Chapter 2

Environmental Conservation

by Japanese Companies in China

: Case Studies of Corporate Practices and Policies

In this chapter we present 14 case studies of practical environmental measures implemented by Japanese companies, primarily in the manufacturing sector, and based on a survey conducted during visits to 12 Japanese companies active in the cities of Beijing and Tianjin in the People's Republic of China.
Section 1 presents an outline of the implementation of environmental measures by Japanese companies in China, and is followed by presentation of the 14 case studies in Section 2, 3, and 4.
Section 2 presents six case studies of implementation of advanced measures to reduce discharge of pollutants.
Section 3 presents three case studies of implementation of improvements in environmental management systems.
Section 4 presents five case studies of implementation of other improvements for environmental protection.

Section 1
Japanese Companies in China and Environmental Measures

The survey was conducted between December 2003 and January 2004 during visits to 12 Japanese companies active in the cities of Beijing and Tianjin in the People's Republic of Chin in which the companies were asked the practical details of the environmental measures implemented. The majority of the companies surveyed were in the manufacturing sector, with the remainder being engaged in distribution (supermarkets) and transport. Factories of companies in the manufacturing sector were visited, and the implementation of environmental measures surveyed at the site of the relevant business activity. Eight of the companies visited were located in the city of Beijing, and four in the city of Tianjin.

All of the Japanese companies surveyed in the manufacturing sector have made considerable investments in equipment for environmental measures directed at waste gas and waste water, and have taken a positive approach to the implementation of measures which satisfy emissions standards to a significant extent. Furthermore, companies in non-manufacturing sectors where a direct environmental load is not generated are engaged in social contributions indirectly promoting awareness and resolution of environmental problems.

Some Japanese companies have noted cases of unnecessary investment in environmental equipment required due to disagreements within the Chinese bureaucracy, and bewilderment as a result of sudden changes in regulations by the Environmental Protection Bureau.

1. Japanese Companies in China and Environmental Measures

Full ownership by Japanese companies in China increasing

A variety of statistics are available on the number of Japanese companies active in China, however if sales bases of manufacturing operations, branches of non-manufacturing operations, and representative offices are included, the figure is between 15,000 and 20,000 companies. The great land area of China, among other factors, has resulted in the number of Japanese companies active in China being an order of magnitude greater than is the case in South East Asia (e.g. Thailand, Indonesia). Entry of Japanese companies into China began in earnest in the 1990s, and reached a peak between 1994 and 1995. Subsequently, factors such as the long recession in Japan resulted in a decrease, however since 2000 the number of Japanese companies active in China is again increasing. Reasons given for the entry of Japanese companies into China include the availability of plentiful and cheap labor of excellent quality, and the massive Chinese consumer market for population of approximately 1.3 billion, however in addition to these fundamental reasons, the primary reasons for the renewed increase since 2000 are the development of manufacturing bases in China by the major Japanese automobile and electronic equipment manufacturers as a means of reducing costs, and the entry of associated small and medium parts manufacturers and materials manufacturers. Furthermore, the entry of China into the World Trade Organization (WTO) in December 2001 and the liberalization of the environment for investment and various restrictions have provided additional incentives.

Approximately half of the Japanese companies active in China are located in the city of Shanghai, Guangdong Province, and the Yangtze Delta in Jiangsu Province. According to the 2001 Overseas Business Activities Yearbook published annually by Toyo Keizai Shinpo Inc., of 2525 Japanese companies recorded, 663 companies (26.3%) were established in the city of Shanghai, followed by 352 in Jiangsu Province, 327 in Guangdong Province, 252 in the city of Beijing, 246 in Lianoning Province, 155 in Shandong Province, and 149 in Tianjin Province, the majority being established in the Yangtze Delta, and in the Hebei and Dongbei regions (excluding the city of Beijing). The Japanese Chamber of Commerce in China which provided support in conducting the current survey has approximately 550 registered members, being primarily Japanese companies in the Beijing area.

A breakdown of the Japanese companies in the manufacturing sector shows that at the beginning of 1990 the majority were engaged in textile manufacture, the proportion engaged in electrical, electronic, chemical, and transport equipment manufacture had increased from the mid 1990s, and that there has been a vigorous entry of materials manufacturers since 2000. Furthermore, the investment format of Japanese companies in China includes full ownership, joint ventures, collaboration, and consignment manufacture, with the full ownership format becoming increasingly common in contrast to the joint venture format of previous years. This is a result of changes in the legislation relating to foreign investment associated with China joining the WTO, and the consequent major liberalization of the investment ratio for foreign enterprises. A survey conducted by JETRO (Japanese External Trade Organization, an independent administrative entity) shows that of Japanese companies established in China prior to 1999, 48% were full ownership, and that this proportion had increased to 76% for companies established in 2000 or later. Furthermore, this proportion had increased to 80% in 2001, and to 86% in 2002. The increase in the full ownership format has allowed introduction of advanced environmental measures without the need for decisions based on consultations with a joint venture partner, and has had a positive effect on environmental measures implemented by Japanese companies in China.

Of the 12 companies visited in the current survey, eight were established in the city of Beijing, and four in the city of Tianjin. One company was established in each of the years 1993, 1994, 1995, 1997, and 2000, three in 1996, and four in 1998. Ten of the companies were engaged in the manufacturing sector, and two in non-manufacturing. Those involved in manufacturing were variously engaged in the areas of electronic and electrical equipment, transport equipment, pharmaceuticals, foodstuffs and liquor, cosmetics, and printing. Those involved in non-manufacturing were engaged in distribution (supermarkets) and transport. The majority of the ten companies engaged in manufacturing were located in areas designated as specialized industrial areas such as development zones, production bases, and

industrial districts (hereafter referred to as ‘development zones’).

Japanese companies implementing advanced environmental measures not only satisfying regulations

As introduced in Chapter 1, China’s environmental problems are severe after a period of rapid industrial growth extending over a quarter of a century. In addition to resolving concerns over the supply of electricity, and water shortages, the need to resolve the problem of pollution is essential for the continued stable economic growth of China. Furthermore, the environmental awareness of the people of China is increasing with the prospect of the Beijing Olympics in 2008, and the Shanghai Expo in 2010, and both central and regional government are unable to avoid the need for serious measures to deal with pollution. On the other hand, in parallel with the strengthening of conventional anti-pollution measures, China has recently commenced a transformation to a recycling society, and it is expected that a range of recycling-related legislation, notably the ‘Domestic Electrical Appliance Recycling Law’, will be implemented in future. As it is expected that preparation of an environmentally-related system of laws incorporating aspects of those of Japan, Europe, and the US will accelerate, Japanese companies entering China will be expected not only to respond to pollution regulations, but to positively embrace a wide range of environmental measures.

In particular, the region incorporating the cities of Beijing and Tianjin, the areas of the current survey, exhibits similar levels of high economic growth to the Yangtze Delta region centered on Shanghai, and the power of the regional administrative authorities, notably the environmental authorities, is considerable. For this reason, Japanese companies in the region are required to satisfy a variety of environmental regulations, including additional emissions regulations imposed by the authorities in these two cities, and are subject to highly effective environmental monitoring to ensure that these regulations are followed. Some factories have been required to install online monitoring equipment in order to increase the efficiency of monitoring, and are subject to on-site inspections once or twice annually, and checks to ensure that emissions standards are followed. If found to be in contravention of environmental regulations, improvements within a fixed period are ordered based on a time-limited pollution prevention system, and if improvements are not possible, administrative measures such as suspension of operations or factory closure may be implemented, rather than simple imposition of a fine.

Furthermore, the “Three synchronization” system for the prevention of environmental pollution requires prescribed environmental procedures during the factory design and construction stages, and formal operations are permitted only after environmental measures are inspected and found satisfactory.

Within this context, the Japanese companies visited in the survey were therefore all involved in implementation of a thorough program of environmental measures. The ten companies engaged in the manufacturing sector had implemented anti-pollution measures to conform strictly to the Chinese system of environmental legislation focused measures in the ‘Three Wastes’ (waste gas, waste water, waste products) program. Since these measures include some regulations more severe than the equivalent in Japan, and some not present in the Japanese system, large amounts of investment for installation and modification of environmentally-related have been required in some cases. A number of Japanese companies were notable for their positive approach to environmental measures, and not only satisfied the environmental regulations, but set voluntary standards in excess of the emissions criteria and implemented environmental measures at a higher level, incorporated stepped reduction in pollutants in action plans based on ISO14001, and were engaged in the implementation of a planned reduction of emitted pollutants. Of the two companies engaged in non-manufacturing, the company involved in distribution was engaged indirectly in environmental measures through contributions to China’s social problems, for example, reducing the difference between rich and poor, and providing employment. The company involved in transport was engaged in incorporating environmental measures associated with truck transport into preparations for planned full development of its operations.

All Japanese companies surveyed were Chinese subsidiaries of major Japanese companies, and considered implementation of environmental measures as a normal part of daily operations. Environmental measures were not considered to be special, and their implementation was seen as

providing cost reductions through savings in energy and resources. These companies have been highly praised by the Environmental Protection Bureau – 'Japanese companies have implemented environmental measures exceptionally well, have strictly followed the legislation, and have given no cause for complaint'.

Japanese companies also implementing voluntary stepped reductions in sulfur dioxide emissions

All ten Japanese companies visited engaged in the manufacturing sector were involved in production processes having a relatively low environmental load such as assembly work, and manufacture of foodstuffs and pharmaceuticals, and located in specialized industrial areas being development zones. The environmental measures concerning these Japanese manufacturing companies were focused on measures to deal with waste gas and wastewater.

The measures implemented by company B and described in detail in Case 2 in Section 2 of this chapter are representative of waste gas measures. Sulfur dioxide pollution of the atmosphere resulting from combustion of coal is a serious problem in China. The use of three large coal-fired boilers by company B therefore required implementation of measures to deal with sulfur dioxide in the waste gas from the boilers. Since the city of Tianjin where the factory is located has implemented additional emissions regulations which are approximately twice as strict as the national emissions standards, measures have been taken to reduce the sulfur content of the coal used as fuel, and equipment to wash the waste gas with water has been added to the waste gas treatment equipment, so that emissions standards have been satisfied since commencement of operations in 1998. Upon receiving ISO14001 certification, the company proposed a planned reduction in sulfur dioxide in excess of the emissions regulations in which, based on the sulfur dioxide emissions of each production unit for 2001 as 100%, emissions are to be reduced each year so that in 2005 emissions will be reduced to 40%. To achieve this target, the company made improvements to waste gas washing equipment added to the waste gas treatment equipment, and reductions targets for 2002 and 2003 have been achieved.

The positive approach to implementation of these advanced improvements is a function of the plentiful experience of Japanese companies in measures designed to deal with atmospheric pollution previously implemented in Japan, and provides Chinese regional enterprises, and others, with an excellent point of reference for measures to deal with atmospheric pollution.

Furthermore, most Japanese companies operating small boilers in Tianjin have been required to convert from coal to clean fuels such as kerosene and natural gas. Some of the companies visited were suddenly ordered to cease use of coal by the Environmental Protection Bureau without prior notification, and without a grace period, the normal method of implementing changes in regulations in China, resulting in considerable confusion on the part of personnel responsible for environmental matters in the companies. As an order of the agency cannot be challenged, rapid, and considerable, investment was required for the reconstruction of the boiler equipment in some cases.

Superior measures to deal with wastewater through major investment and wise design

Most of ten Japanese companies visited engaged in the manufacturing sector had implemented measures to deal with a further important environmental problem, that of wastewater. As described in Section 3 of Chapter 1, standards for COD and ammonia nitrogen in the Chinese wastewater standards are more strict than is the case in Japan, and some restrictions not present in the Japanese legislation, for example, nickel, are also employed. Furthermore, as with waste gas restrictions, regional governments may apply more stringent restrictions beyond the national emissions standards, or add parameters in the restrictions.

As a result, a number of cases were noted in which Japanese companies had expended considerable sums in construction and operation of wastewater treatment equipment. Of these, a company generating wastewater from the plating process (see Case 1 in Section 2) has added improvements to the wastewater treatment process, and employs an absorption process using chelate resin, used in Japan in the production of pure water, to remove the trace amounts of copper and nickel from the final stage of the wastewater

treatment process, and thus satisfy the wastewater standards, albeit at considerable expense in terms of running costs. In order to satisfy the strict standards for SS, another Japanese company has employed a sand filter, rarely used in Japan, in the final stage of the wastewater treatment process (see Case 3 in Section 2). Setting of voluntary standards in excess of the existing wastewater standards, and advanced measures in wastewater treatment, are common.

While the companies in the survey have a proud record of promoting wastewater treatment, contradictions within Chinese administrative policy have resulted in unnecessary construction of wastewater treatment equipment in one case. This was a result of completion of central wastewater treatment site, and a relaxation of the relevant standards, soon after the company constructed a sophisticated wastewater treatment facility to satisfy strict wastewater restrictions, so that the facility became unnecessary (see Case 12 in Section 4). In this case, the company continued operating the facility, making effective use of the highly treated water by spraying it within the site, however one cannot escape the conclusion that the company was the victim of a mismatch between development and environmental policies. While the variety of environmentally-related procedures can be seen as an imposition on the companies active in China, collection of a wide range of information is necessary in environmental terms.

