by the Company

a. Wastewater Treatment

Figure 2-4-7 shows the effluent standards indicated to Company M. These are B standards applicable to wastewater discharged to the public waters downstream of the intake point of drinking water. The present wastewater treatment system depending on a septic tank is not capable to meet either BOD or COD standards. Several trials including replacement of gravel in the septic tank have been made but all proved not effective enough. The company has been given by DOE a time allowance on condition that the company will submit a renovation plan of the wastewater treating system by the end of January 2000.

Figure 2-4-7 Effluent Standards for Company M

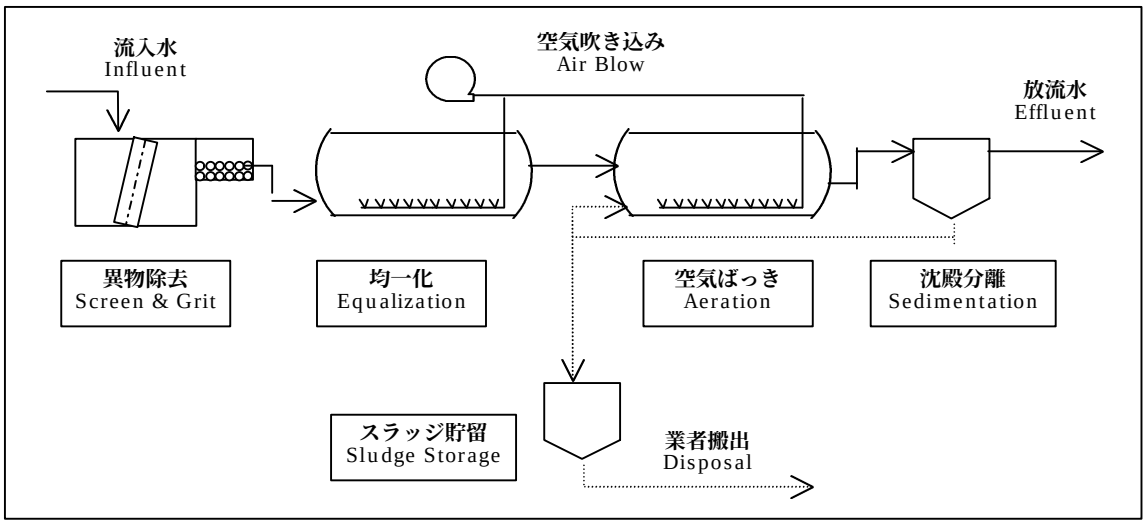
(Unit: mg/liter)

Item	Temperature, °C	pH	BOD	COD	SS	Oil & Grease
Standard	40	5.5 - 9.9	50	100	100	10.0

The company has decided to build a most advanced wastewater treatment plant as shown in Figure 2-4-8. The water received goes through a layer of grit and a screen to get rid of such foreign materials as plastic bags, and flows to a tank where water is aerated to be homogenized. Subsequently, water goes to another tank where biological treatment with aeration is conducted to decompose organic substances by microorganisms. On completion of the biological treatment water enters the sedimentation basin where the water is separated into clear supernatant water and sludge. The clear supernatant water is discharged to the public waters. Portion of the sludge settled in the sedimentation basin is recycled back to the biological treatment to be used for bio-decomposition. The amount of activated sludge in the aeration tank must always be kept constant. Therefore, this plant needs a trained operator to control the amount of sludge all the time. The excess sludge is kept in the sludge storage tank to be periodically taken away by a waste disposal company.

This design of plant features biological treatment in a closed tank. This wastewater treatment plant is less expensive than the one with a large concrete-made aeration basin for biological treatment. The exhaust gas from the activated treatment has an offensive smell. Use of a tank makes deodorization easier at the vent of the tank. This wastewater treatment plant seems capable to cope with the A standard. A local contractor estimates the cost of the plant at nearly 20 million yen under technical collaboration agreement with a Japanese equipment manufacturer for wastewater treatment.

Figure 2-4-8 Planned Wastewater Treatment Plant of Company M



b. Establishment of Environmental Management System

Company M started preparing for acquisition of ISO14001 certification in February 1998 and obtained the certification in August 1998. The company placed a Malaysian expert with experience in acquisition of certification in another Japanese company. With this Malaysian expert as the core of the activities, the company established the environmental management system, formulated the environmental policies and set the environmental objectives.

The plant mainly has assembling process, therefore, it does not discharge industrial wastewater, industrial exhaust gas or hazardous substances. Accordingly, the company found it difficult to identify suitable subjects for reduction of environmental impact. The environmental objectives include reduction of air pollutants by reducing traffic of trucks and turning off engines while engines are idling. On top of these, the company decided to add complying with the standards for household wastewater by introducing a most advanced wastewater treatment plant. Regarding general wastes, the company plans to reduce it by 5 % in 1999 from that of 1998. The company also intends to change the present system of washing the parts imported from Japan with substitute of CFC solvent to remove rust preventive oil to a new washing system. The company is now studying this subject with a facility vendor.

The Malaysian manager for ISO14001 promotion has pointed out problems, which appear unique for a Japanese company. These problems include insufficient awareness of the top and middle management on the issue of environmental management; insufficient understanding on the part of employees about the environmental management system, the practice of discarding wastes without sorting. The manager has presented some recommendations including: The president makes the middle management understand the importance of environmental consideration in a top-down initiative; the company should arrange tours to companies noted for good environmental management.

It is obvious that the Japanese companies have made contributions to Malaysian society in the area of human resource development when looking at the roles this Malaysian manager are playing in this company.