As described above, installation of equipment for the online monitoring of wastewater is required in some cases. While installation costs are borne by the factory, refusal to install such equipment results in a fine, so that there is no choice but to comply with an instruction from the Environmental Protection Bureau.

Storage of toxic waste in processing facility in factory for a period of six years

As part of measures to deal with industrial waste, all of the companies in the survey rely on contractors licensed by the Environmental Protection Bureau for processing of reusable material such as metal scrap, waste materials, and cardboard boxes, however handling of toxic industrial waste is problematic.

Factories of some of the companies in the survey discharge waste products specified as industrial waste products such as sludge containing heavy metals, waste oil, and asbestos. The companies generally rely on licensed waste disposal contractors for treatment of these toxic industrial waste products, however the treatment abilities of such contractors extends only to incineration. The city of Tianjin therefore legally required that toxic industrial waste products unable to be treated by incineration be stored by each company until the completion in 2003 of China's first comprehensive treatment facility capable of incineration, stabilization, and landfill disposal, and toxic waste products generated by one Japanese company were therefore stored at its factory for a period of six years between the commencement of operations in 1997 and completion of the comprehensive treatment facility in 2003. While a contractor was available to the receive the toxic waste products, it was assumed that the waste would simply be disposed of illegally by the contractor, and the image of the company would suffer once this was discovered. Other Japanese companies are also sensitive to illegal disposal, and a number track disposal by visiting the incineration site to ensure that the toxic waste has indeed been disposed off.

Opening of China's first comprehensive treatment facility in Tianjin in 2003 (see Chapter 1 Section 4) result in progress in measures for the disposal of toxic waste, and the problem faced by Japanese companies of storage of the waste on-site was alleviated. However, as many of the companies in the survey are located at a considerable distance from Tianjin, when transport of the waste over a long distance is impractical, on-site storage will become necessary in some cases. Under the Tenth Five-year National Environmental Plan, the development of similar treatment facilities will be promoted, and a new plan to accelerate the development of such facilities was announced in January 2004. Under any circumstances, development of a well balanced and distributed system of treatment facilities throughout the great expanse of China is considered a matter of great urgency.

As a further measure in dealing with waste products, a Japanese brewing company has implemented measures to ensure that empty bottles are reusable. Empty bottles are now collected from restaurants, major consumers of bottled beverages, and washed and refilled. While not classified as a manufacturing industry, the company engaged in distribution has installed boxes for recovery of used batteries, paper,

and plastic etc in front of its supermarkets. As described above, a variety of laws related to recycling, notably the 'Domestic Electrical Appliance Recycling Law' are scheduled, and related infrastructure and mechanisms will be required, and the cases noted here are the focus of attention from the point of view of developments in China similar to that in Japan.

Development of an ISO14001-based environmental management system

ISO14001 certification is considered the representative example of development of a voluntary environmental management system to provide a higher level of environmental responsibility than merely satisfying environmental requirements. As noted in Section 1 of Chapter 1, the Chinese government is engaged in the positive promotion of ISO14001 certification, and by the end of 2003, 5,000 companies had received certification. One of the first companies in China to receive ISO14001 certification in 1997 was a Japanese electrical equipment manufacturer.

Five of the 12 companies in the survey have already received ISO14001 certification, and have developed a well-organized environmental management system within the company. All companies have developed internal environmental management systems represented by top management, and employ a variety of numerical targets in the reduction of discharge of environmental pollutants, and conservation of energy and resources in terms of power consumption, water consumption, and fuel consumption etc. While reduction plans are normally implemented annually, some companies take a mid-term view by employing a three-year continuous plan in the development of continuous reduction activities. Furthermore, in one case, an environmental management manual produced as part of ISO14001 activities contains, in addition to the normal environmental measures for the prevention of atmospheric and water pollution, a manual dealing with the prevention of potential environmental pollution and emergency measures, as well as measures for the prevention of environmental risk. This identifies items liable to cause pollution in each workplace, and provides a plan to deal with pollution should it occur, and all employees are trained to ensure familiarity with the content of the manual. This company has clearly stated its policy of giving priority to ISO14001-certified companies in selection of its wide range of suppliers and contractors.

One point of concern with ISO14001 certification was the fact that a number of the companies in the survey not yet ISO14001-certified have policies to postpone certification. Reasons given for postponement include "the business has just started and we do not have time", and "gaining the international ISO9000 Series certification for quality management has priority", however it is hoped that certification be received as soon as possible to ensure a voluntary and progressive attitude to environmental matters. At the same time, as noted in Section 1 of Chapter 1, the costs of gaining certification in China are approximately one-seventh that in Japan, so that, provided the management of the company is willing, certification may be obtained relatively easily.

Personnel responsible for environmental matters in most of the companies visited were Chinese employees, operation of the equipment associated with environmental measures, and contact with the Environmental Protection Bureau, being left to these employees. Furthermore, companies gaining ISO14001 certification have Chinese personnel at each workplace responsible for promoting environmental matters, and have developed systems to promote the implementation of environmental measures throughout the entire company.

Development of a system to provide common environmental information to Japanese companies

In a similar survey conducted in the nations of South East Asia, problems appeared in relation to the effort expended by Japanese companies in the collection of information on environmental regulations, however in China a considerable amount of this information is available on the Internet. In practice, the companies in the survey commonly collect information other than that received from the Environmental Protection Bureau on the Internet. For example, the website of the Environmental Protection General Office (http://www.zhb.gov.cn), one of the primary sources of information, is comprehensive and well organized, and the various environmental legislation and standards for regulations etc are available in an easily understood manner. This website is in both Chinese and English, and a considerable amount of

information is available. Furthermore, the Japan-China Friendship Environmental Protection Center, established in Beijing in 1996 with Japanese funding, is staffed by Japanese environmental experts.

This Center is subordinate to the Environmental Protection General Office, however it has a Japanese website (http://www.zhb.gov.cn/japan) providing Japanese translations of Chinese environmental legislation and standards etc, and related news, and is very helpful in clarifying points which may be unclear in this field.

As is apparent from the above, China provides many sources of environmentally-related information, and for this reason, Japanese companies in China are relatively well provided for in comparison to those active in South East Asia.

On the other hand, information available from these sources is solely official policy. For example, even with the establishment of recycling-related legislation etc, and further development of the Chinese system of environmental legislation, while the system will outwardly resemble that of Japan, actual operation of the system of environmental legislation will be problematic due to, for example, a lack of specialists, and regional differences in the administrative abilities of the Environmental Protection Bureau. It is therefore unlikely that a national system equivalent to that of Japan, Europe, or the US will develop in the short term. For example, development of facilities for the treatment of toxic industrial waste is not as proceeding as planned.

It is therefore necessary to develop a system in which Japanese companies provide information they hold on both legislation etc readily available on the Internet, and the more detailed practical knowledge and information useful in dealing with environmental policies, for example, information such as that related to actual operation of the legal system, and treatment of toxic industrial waste, to a common pool. Availability of such a system will forestall cases such as that noted above in which a sudden change in regulations led to confusion, and avoid unnecessary investment in environmental equipment, as well as facilitate submission of proposals for improvements in the rational implementation of legislation as a group rather than as individual companies.

In South East Asia, where Japanese companies have a long history of activity, this type of system has been in place for some time providing an exchange of environmental information on a daily basis. Furthermore, in Malaysia, an organization within the Japanese Chamber of Commerce fulfilled this function, and submitted a petition to government in an attempt to reduce the cost of treatment and disposal of toxic waste.

It is anticipated that the development of this system will commence with the exchange of information between companies within individual development zones having a high proportion of Japanese companies, and progress to the provincial level within the area of jurisdiction of each regional government. Development of eco-business on a considerable scale is forecast for China. A large number of Japanese environmental engineering companies etc dealing with anti-pollution measures and recycling are present in China, and participation of these companies in the common holding of environmental information will improve the level of detail available.

While the system will initially inevitably be for the purpose of improving the ability of Japanese companies to deal with environmental matters, and to protect the interests of Japanese companies in terms of environmental regulations, its future lies in implementing the experience of Japanese companies in environmental measures in the Chinese context, and in promoting development of Chinese environmental measures.

Section 2
Case Studies of Advanced Measures to Reduce Discharge of Pollutants

When a regional government in China determines a need to reach environmental standards, it is able to set numerical levels exceeding those in discharge standards established by the national government, and to add new regulatory items. The current survey was conducted only in the cities of Beijing and Tianjin, however standards were found to be in excess of Japanese standards, or to include extremely strict numerical levels for items not covered in Japan. For example, standard levels for COD and nickel in wastewater, and lead and VOC in waste gas.

Japanese companies have installed advanced equipment not used in Japan, and invested large amounts of money, in order to satisfy the standard levels. For example, the use of chelate resin absorption treatment technology is normally employed in the production of pure water, to absorb copper and nickel.

Case 1 Satisfying Strict Wastewater Discharge Standards with Advanced Treatment Rarely Used in Japan

1) Outline of the company

Company A
Details of business: Electronics-related manufacturing.
Number of employees: 1100
Commencement of operations: 1998
Location of factory: Production base to the north of city of Beijing (Haidian District, Beijing)
Japanese equity ratio: 78.3%

2) Background

Company A is engaged in the manufacture of PCs, mobile phones, and electronic products employed in automobile control etc. The Japanese head office is a well-known company operating on an international scale. The mission of this factory is the manufacture of products cheaply and to the same level of quality as in Japan.

The manufacturing process generates wastewater containing heavy metals, and the standard values for wastewater set by the city of Beijing are considerably more strict than those employed in Japan. As there is no central wastewater treatment facility in the production base, the wastewater from the factory is discharged directly into the public water system, and thus strict standard values have been set. Expensive and advanced treatment technology was therefore adopted in order to reliably satisfy these standard values. The company has taken a positive approach to the environmental measures while being fully aware of the fact that the costs of wastewater treatment are reflected in product cost.

3) Details of measures implemented

a. Wastewater Treatment

The factory discharges wastewater from the plating process. Standard values set by the city of Beijing Environmental Protection Bureau are shown in Table 2-2-1.

Table 2-2-1: Wastewater standard values

(values other than pH are in measuring mg/liter)

Items	pH	COD_{Cr}	BOD	SS	Pb	Cu	Ni	Animal/ vegetable oil
Standard values	6.0 - 8.5	100	60	80	0.1	0.5	0.5	20
Reference								
Chinese government's standard value[1)]	6 – 9	150	30	150	1.0	1.0	1.0	15
Japanese standard value[2)]	5.8 - 8.6	160 [3)]	160	200	0.1	3.0	—	30

1) Values for Pb and Ni are standard values for Type 1 pollutants, others are Class II standard values for Type 2 pollutants.
2) Ministerial ordinances determining wastewater standard values are taken from the separate Tables 1 and 2.
3) Value according to COD_{Mn} method.

Levels other than BOD and animal fats are more strict than the standard values set by the Chinese government. These strict standard values have been added after being evaluated as necessary to reach the water quality environmental standards of the city of Beijing (a regional government).

Standards for all items are more strict than the relevant Japanese standard values, and the standard value of 0.5mg/liter for copper (Cu) and nickel (Ni) are particularly strict. Nickel is not subject to regulation in Japan. Heavy metals are generally dissolved at low pH acidity, and when neutralized by addition of an alkaline agent to raise the pH, form a hydroxide which settles and is then separated. However, copper and nickel are amphoteric metals, and while they are naturally dissolved by acids, they also form complex salts and are dissolved, by alkalines. The optimum pH for separating the hydroxide from the solution lies

within a fixed range. Since it is normally difficult to reliably satisfy the standard value solely with the neutralization sedimentation method, wastewater treatment equipment using the chelate resin absorption process has been installed in addition to the neutralization sedimentation method as a finishing treatment (see Figure 2-2-a).

The pH of the wastewater from the plating process is first adjusted to an acidity of between pH2 and pH5, and subsequently to an alkalinity of between pH8 and pH10 to produce an insoluble hydroxide from the heavy metals. A coagulant is then added to coagulate and settle the hydroxide, forming an excellent large floc. The hydroxide floc is settled and separated in a sedimentation tank, and the supernatant fluid passed through a sand filter to remove the microscopic suspended material. Trace amounts of copper and nickel are then finally removed by chelate resin absorption. Since the sand filter and the chelate resin absorption tower must be rejuvenated periodically, two towers are installed, with one being rejuvenated and on standby. The treated water is then checked for pH and discharged. Approximately 500m^3 of wastewater is treated daily.

Chelate resin is extremely expensive at approximately JPY4,000/liter, requiring an expenditure of a few millions of Yen to refill an absorption tower. The saturated resin is rejuvenated repeatedly using expensive materials such as sodium hydroxide and reused, and must be replaced every two or three years with new product. It is used in Japan only for such special applications as the production of extremely pure water, and its use in the treatment of factory wastewater is extremely rare.

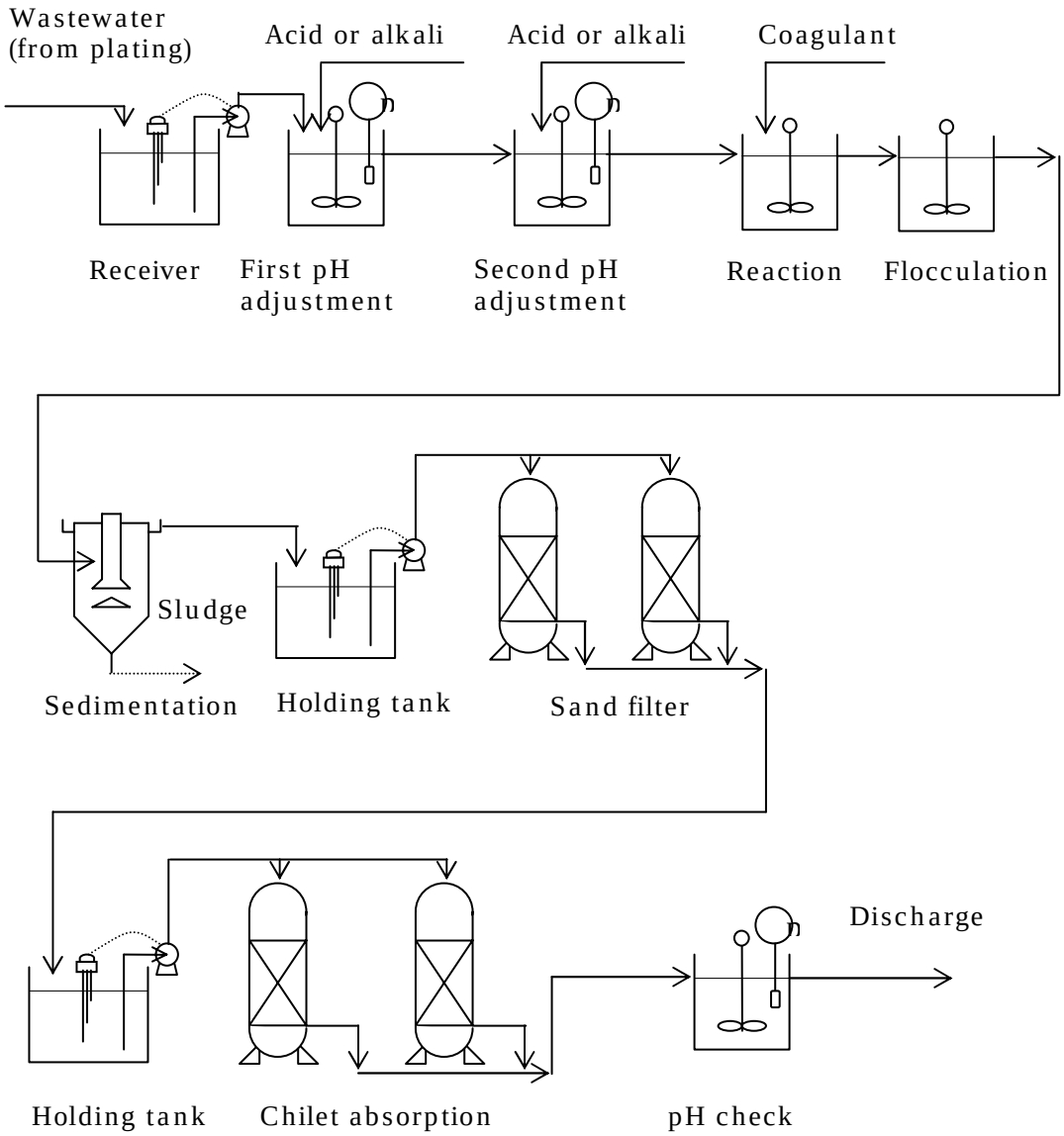
The treated water is checked weekly by simple analysis, and an inspection conducted twice yearly by the city of Beijing Environmental Protection Bureau during which the water is sampled. The analysis results are reported back to the factory. All standard values are satisfied.

The sludge produced in the sedimentation tanks is dried with a dehydrator, and the sludge cake handled by a licensed toxic waste treatment contractor.

b. Miscellaneous

Information on environmental regulations is available on the Internet and published environmentally-related material. The energy section of Company A is responsible for environmental measures sometimes receives information directly from the city of Beijing Environmental Protection Bureau.

Figure 2-2-a: Wastewater treatment flow



Case 2 Voluntary Reduction in Sulfur Dioxide Discharge

1) Outline of the company

Company B (same as Company G in Case 7)
Details of business: Manufacture and sale of automobile engines.
Number of employees: 800
Commencement of operations: 1998
Location of factory: Xiqing District, city of Tianjin
Japanese equity ratio: 50%

2) Background

The Japanese head office of Company B is engaged in the manufacture and sale of automobile engines on an international scale. The company is aiming at the top level of environmental measures in international terms, and was the first in the Chinese automobile industry to gain ISO14001 certification. The company not only follows strictly the standard values for discharge set by the bureaucracy in association with certification, but also is engaged in activities directed towards the maximum possible reduction in environmental load.

3) Details of measures implemented

a. ISO14001 reduction plan

Company B is concerned with reducing the sulfur dioxide in the waste gas discharged from the three coal-fired boilers it owns. The reduction plan adopted under ISO14001 is shown in Table 2-2-2. The amount of gas discharged is managed in terms of each engine manufactured, so that with the amount discharged in 2001 as 100%, discharge has been reduced to 87%, 49.0%, and 43.0% in subsequent years, and is planned to be reduced to 40.0% in 2005.

Table 2-2-2: Planned reduction in discharge of sulfur dioxide

(amount discharged per engine manufactured)

Year	2001	2002	2003	2004	2005
Amount discharged	100%	87.0%	49.0%	43.0%	40.0%

b. Waste gas regulations

The standard values set by the city of Tianjin for waste gas from the boilers operated by company B are shown in Table 2-2-3.

Standard values set by the government of China for particulate matter from coal-fired boilers are according to location. The standard value is set at 100mg/m^3 for Type 1 areas, 250mg/m^3 for Type 2 areas, and 350mg/m^3 for Type 3 areas. While it is unclear as to which type of area the location of the factory belongs, based on the fact that it is in an industrial area in the city of Tianjin, it is thought to be either Type 1 or Type 2.

It is therefore considered that the additional standard value of 220mg/m^3 set by the city of Tianjin is a little excessive.

Similarly, standard values for sulfur dioxide as set by the Chinese government are 1200mg/m^3 in all areas. The additional 650mg/m^3 set by the city of Tianjin is extremely strict.

Table 2-2-3: Standard values for boiler waste gas

(mg/m^3)

Items	Particulate matter	SO_2
Standard value	220	650

In accordance with regulations applicable prior to period of construction (December 31st, 2000).

As well as regulating waste gas concentration, the city of Tianjin also regulates the sulfur content of the coal burnt to 0.5% in order to reduce sulfur dioxide. The sulfur dioxide content of waste gas resulting from the combustion of coal having a sulfur content of 0.5% is approximately 1,000mg/m^3 according to combustion calculations, and combustion of coal as per the regulations therefore does not satisfy the standard values for waste gas. Combustion of coal having a sulfur content less than required by the regulations, or treatment of the waste gas to remove sulfur dioxide, is necessary to ensure that the standard values are satisfied.

c) Treatment of Waste Gas

Company B obtained detailed information on the strict boiler waste gas standard values during the construction planning stage, and therefore uses low-sulfur coal, and has installed waste gas washing equipment. These measures have allowed the company to satisfy the standard values set by the city of Tianjin since the start of operations in 1998, however, as described above the company has set a target of reducing emissions to 40% of the 2001 value by 2005 as part of the ISO14001 certification activities. The company has therefore commenced work on improving the waste gas washing equipment, and adding sodium hydroxide to the wash water to create an alkaline solution and remove sulfur oxides by absorption, in order to achieve this target.

In 2002, one of the three boilers was modified as shown in Figure 2-2-b. Water was previously recirculated while washing the gas, however two modifications have been implemented, one in which equipment has been installed to add sodium hydroxide to the recirculated water to create an alkaline solution, and thus increase the ability to absorb the acidic sulfur dioxide gas, and the other in which an interrupter plate in the form of an impeller is installed to raise the efficiency of contact between the gas and the water. These two modifications have had a dramatic effect in raising the efficiency of removing sulfur dioxide from between 40 and 50% to more than 79%, and reduced the concentration of the sulfur dioxide in the waste gas to 100mg/m^3 or less, well below the standard value of 650mg/m^3.

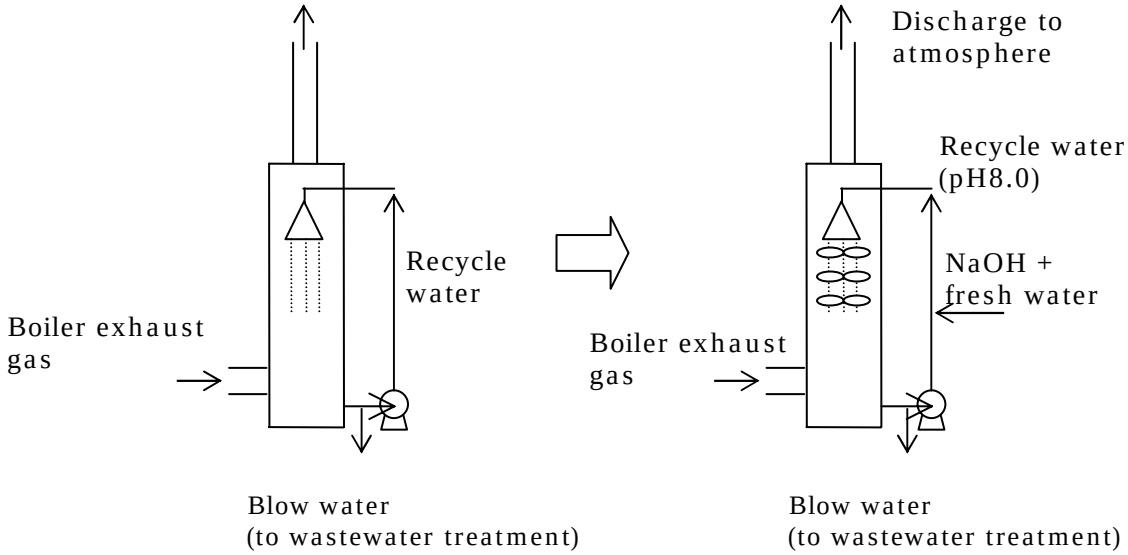
Since the recirculated water absorbs the sulfur dioxide, the concentration of sulfur dioxide in the water is increased, and thus part of the water is discharged as blow water.

Conversion to oil and natural gas as boiler fuels is promoted in the city of Tianjin, particularly in the case of small boilers which are characterized by a very low combustion efficiency. Company B has been permitted to continue with coal fuel due to its relatively large coal consumption (1ton/hr), and its effective program of managing waste gas treatment.

On-site waste gas inspections are conducted by the bureaucracy once ever two or three months, and random samples taken. Coal is sampled immediately before being supplied to the boiler.

The remaining two boilers were modified in 2003, and the company is confident that the reduction targets for 2004 and 2005 will be achieved.

Figure 2-2-b: Modification of boiler exhaust discharger



Before remodeling **After remodeling**

Case 3 Online System Transferring Measured COD Values to the Authority

1) Outline of the company

Company C
Details of business: Manufacture and sale of Japanese liquor.
Number of employees: 52
Commencement of operations: 1998
Location of factory: South East area of city of Beijing (Fengtai District, Beijing)
Japanese equity ratio: 92.0%

2) Background

Company C is engaged in the manufacture of Japanese sake liquor using Chinese rice as the raw material, and sale of the liquor within China. The company is the focus of much attention for its attempt to introduce and establish hitherto unknown liquor to Chinese food culture, and has featured on Chinese TV and in newspapers.

The process of manufacturing sake liquor generates highly polluted wastewater which is eventually discharged into rivers. For this reason, the city of Beijing has set very strict standard values for waste water. While the name of the product is becoming increasingly well-known, and the business is expanding, due to exposure in the mass media, any problem involving the standard values for wastewater must be avoided at all costs.

Furthermore, at the instruction of the Environmental Protection Bureau, an online monitoring system has been installed in which the COD value of treated water is sent automatically via a telephone cable to the agency in the Fengtai district of Beijing. Since a fine is imposed if the standard value is exceeded, it is expected that the wastewater treatment equipment be able to provide treatment to a high degree and cover all eventualities.

3) Details of measures implemented

a. Wastewater Treatment

Almost 400m^3 of rinse water is generated daily by the rice steamer, the liquor fermenter, and malt press etc. Standard values set by the city of Beijing for discharge of this wastewater with its high concentration of organic materials are as follows.

Table 2-2-4: Standard values for wastewater

(mg/liter)

Items	COD	BOD	SS
Standard values	100 (COD_{Cr})	60	80
(Reference) Japanese standard values [1)]	160 (COD_{Mn})	160	200

1) Ministerial ordinances determining wastewater standard values are taken from the separate Table 2.

All items are more strict than the Japanese standard values. As described in Section 3 of Chapter 1, since the oxidizability of COD_{Cr} is approximately three times that of COD_{Mn}, a COD_{Cr} of 100mg/liter is the equivalent of 30mg/liter under the Japanese standards. Comparison with 160mg/liter reveals the severity of this value. This standard value is the equivalent of the Chinese government's Class I standard for manufacture of alcohol-related products. Furthermore, the standards of 80mg/liter for suspended solids (SS) is severe in comparison with the Japanese standard value of 200mg/liter. The wastewater treatment equipment shown in Figure 2-2-c has been installed to satisfy this standard.

Aeration is conducted in three stages in order to satisfy the strict COD and BOD standard values. In the first stage the air is introduced from the bottom of the aeration tank immediately after the equalization tank, and in second and third stages the air is introduced from the bottom of a column packed with filler.

The biological slime method involves the growth on the surface of the filler of a biofilm which

decomposes the organic matter in the waste water. In order to satisfy the strict standard values for suspended solids, the wastewater is passed through an inclined plate-type sedimentation tank is provided in the first stage of the biological slime treatment, and through a further inclined plate-type sedimentation tank and sand filter in the finishing treatment. In 2002, a system was installed entirely at Company C's expense to measure the COD of the treated water once every three days with an automatic COD analyzer, and send the data automatically via a telephone cable to the Environmental Protection Bureau in the Fengtai District. Prior to the installation of this system, on-site water quality inspections were conducted by personnel from the Environmental Protection Bureau in the Fengtai District. The system is such that a warning is generated if a measurement in excess of the standard value is does not return to normal within a fixed period.

COD_{Cr} at the time the wastewater enters the treatment equipment is between 400mg and 600mg/liter, and the value for the treated water is 30mg/liter, a reduction more than sufficient to satisfy the standard value. Installation of a sand filter for treatment of wastewater not containing toxic substances is rare in Japan.

Sludge produced when part of the organisms in the reproducing biofilm peel off, and the sludge formed by sedimentation in the first stage of the sand filter is concentrated and dried with a filter press dehydrator. Since the annual total of this sludge is a mere one ton, it is all used as fertilizer for garden plants within the factory site.

Since the outward appearance and odor of the wastewater treatment equipment are inappropriate for a factory manufacturing foodstuffs, the entire equipment is enclosed within a building. To ensure that the entire equipment is compact, the equalization tank, the first stage aeration tank, and the air compressor pump are installed underground.

The inclined plate-type sedimentation tank and the biological slime treatment equipment both have a high treatment capacity per unit area, and were adopted to ensure a compact and efficient installation. The design of this equipment was undertaken at the Chinese Academy of Environmental Science, constructed by a Chinese company, and funded by Japanese overseas development aid.

b. Waste products

Since the dregs left after the manufacture of Japanese sake liquor is sold as animal feed, and the sludge remaining after treatment of the wastewater is used as fertilizer for garden plants within the factory site as described above, almost no waste products need be disposed of outside the site.

Sake is sold in issho bottles (0.477 U.S. gallons), and empty bottles are recovered and reused. A system has been established whereby approximately 100 restaurants being large consumers of the product contact the company when the empty bottles have been collected in sufficiently large numbers, and the bottles are then picked up for reuse. This service extends to areas such as Dairen, approximately 100km away. Approximately one third of the bottles shipped are recovered. As the issho bottle is not a standard size in China, they must be imported from Japan, and the reuse of this resource, and the associated cost reduction, has proved useful.

c. Waste Gas

Coal-fired boilers were employed until recently, however at the instruction of the authorities, the boilers were converted to a fuel oil similar to kerosene in November 2003. The city of Beijing is promoting the use of clean fuels as a means of preventing atmospheric pollution. The policy of converting to clean fuels is still implemented, even though this factory is located away from urban areas in an underdeveloped area. Costs of improvements to the equipment amounted to approximately JPY2,600,000 (RMB17,000), and fuel costs increased four-fold. The city of Beijing provided an incentive of JPY600,000 (RMB40,000) for improvement of the equipment. The improvements allowed removal of the smokestack required by the coal-fired boiler.

The restrictions on the type of coal used were severe, and sulfur content and brand were prescribed, with

on-site inspections and associated sampling conducted. Furthermore, waste gas was also analyzed twice yearly.

d. Environmental measures during the factory planning stage

Environmental measures (e.g., characteristics of waste products, amount generated, and method of treatment) were submitted for each process, evaluated, and construction permission granted based on the outcome.

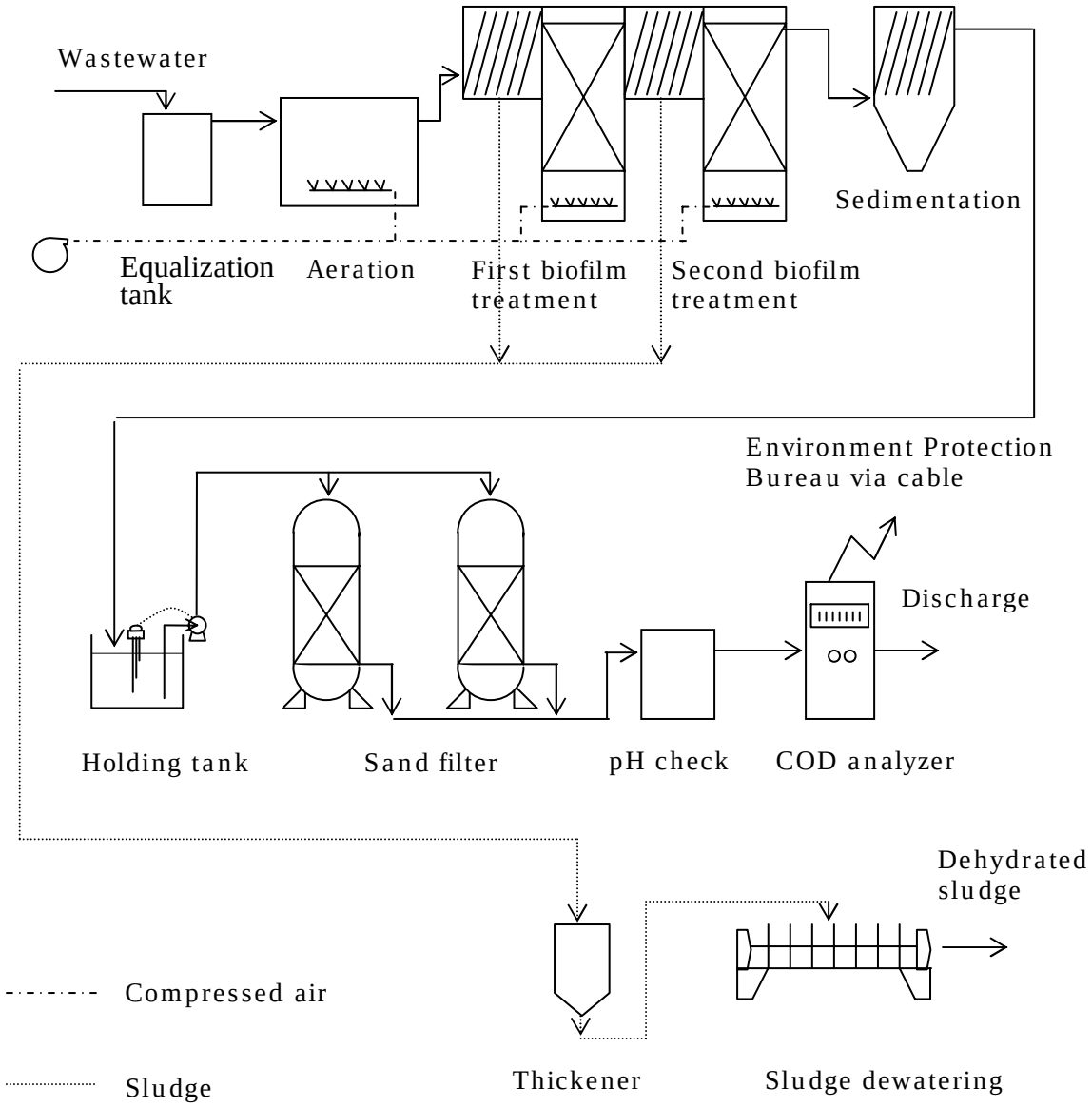
Permission to commence operations was issued once the completion inspection was conducted. This permission notes the standard values for emissions. The company was required to comply with the environmental regulations at the planning, construction, and operational stages ("Three synchronization").

e. Miscellaneous

Since good quality water is necessary for the brewing of sake, hard water is drawn from artesian sources and treated with ion exchange resin to obtain soft water. The amount of artesian water which may be drawn is restricted to 250,000 tons annually. Within this limit, approximately RMB0.5/ton is payable to the city of Beijing. This price jumps ten-fold if the limit is exceed. The limited water resources available in China require restrictions on the use of artesian water as well.

While Beijing's standard values for wastewater are very strict, local businesses are also subject to sanctions if found to be contravening the regulations. A local company brewing vinegar adjacent to Company C's site was fined RMB100,000 (approximately JPY1,500,000) for exceeding standard values, and were subject to an order requiring improvements within a set time. Some businesses under government management have moved to areas where restrictions are less severe.

Figure 2-2-c: Wastewater Treatment Flow



Case 4 Storage of Toxic Waste in Factory for a Period of Six Years

1) Outline of the company

Company D
Details of business: Manufacture and sale of copiers.
Number of employees: 170
Commencement of operations: 1997
Location of factory: South of the city of Tianjin (Hexi District, Tianjin)
Japanese equity ratio: 92.0%

2) Background

The Japanese parent company of Company D employs a positive approach to environmental measures as an effective contribution to management, for example, through increased operating earnings, and is top in newspaper N's environmental management rankings. Overseas subsidiaries are also expected to implement thorough environmental measures.

As assembly work is the main operation at the factory, highly polluted wastewater and waste gas is not generated, however a few materials designated as toxic waste products by the Chinese government are generated. Materials recognized as toxic waste products are required to be treated in a treatment facility, however a certified facility has yet to commence operations even after six years of operation of the factory.

Toxic waste products may be handed over to contractors, however if these materials are disposed of illegally and their source determined, the image of the company is severely damaged. The toxic waste products generated are therefore properly sorted and stored on the factory site until completion of the treatment facility.

3) Details of measures implemented

a. Control of waste products

Waste products generated at the factory are sorted into toxic waste products and general waste products as shown in Table 2-2-5. Toxic waste products are defined by the Chinese government and equate to waste products regulated under the Basel Treaty. In this factory they are sorted into waste solder and flux, and waste oil and toner. Waste solder and flux are reusable and are therefore purchased by licensed contractors. Waste oil and toner are consigned to other licensed contractors for treatment, treatment costs being paid by Company D. These contractors first appeared in 2003, and toxic waste products generated in the six years between commencement of operations at the factory in 1997 and 2003 were therefore stored on the factory site.

A manifest system is employed for consignment of toxic waste products to contractors for treatment. The business generating the toxic waste products, the transport operator, and the treatment operator are noted on the form in that order, and the form submitted to the city of Tianjin Environmental Protection Bureau when treatment is complete. A copy is then returned to the business generating the waste products. Items entered on the form are the name of the business generating the waste products, the type of waste products, amount of waste products treated, name, license number, and contact address of transport operator, and name, license number, treatment method, and contact address of treatment company. Treatment costs are RMB3(approximately JPY45)/kg.

General waste products are sorted into reusable and domestic waste products, each being consigned to a different licensed contractor for treatment. Considerable amounts of reusable metal scrap, waste plastic, and cardboard boxes are generated, and are each sold to different contractors. Domestic waste consists of leftovers from the canteen and office trash, and is collected by the Hexi District trash collection at three or four day intervals. Annual collection costs are approximately RMB7,000 (approximately JPY100,000).

Table 2-2-5: Generated waste products

Type		Waste products	Treatment company	Final disposal	Remuneration
Toxic waste products		Waste solder and flux	Tianjin Rising Corporation	Reused	Sold
		Waste oil and toner.	Tianjin Integrated Hazardous Waste Treatment Center	Incinerated	Treatment costs paid
General waste products	Reusable waste products	Metal scrap Waste plastic Cardboard boxes	Handled by different contractors	Reused	Sold
	Domestic trash	Canteen leftovers Office trash	Hexi District Health Office	Disposed of in landfill	Treatment costs paid

b. Waste Gas

Small coal-fired boilers are used in the factory, and as part of the city of Tianjin's Blue Sky Program designed to reduce atmospheric pollution, the use of coal in boilers generating ten tons of steam or less per day is prohibited. Notification of this regulation by the Hexi District Environmental Protection Bureau was without warning, and caused considerable confusion. Boiler equipment was rapidly updated for the combustion of natural gas, the gas being taken from a natural gas pipeline passing close to the site.

Waste gas regulations for lead have been set for two locations in the soldering process. Standard values are 0.7mg/m^3 under the Chinese government's general standard values for atmospheric pollution. These levels are adequately satisfied. The process will be converted to lead-free solder in July 2004.

c. Wastewater

Wastewater standard values as shown in Table 2-2-6 have been set for domestic wastewater, e.g., wastewater from the canteen and toilets. Standard values for everything from pH to mineral oil are covered by the Chinese government's general wastewater discharge standard values and Class III standard values. Ammonia nitrogen is not set in the Class III standard values, however the Class II standard value are set here. Class III standard values are discharge standard values for sewerage systems in the final treatment plant, and the Class II standard values are direct discharge standard values for public water areas, however some regulations incorporate both standard values.

Personnel from the Hexi District Environmental Protection Bureau take samples on site to monitor water quality twice yearly.

Table 2-2-6: Wastewater standards

(values other than pH are in mg/liter)

Regulated items	pH	Suspended Solid	COD	Mineral oil	Ammonia nitrogen
Standard values	6-9	400	500	30	25

c. ISO14001

Certification was received in 2003. A person solely responsible for environmental matters is assigned to the equipment section, and all matters related to certification were handled primarily by this person. Persons responsible for environmental matters are also assigned to other sections.

Environmental targets for 2003 are as follows.

- Reduction of sulfur dioxide in boiler waste gas to zero through conversion to natural gas.
- A 1% reduction in power consumption in comparison with 2002 by eliminating unnecessary lighting.
- A 70% reduction in the costs of treating waste products through reuse of old paper, and resorting of waste products etc.

- A 400m^2 increase in vegetation within the site by tidying up.

An environmental management manual covering the following has been produced as part of ISO14001 activities.

- Preventing water pollution.
- Preventing atmospheric pollution.
- Preventing potential environmental pollution and emergency responses.
- Preventing pollution by waste oil and waste fluids.
- Transmitting environmental information.
- Requesting environmental measures of suppliers and contractors.
- Acquiring up-to-date information on environmental regulations and legislation.

Prevention of potential environmental pollution and emergency responses is particularly advanced and is unique. Items liable to cause environmental pollution in each workplace are identified, and a plan to deal with pollution has been developed. This plan clarifies the persons in charge, and includes a list of all personnel in related workplaces, the path of communications in an emergency, practical methods for emergency measures etc, and includes training to ensure that all personnel at the workplace thoroughly conversant with the details.

The section on requesting environmental measures of suppliers and contractors gives priority to ISO14001 certified suppliers in selection, requires that contractors sufficiently understand and follow strictly the factory environmental policy, and provides environmental training prior to commencement of operations.

d. Miscellaneous

An environmental report is required to be submitted to the Hexi District Environmental Protection Bureau annually. This report is approximately 50 pages in length, and covers amounts of wastewater, waste gas, toxic waste products, general waste products, noise generated, and also reports on the flow of current manufacturing processes. This report covers environmentally-related items in a lateral manner, since hierarchical bureaucratic structures are normally rare in China.

Case 5 Treating Highly Concentrated Wastewater while Accepting a Large Number of Visitors

1) Outline of the company

Company E
Details of business: Manufacture and sale of confectionery.
Number of employees: 520
Commencement of operations: 1996
Location of factory: Economic and technical development zone south east of the city of Beijing.
Japanese equity ratio: 100%

2) Background

Company E manufacturers chewing gum, cookies and snacks etc, and generates large amounts of highly concentrated wastewater in the washing of containers employed in mixing raw materials. Wastewater is subject to primary treatment at each tenant's factory within the economic and technical development zone, and is then piped to a central wastewater treatment facility for final treatment. The company established the factory in this area as a result of its well-developed infrastructure (e.g., wastewater treatment facility).

As the factory is engaged in the manufacture of items for human consumption, it is important to maintain an image of cleanliness in the primary wastewater treatment process as well. The wastewater treatment process is therefore installed entirely indoors, the odors characteristic of wastewater treatment are suppressed, and equipment having an appearance inconsistent with foodstuffs is covered from view. Furthermore, the economic and technical development zone is considered to be a model development zone in China, and as such receives many overseas visitors, so that there is a need to be able to respond to sudden visits of interested parties.

3) Details of measures implemented

a. Wastewater treatment

Controlled items and standard values set for company E's wastewater treatment are as shown in Table 2-2-7. After treatment to ensure that these standard values are satisfied, the wastewater is piped to the central wastewater treatment facility. Since it is assumed that this wastewater will be finally treated in the central wastewater treatment facility, standard values for the company are comparatively low.

Table 2-2-7: Wastewater standards set by the city of Beijing

(Values other than pH are in mg/liter)

Items	COD_{Cr}	BOD	SS	pH
Standard values	500	300	160	6 - 9

The wastewater treatment process is shown in Figure 2-2-d. The wastewater from each type of product process is mixed together in the equalization tank. Approximately 250 tons of wastewater is equalized daily, and has an average BOD of 3,000mg/liter. Oil is separated from the wastewater with oil cracking equipment. BOD following separation of the oil is reduced to approximately 1,000mg/liter. The wastewater is then piped to the aeration tanks where it is aerated in batches for approximately ten hours. BOD following aeration is sufficient to satisfy the BOD standard value of 300mg/liter, and it therefore piped to the central wastewater treatment facility. Three aeration tanks are employed alternately. Wastewater piped to the central wastewater treatment is charged at a rate of RMB1.2/ton. The oil separated by cracking is taken by a waste products contractor for disposal as waste oil.

The wastewater treatment equipment is designed by the Japanese parent company, and is installed by local contractors. Operation is the responsibility of the energy section of the company at the factory. When the equipment was first constructed its processing capacity was found to be insufficient, and was therefore expanded in a Stage II program. Including Stage II costs, a total of JPY50,000,000 has been expended on the equipment.

Personnel from the Beijing Environmental Protection Bureau visit the factory to take random samples for water quality inspections. Fines are payable if inspection reveals that standard values are exceeded, and if these levels are repeatedly exceeded, the company may be ordered to cease operations at the factory. The initial contract upon becoming a tenant of the development zone requires that the wastewater standard values be strictly adhered to.

b. Treatment of waste products

Waste products are of two types, one being cardboard boxes, plastic, and wooden pallets etc which are saleable, and the other being garbage and office trash etc which is not saleable. Cardboard boxes can be sold for RMB0.8/kg. Unsaleable garbage is collected by truck by the development zone twice daily, this collection being charged at a rate of RMB40/truck/time. Combustible items in the collected garbage are incinerated, and incombustible items are disposed of in landfill.

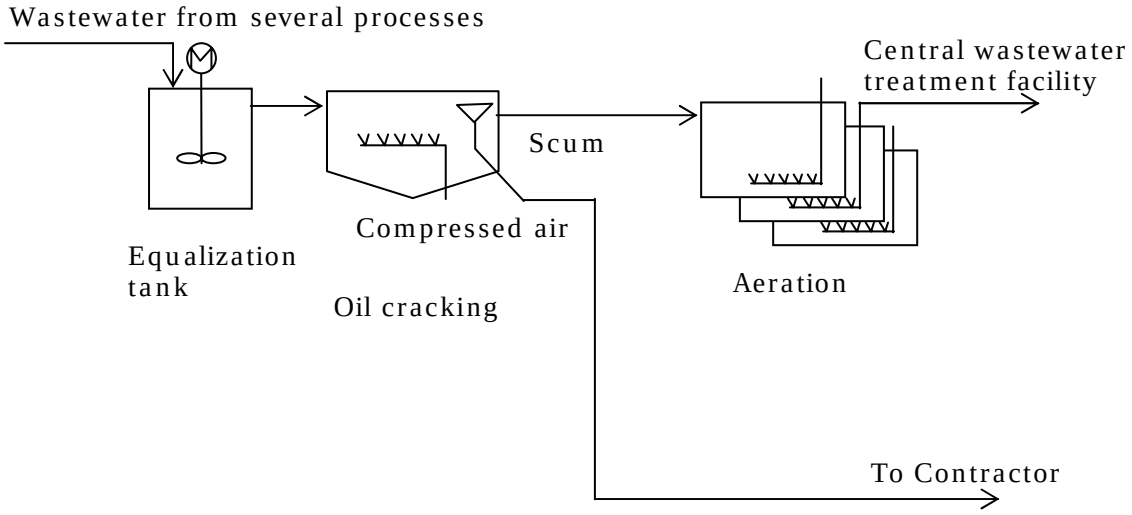
c. Miscellaneous

Information on revisions of environmental regulations etc is received from the person responsible for environmental matters in the development zone. When a revision occurs, a meeting is held at which it is explained and explanatory materials distributed.

Employees have been invited to submit slogans, the best of which are displayed.

Ovens used in baking the confectionary are fired with natural gas, and waste gas regulations are therefore not applied.

Figure 2-2-d: Treatment flow for highly concentrated wastewater



Case 6 Handling Volatile Organic Compounds (not subject to regulation in Japan)

1) Outline of the company

Company F
Details of business: Printing.
Number of employees: 200
Commencement of operations: 1995
Location of factory: Economic and technical development zone south east of the city of Beijing.
Japanese equity ratio: 100%

2) Background

Company F is engaged in the printing of catalogs and brochures, and other general printing work, and is the largest in its field in Beijing. Volatile organic compounds (organic solvents) released from ink used in the printing industry are subject to regulations in China.

When establishing operations in China, the company employed the same technology in its environmental measures as used in Japan, and has installed the most recent equipment for treatment of organic solvents.

3) Details of measures implemented

a. Waste gas treatment

Discharge standard values set by the city of Beijing for organic solvents in gas discharged during printing are as shown in Table 2-2-8.

Table 2-2-8: Discharge standard values for organic solvents

Items	Benzene	Toluene	Xylene	Remarks
Concentration (mg/m^3)	12	40	70	Discharged volume: $8064m^3$/hr Smokestack height: 11m
Exhaust quantity (kg/hr)	0.13	0.83	0.27	

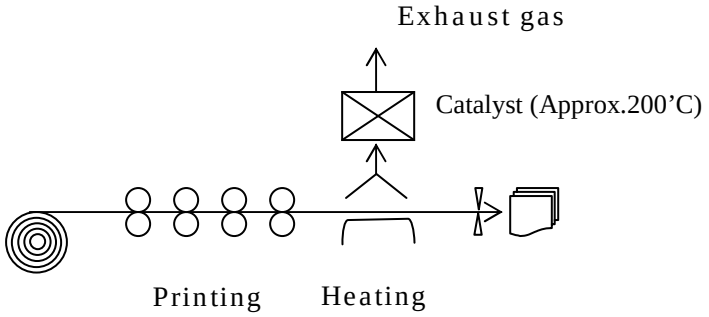
Concentration and discharged volume are regulated for the three components benzene, toluene, and xylene in printing ink. Standard values are determined in accordance with discharged volume and smokestack height. In Japan, voluntary reductions in discharge for each industry are sought, rather than standard values at a national level.

Catalytic decomposition equipment as shown in Figure 2-2-e was installed in order to satisfy these standard values. The solvent in the ink is evaporated when the printed pages are heated with the dryer. This evaporate is collected, heated to approximately 200'C, and passed through a catalyst layer where it is oxidized and decomposed by the oxygen in the air in the equipment. The waste gas after treatment is then discharged from the smokestack. A licensed organization specializing in analysis is contracted to measure the regulated items in the treated gas once each year, and the results of the analysis are submitted to the Environmental Protection Bureau.

Measured concentrations for benzene and toluene in the treated waste gas are less than $1mg/m^3$, and $3mg/m^3$ for xylene. All three standard values are readily satisfied. The exhaust quantity for discharge for all three solvents is 0.03kg/hr or less. This level is satisfied with considerable leeway. On-site inspections are sometimes conducted by personnel from the Beijing Environmental Protection Bureau.

The catalytic decomposition equipment was designed and manufactured by a specialist Japanese manufacturer after investigating the relevant regulations established by the city of Beijing.

Figure 2-2-e: Treatment process for solvents in printing ink



b. Waste products

Small amounts of toxic waste products (e.g., photographic developer fluid, waste film) are generated and are consigned to specialist contractors for treatment. On-site inspections are conducted by personnel from the Beijing Environmental Protection Bureau to determine the amounts generated, and the status of treatment.

Section 3
Case Studies of the Relationship of Environmental Management Systems to Improvements in Management

ISO14001 certification is useful as evidence of the positive approach of a business to environmental matters, however there is sometimes a tendency for it to become a matter of mere formality. In order to ensure its effectiveness, one company has developed a continuous three-year activity plan based on ISO14001 requirements, and another has obtained considerable benefits in terms of reduced use of resources and energy through its implementation.
The common thread running through these approaches is the leading role of top management in the use of ISO14001 certification to contribute to the management of the company. In these cases, this attitude is reflected in consolidation of internal company organization, and in the creativity of activities.

Case 7 Implementing a Continuous Three-year Activity Plan Based on ISO14001 Requirements

1) Outline of the company

Company G (same as Company B in Case 2) Details of business: Manufacture and sale of automobile engines. Number of employees: 800 Commencement of operations: 1998 Location of factory: Xiqing District, city of Tianjin Japanese equity ratio: 50%

2) Background

The Japanese parent company of Company G is engaged in the manufacture and sale of automobile engines on an international scale, and has commenced its operations in China in earnest. The company is engaged in acquiring international certification appropriate to a world-class enterprise, and as such, ISO9001 certification was obtained in 2001, and ISO14001 certification is considered a natural part of this progression. A plan directed towards obtaining ISO14001 certification came to fruition in September 2002, immediately prior to the release of a new model in the Chinese market in October of that year. The company did not wait for instructions from the Japanese parent company, and made and implemented its own proposals.

The implementation of ISO14001 was characterized by autonomy and creativity, and included the continuous three-year activity plan, and the setting of standard values for waste discharges in excess of those set by the relevant authorities. ISO14001 activity plans are commonly established for single years, and struggle to incorporate new ideas for reduction in environmental load each year. The company is the focus of much attention for its long-term vision as evidenced by its continuous three-year activity plan harmonized to company management.

3) Details of measures implemented

a. Acquisition of ISO14001 certification

In 2001, the environmental philosophy comprising the four items shown below as preparations for acquisition of ISO14001 certification was developed, the environmental management organization shown in Figure 2-3-a was inaugurated, and the environmental management policy clarified.

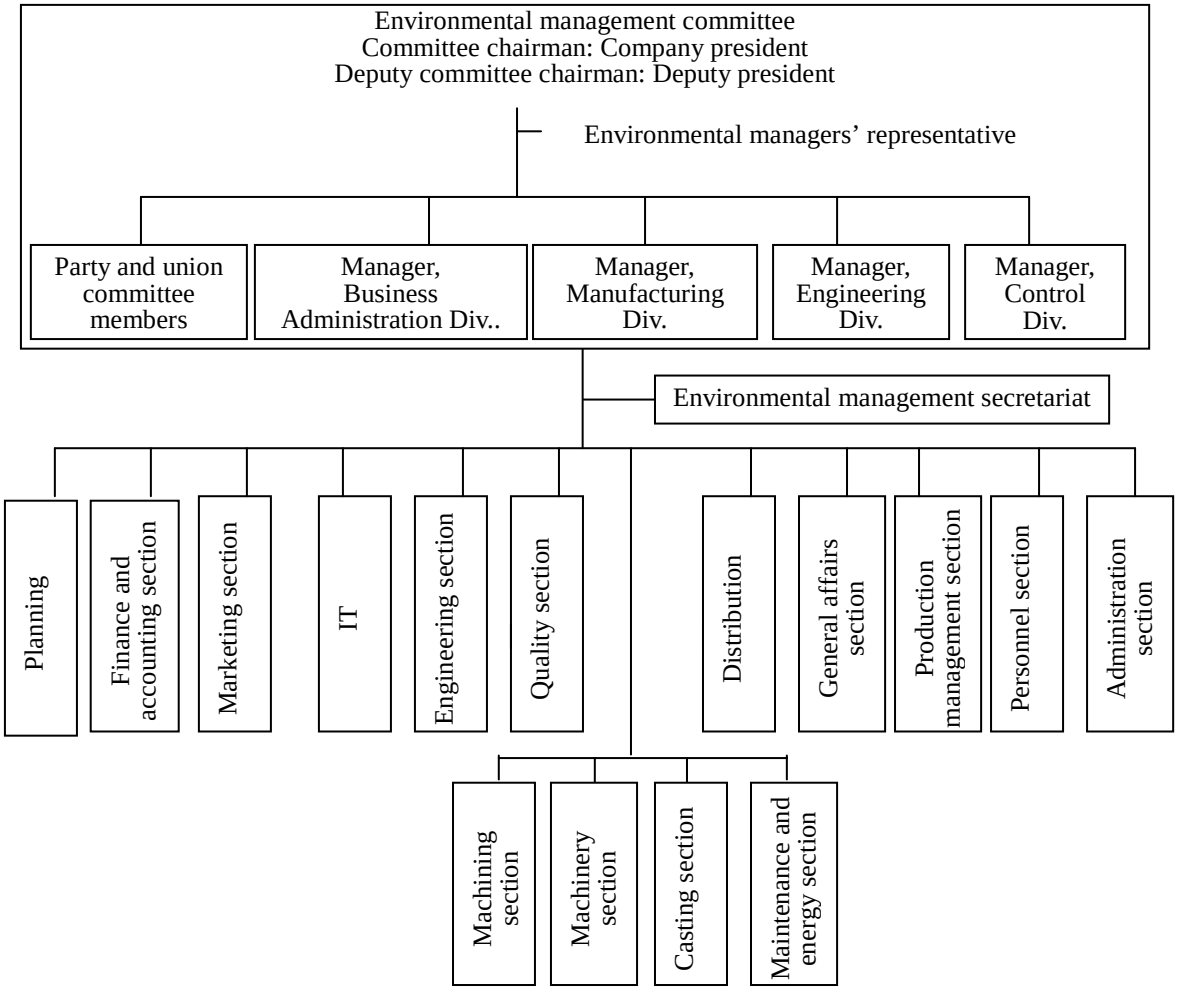
Environmental Philosophy

(1) Integration of environmental protection and sound management
(2) Effective use of resources
(3) Global environmental protection
(4) Continuous development

An environmental committee comprising top management and responsible persons from each section was established as the organization responsible for decisions on environmental matters. This committee was placed directly under the secretariat in charge of day-to-day operations, and was charged with the promotion of activities at each workplace. A person responsible for environmental matters was assigned to each workplace, and was assigned the central function of assigning activities.

The first requirement of environmental policy was the strict observance of the environmental regulations set by the Chinese government, the second being the clarification of the responsibilities of each section, and overall, the implementation of the environmental philosophy through reduction in environmental loads associated with production, and effective use of resources.

Figure 2-3-a: Environmental management organization and environmental policy



Environmental Management Policy

The company is to engage in production activities in consideration of environmental protection, and to contribute to society.

1. To strictly observe both Chinese national and Tianjin municipal environmental regulations, and respond rapidly to changes in such regulations.
2. To identify the persons responsible for environmental management, and to endeavor to improve environmental management abilities of each responsible person.
3. To endeavor to reduce environmental load of waste water, waste gas, waste products, and chemicals etc, and prevent environmental pollution before it occurs.
4. To endeavor to reduce consumption of resources and utilities, and to reduce environmental load.
5. To incorporate the company's environmental philosophy firmly in its operations, and to make maximum efforts in environmental protection.

Education and training activities at all levels within the company commenced in 2001 as preparation for certification. Environmental matters were investigated thoroughly at each workplace centered on the environmental management secretariat, and targets for reduction in environmental loads, and practical measures for such reductions, determined. Certification was granted in September 2002 following preparatory and final inspections by the certificating organization.

In order to ensure that ISO14001 certification activities were continuous, the plan for reduction in environmental load was in the form of a three-year schedule. In other words, results at the end of the first year were evaluated, the following three-year plan reviewed, and a new plan prepared. The outline of the plan for 2003-2005 based on the evaluation of the 2002 year is as shown in Table 2-3-1. Assuming the load on the environment per engine manufactured in 2001 as 100%, target values for subsequent years are shown as percentages. For example, power consumption was reduced to 87.0% in 2002, and is going to be reduced to 72.0% in 2003, to 67.0% in 2004, and to 65.0 % in 2005, in their plan.

Assuming the COD of wastewater as 100% in 2001, discharge is planned to be reduced to 65.0% in 2005, and sulfur dioxide (SO_2) in waste gas from boilers is planned to be reduced to 40.0%. In addition to strictly observing the discharge standard values, the target is to reduce load on the environment as much as possible.

Between two and six practical measures to reduce discharge are proposed for each item. While not shown in the following table, the possibility of listing expenses for each measure, and equalizing these expenses by implementation of the reduction measures through the years, is considered. This method is considered to have promoted the reduction plan without imposing excessive costs of environmental measures on administration.

Furthermore, the responsible divisions are shown in the following table in only one location, however where measures are implemented in common at two or three locations, the name of the division is clearly noted.

In addition to the six items in the following table, a total of ten items (including domestic wastewater etc) were subject to reductions.

Table 2-3-1: Targets of primary ISO14001 activities

Items		Year	2001	2002	2003	2004	2005	Division responsible
Reduction in power consumption	Reduction target (per engine manufactured) (%)		100	87.0	72.0	67.0	65.0	
	Measures	Immediate repair of compressed air leaks at joints			○	○	○	Each production section
		Thorough maintenance and inspection of electrical equipment			○	-	-	Engineering section
		Thorough reduction in defective items			○	○	○	Engineering section
		Study to reduce power consumption of casting smelting furnace			○	○	○	Each production section
		Active promotion for power-saving activities of each division Technical section			○	○	○	Engineering section
Reduction in LNG consumption	Reduction target (per engine manufactured) (%)		100	99.0	94.0	88.0	85.0	
	Measures	Review of smelting furnace work standards			○	-	-	Casting section
		Statistical analysis of consumption			○	-	-	Engineering section
		Various modifications to improve combustion efficiency			○	○	○	Casting section
		Reduction in heat loss by modifications to thermal insulating walls			○	-	-	Casting section

Items		Year	2001	2002	2003	2004	2005	Division responsible
SO_2 reduction	Reduction target (per engine manufactured) (%)		100	87.0	49.0	43.0	40.0	
	Measures	Thorough maintenance of boiler waste gas treatment			○	○	○	Energy section
		Maintain pH8 for circulating wash water			○	○	○	Energy section
COD discharge reduction	Reduction target (per engine manufactured) (%)		100	80.0	73.0	68.0	65.0	
	Measures	Thorough optimization of operation of wastewater treatment equipment			○	○	○	Energy section
		Prohibit disposal of waste oil in wastewater			○	○	○	Each production section
		Thorough monitoring of discharged water			○	○	○	Energy section
		Creative improvements to raise treatment efficiency			○	○	○	Energy section
Reduction in waste cutting oil	Reduction target (per engine manufactured) (%)		100	130	95.0	92.0	90.0	
	Measures	Immediate repair of leaks from cutting machinery			○	○	○	Machinery section
		Collect all possible ideas to extend life			○	-	-	Machinery section
		Improve method of changing waste fluids			○	-	-	Machinery section
Reduction in consumption of wastewater	Reduction target (per engine manufactured) (%)		100	75.0	67.0	63.0	60.0	
	Measures	Raise awareness of saving water			○	○	○	Engineering section
		Thorough leakage checks and rapid repair			○	○	○	Energy section
		Endeavor to raise recirculation of cooling water to 100%			○	○	○	Each production section
		Remove unnecessary water supply systems			○	-	-	Technical section
		Spray wastewater on vegetation			○	-	-	Administration section
		Promote measurement and management of water consumption			○	○	-	Technical section

b. Wastewater treatment

Between 200m^3 and 240m^3 of wastewater containing cutting oil from parts cutting and product washing processes is generated daily. Cutting oil is an emulsion of oil and waste water, and the two are therefore not readily separated, and wastewater treatment is difficult. The wastewater standard values set by the city of Tianjin are as shown in Table 2-3-2. These standard values are the same as the Class II standard values for discharge of water into rivers set by the Chinese government. As COD_{Cr} of 150mg/liter is equivalent to a COD_{Mn} of 50mg/liter with the Japanese measurement method, it is very severe in comparison with the Japanese standard values of 160mg/liter. A more strict voluntary standard value of 140mg/liter was set by the company in order to ensure that the standard value was to be reliably observed, and operations are managed to ensure that this level is not exceeded.

Table 2-3-2: Wastewater standard values

(values other than pH are in mg/liter)

Items	pH	COD_{Cr}	SS	Mineral oil	NH_3-N
Standard values	6 - 9	150	150	10	25
Company standard values	6 - 8	140	150	8	25
Reference: Japanese standard values [1)]	5.8 - 8.6	160 (COD_{Mn})	200	5	100 [2)]

1) Ministerial ordinances determining wastewater standard values are taken from the separate Table 2.

2) (NHO_3 - N + NHO_2 – N + 0.4 × NH_3-N) $\leqq$100 mg/liter

The wastewater treatment equipment shown in Figure 2-3-b is operated not only to satisfy the standard values above, but to reach the ISO14001 COD reduction target. The quality of the factory wastewater received is equalized in the equalization tank, and a de-emulsifier added to break down the emulsion. The oil is then readily separated from the wastewater by cracking. The tank is pressurized by injecting air through small holes into the waste water, the resulting small bubbles adhering to the oil particles and rising, and thus separating from the water. After most of the oil is removed, the remainder is aerated to assist decomposition by microorganisms. A secondary cracking process is then employed to float and remove suspended matter. The remaining suspended matter is then removed with a sand filter, and organic matter is absorbed with activated charcoal and removed. The use of activated charcoal is a sophisticated method of treatment which increases operating costs, and is rarely used in Japan for treatment of wastewater, however it is necessary in company G's factory to satisfy the COD standard value.

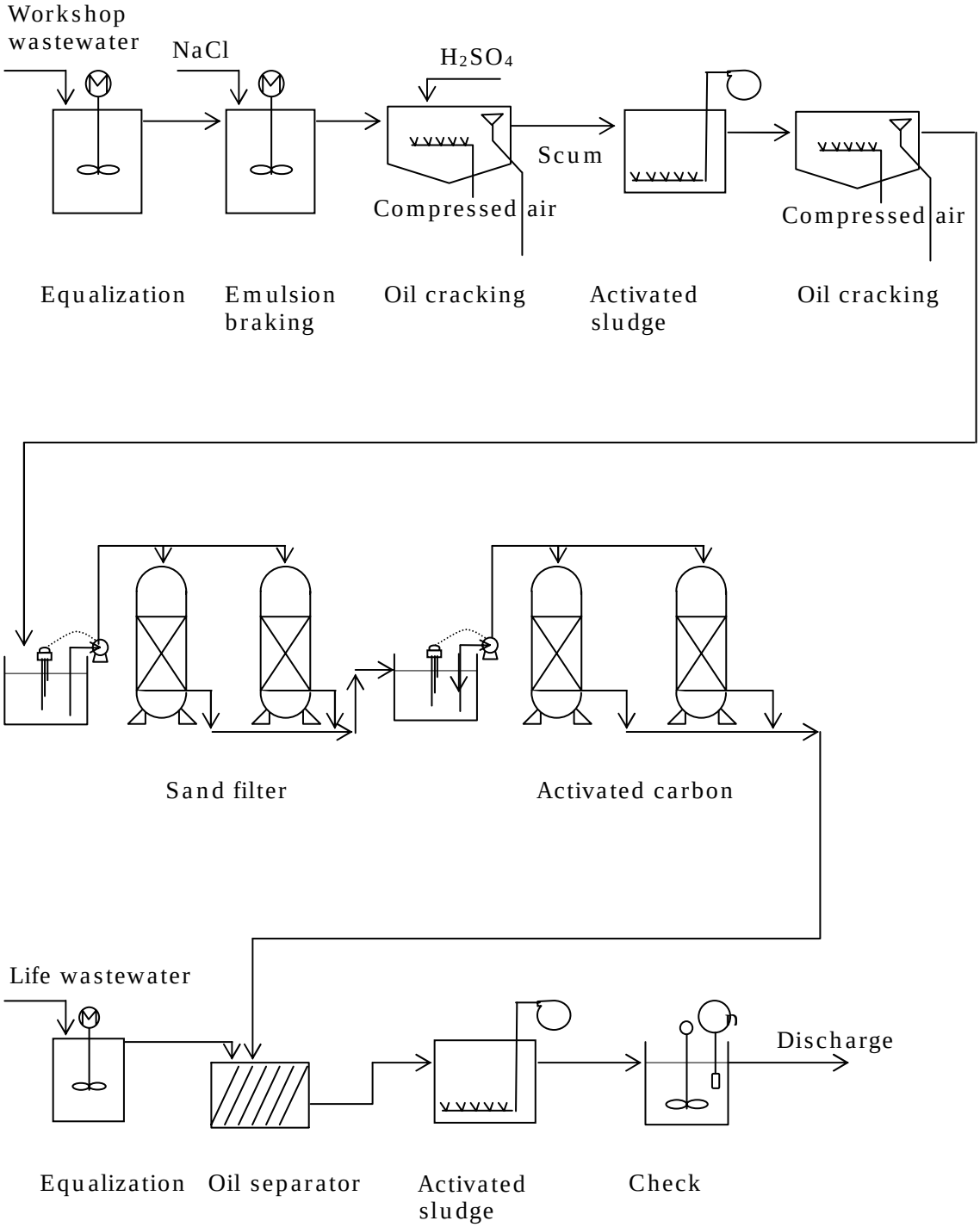
The treated water is then mixed with between 300m^3 and 360m^3 of domestic wastewater per day from a separate system and oil removed again, subjected to activated sludge treatment, checked, and discharged. The treatment equipment was designed and installed by a Chinese manufacturer. The equipment produces between 500 tons and 600 tons of treated water per day, of which part is sprayed on vegetation within the factory site.

The standard value for NH_3-N (ammonia nitrogen) of 25mg/liter is very severe, however as this compound is not generated at the factory, the standard value is satisfied without the need for special measures.

c. Toxic Waste Products

Approximately 15 tons of toxic waste products such as sludge from the wastewater treatment process, discarded dry batteries, and asbestos is generated annually. Those are left to a contractor by paying RMB2,000/ton, and incinerated at the Integrated Hazardous Waste Treatment Center completed in 2003. The waste was tracked to ensure that it had been disposed of in the correct manner. Prior to completion of the Treatment Center this waste was stored on-site, and when the Center was completed, 60 tons of the waste was disposed of in one operation.

Figure 2-3-b: Wastewater treatment equipment



Case 8 Employing ISO14001 Certification in Conservation of Resources and Energy

1) Outline of the company

Company H (same as Company A in Case 1)
Details of business: Electronics-related manufacturing.
Number of employees: 1,100
Commencement of operations: 1998
Location of factory: Production base to the north of city of Beijing (Haidian District, Beijing)
Japanese equity ratio: 78.3%

2) Background

Company H is a subsidiary of a well-known company operating on an international scale. The parent company is naturally ISO14001-certified, and employs environmental accounting. Most of its Japanese factories have already gained ISO14001 certification. The products of this factory are shipped to Japan and the rest of the world, and the environmental evaluation of the company occupies an important role in management.

Within this context, ISO14001 certification of company H's factory was a natural development. While comprehensive environmental management is a natural aim of the company, reduction in consumption of power, water, and paper for office use is also a goal.

3) Details of measures implemented

a. ISO14001 certification

ISO14001 certification was gained in August 2002, however progress towards certification was as follows.

October 2001	Preparatory organization for certification initiated
February 2002	Preparatory organization for environmental management initiated
March 2002	Primary identification of environmental aspects
May 2002	Preparatory inspection by external organizations
August 2002	Certification by passing final inspection
January 2003	Secondary identification of environmental aspects
February 2003	Primary internal inspection
September 2003	Revision of environmental aspects
December 2003	Targets set for 2004

Environmental policy comprising the following six items was clarified at initiation of the preparatory organization for certification.

(1) Strictly observe current environmental regulations, and respond rapidly to changes in such regulations.
(2) Endeavor to reduce consumption of resources, and make effective use of resources.
(3) Prevent environmental pollution by chemicals through preventative measures.
(4) Educate employees thoroughly in environmental matters, and raise environmental awareness.
(5) Disclose environmental policy and endeavor to implement it.
(6) Invigorate the environmental management organization, and effectively promote environmental policy.

The organization of the internal company system promoting the above activities is as shown in Figure 2-3-c. The ISO secretariat is positioned directly under the president of the company, and is comprised of three specialist staff and six staff dispatched from the various workplaces. The secretariat proposes, promotes, and checks results of activity plans, and reviews plans for the next year etc. Technical aspects are the responsibility of environmental staff in the energy management section of the management division. Each workplace has staff responsible for environmental matters.

Practical topics and targets for reduction of environmental loads for 2003 are as follows.

(1) Reduction of power consumption per 1,000 products manufactured by 5% (to 137.7kwh) in comparison with 2002.
(2) Reduction of water consumption per 1,000 products manufactured by 5% (to 1.43 tons) in comparison with 2002.
(3) Reduction of office paper consumption per 1,000,000 products manufactured by 5% (to 18.76 packs) in comparison with 2002.
(4) Reduction of sealing plastic consumption by 60% (to 2.4 tons annually) in comparison with 2002.
(5) Strict observance of wastewater standards.
(6) Reliable management and treatment of toxic waste products.
(7) Appropriate response to emergency situations such as chemical leaks.

Time limits, and divisions responsible, for implementing these targets have been clarified. The related divisions are responsible for implementing targets. The secretariat collects monthly data and checks the state of progress. As of November 2003, almost all items are progressing smoothly, and full implementation by the end of December is expected as planned. For example, power savings are concentrated in equipment having low operating ratios, and unnecessary lighting is extinguished. Air-conditioning is operated partially, and unused spaces are divided off with partitions.

A thorough program of water reuse has been implemented, and shower faucets etc in which water issues only while the button is pressed have been adopted. These measures are proving effective.

As of December 2003, the ISO14001 training plan for 2004 is as shown in Table 2-3-3.

The training plan encompasses all employees, including new employees and division managers, with content being relevant to each. Internal audits and environmental management encompass specialist fields, and external tutors are employed in training lectures. As the company has more than 1,000 employees, persons responsible for promoting training are assigned to each workplace, and all workplaces are incorporated organically in activities under the instructions of the secretariat.

Figure 2-3-c: ISO14001 promotion organization

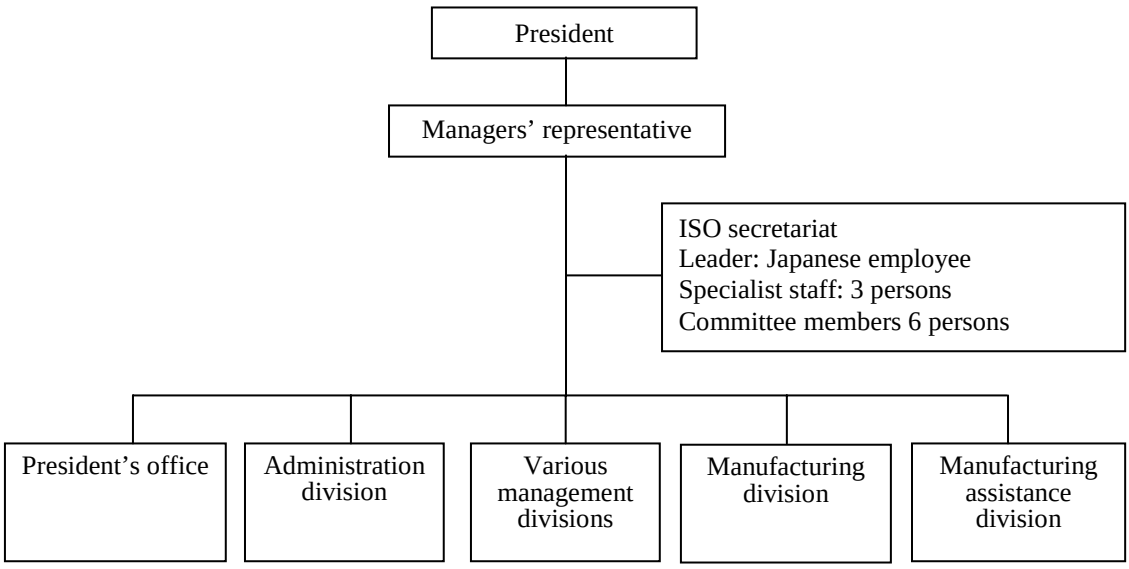


Table 2-3-3: Environmental training plan

Personnel	Details	Method	Persons responsible for promotion	Timing
Division heads and above	Environmental legislation	Visits	--	January, April, July, October
	Environmental manuals	Visits	--	February
Intermediate managers All employees	Environmental legislation, manuals	Mass lectures and reading texts	Persons responsible for each workplace	January, April, July, October
	Environmental topics for each workplace			February, September
	Environmental topics for each head office			November
Environmental controller	Comprehensive environmental management			February, September
Internal audit controller	Auditing methods	Mass lectures	External lecturer	August
Assistant manager and above	Environmental management methods	Mass lectures	External lecturer	June
New employees	Environmental policy	Mass lectures	Person responsible for training plans	As necessary

b. Waste products

Reliable management and treatment of toxic waste products is covered in ISO14001 activities, however general waste products and reusable waste products are also generated. These three categories of waste products generated by the factory are shown in Table 2-3-4.

Table 2-3-4: Classification and treatment of waste products

Major classification	Intermediate classification	Examples
General waste	Scrap glass	--
	Office trash	Paper scraps and discarded office supplies
	Canteen leftovers	--
	Rags	--
Toxic waste	Waste oil	Machine oil
	Plating sludge	Wastewater treatment sludge
	Printer toner	Including ribbons
	Waste plastic	Resin exceeding shelf life etc
	Chemical waste	Waste chemicals from analysis lab
	Discarded batteries	--
	Florescent lamps	--
	Rags contaminated with oil	--
	Waste chelate resin	--
	Filters	Waste gas filters and activated charcoal
	Waste solder	Waste solder
	Plastic office paper	OHP paper
	Medical waste	Syringe needles, cotton used for sterilization

Reusable waste	Defective products	--
	Steel scrap	--
	Glass bottles	--
	Metals	Copper wire
	Paper packaging	Cardboard boxes
	Wood packaging	Wooden frames

Classification of toxic waste products is determined by regulations set by the city of Beijing. All three categories are consigned to licensed treatment contractors.

c. Miscellaneous

Lead-free solder and high-melting point solder are technically possible, and are used at the request of the customer.

Case 9 A Company at the Top of its Field Gains ISO14001 Certification

1) Outline of the company

Company I
Details of business: Manufacture and sale of cosmetics.
Number of employees: 1900
Commencement of operations: 1993
Location of factory: Economic and technical development zone south east of the city of Beijing.
Japanese equity ratio: 65%

2) Background

Company I's cosmetics have a sophisticated image and are sold in 72 countries. The company is aiming at a sophisticated brand image for the products manufactured and sold in China. The Chinese cosmetics market is growing at an annual rate in excess of 10%, and the company is developing a network of sales outlets throughout the country to take advantage of this growth.

The company is thought of favorably in China - in 2001 the company was certified as an enterprise supporting the Chinese Olympic Committee, and in 2002 the honorary president of the Japanese parent company was made an honorary citizen of the city of Beijing. Furthermore, Company I was the first tenant in this development zone.

Within this context, it is desirable that the company engage in advance environmental measures, and indeed, from its position at the top of the Chinese cosmetics industry, the company has made its own decision to obtain ISO14001 certification without waiting for instructions from the Japanese parent company.

3) Details of measures implemented

a. Gaining ISO14001 certification

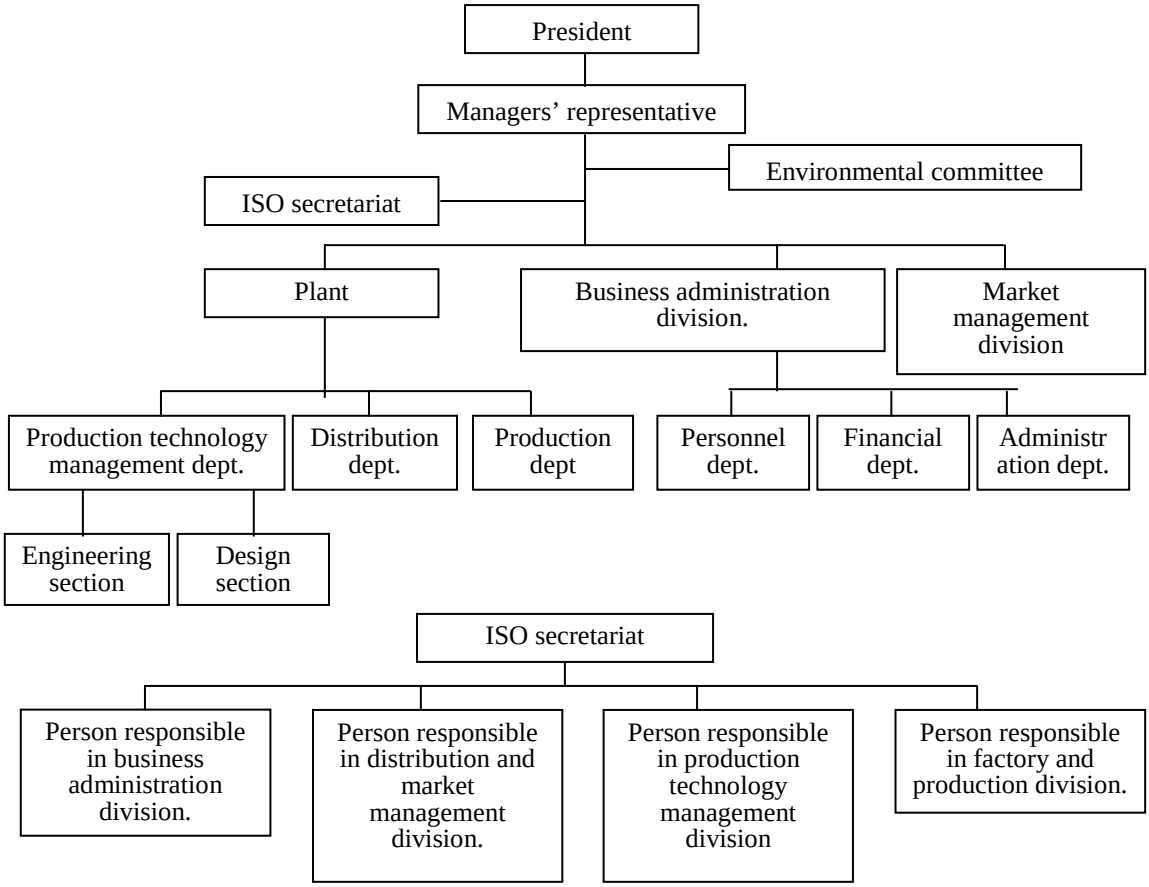
The schedule for gaining certification was as follows.

July 1999	Organization for ISO14001 certification initiated
January 2000	Organization for environmental management initiated
February 2000	Activities of organization for environmental management commenced
July 2000	External inspection by certifying organization
August 2000	ISO14001 certification obtained
August 2003	First survey and certification update

Activities of the organization for gaining certification were commenced in July 1999 to provide education and training at all levels within the company. Environmental aspects were thoroughly investigated for each division in February 2000, and targets and numerical targets, set. During this period the importance and purpose of ISO14001 was emphasized to general employees at each morning company meeting as part of education and training. ISO14001 certification was obtained in August 2000.

The internal company organization for ISO14001 is as shown in Figure 2-3-d. The environmental committee (same members as the management committee) is the highest authority responsible for environmental problems within the company. The ISO secretariat is responsible for day-to-day activities, and is directly under the president. The secretariat is comprised of a specialist leader and personnel dispatched from each workplace, and is engaged in development of practical activity plans, promoting their implementation, follow-up, and modifications to plans etc. The leader is a section head who is a local employee.

Figure 2-3-d: Environmental management organization



The following items have been identified for reduction of environmental load.

- Reduction in the amount of water used per 100,000 products.
- Reliably satisfying standard values for treated wastewater.
- Reduction in the amount of power used.
- Reduction in the amount of paper for office use.
- Fire prevention
- Elimination of chemical leaks.

A dramatic reduction was achieved in water usage as shown in Table 2-3-5.

Table 2-3-5: Reduction in water usage

Year	2000	2001	2002	2003 (tentative)
Water (tons)	47,000	47,220	48,585	49,000
Amount of water used per 100,000 products (tons)	737	439	385	290

Water usage is increasing in association with the overall increase in production, however while water usage per 100,000 products was 737 tons in 2000, it had decreased by 61% to 290 tons in 2003 as a result of thorough use of recirculated water, and measures such as turning off all faucets immediately. Replacement of washroom faucets with a design which shuts off after a set time has been particularly useful in saving water.

b. Treatment of wastewater

Satisfying the standard values for wastewater treatment reliably is an ISO14001 certification target, and is an environmental policy of primary importance. A total of 140 tons of wastewater per day is generated at the factory in the process of washing containers used in mixing raw materials. This wastewater is subjected to preliminary treatment and is then sent to a central wastewater treatment facility located within the development zone. The wastewater standard values set by the city of Beijing for preliminary treatment are as shown in Table 2-3-6.

Table 2-3-6: Wastewater standard values

(values other than pH are in mg/liter)

Items	pH	COD_{Cr}	BOD	SS	LAS
Wastewater Standard set by city of Beijing	6 - 9	500	100	160	10

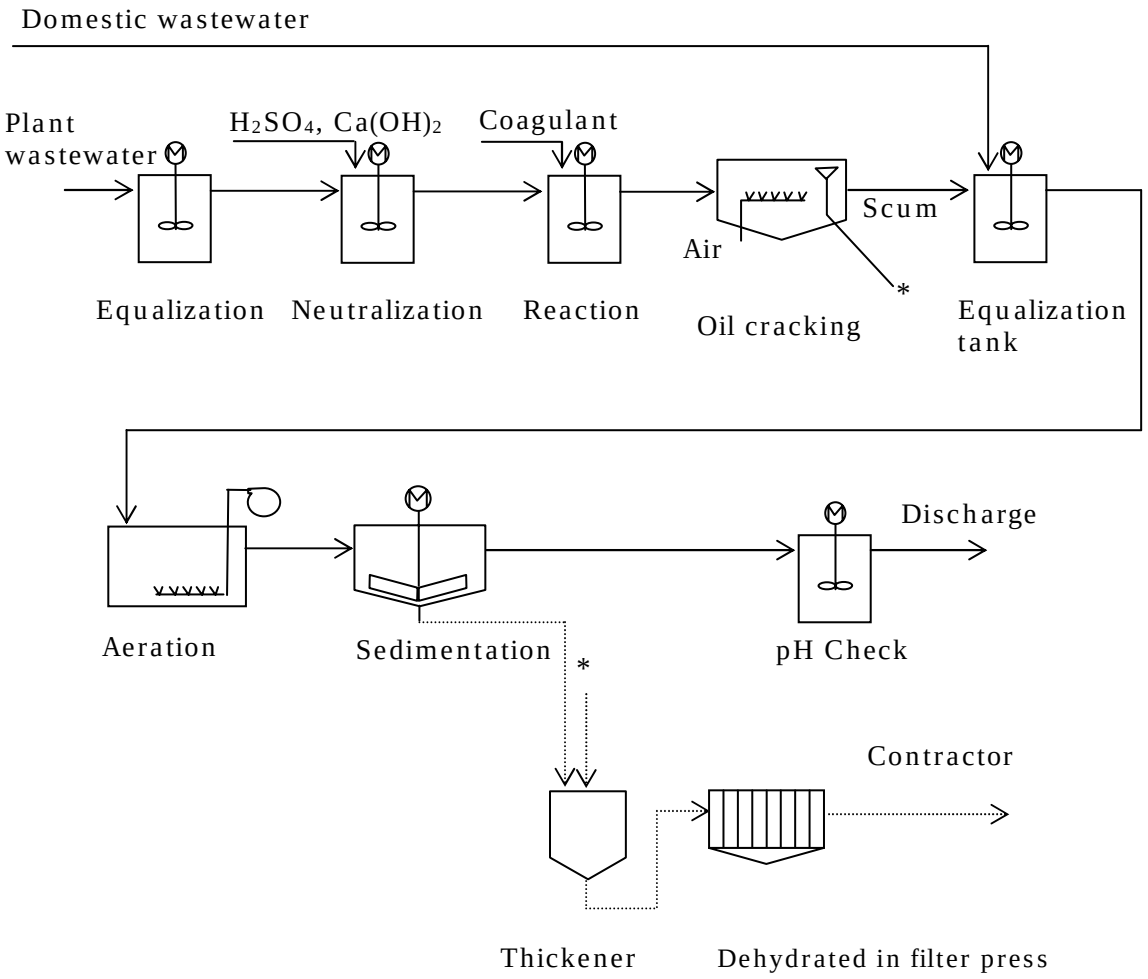
Since it is assumed that wastewater will be finally processed in the central wastewater treatment facility located within the development zone before discharge into the public water area, the standard value for COD is comparatively high at 500mg/liter. LAS is an anion surfactant linear alkylbenzene sulfonic acid, and is the largest component of synthetic detergents.

The wastewater treatment plant shown in Figure 2-3-e was installed in order to satisfy these standard values. As the quality of the wastewater generated in the various processes within the factory differs, it is equalized in the equalization tank, adjusted for pH, and a coagulant added to coagulate suspended matter. Compressed air is then injected in microscopic bubbles, the suspended matter and oil floating on the surface as a scum. Wastewater from which the scum has been removed is then mixed with domestic wastewater (from toilets and canteen etc) in the second equalization tank to ensure a uniform water quality and sent to the aeration tank. Aeration breaks down organic matter through the action of microorganisms. The floc of microorganisms settles and is separated in the sedimentation tank, and the supernatant fluid is then discharged as treated water. The equipment is managed by two specialist personnel from the equipment management section, and was designed and constructed by a Japanese specialist manufacturer of water treatment equipment. The annual cost of chemicals for the equipment is JPY2,000,000 (RMB133,000).

The pH of the treated water is checked, and it is then pumped to the central wastewater treatment facility in the development zone via the sewerage system. A COD value of more than 1,000mg/liter at the entrance to the wastewater treatment equipment is reduced to an average of no more than 100mg/liter after treatment, thus satisfying the standard value of 500mg/liter by a considerable margin. The scum produced by cracking, and the sludge generated in the aeration tank, are separated and thickened and dried in a filter press to produce a cake which is taken by a waste disposal contractor.

Random water samples are taken without warning from the development zone for water quality inspection. COD and pH checked in the factory lab weekly for this purpose.

Figure 2-3-e: Wastewater treatment equipment



c. Miscellaneous

An environmental policy plan was submitted to the office of the development zone prior to construction of the factory. The plan was investigated in detail and permission granted to proceed with construction. A geological survey was also required to determine the strength of the ground in the area. Soil samples were taken to depths of 30m and analyzed. No requirements are currently in place for soil contamination, however a system will be introduced in 2005.

Waste products are sorted into those able to be disposed of by sale, and those for which treatment costs are paid. The former include cardboard boxes, metals, and plastics. Plastics are recycled for use in products such as children's chairs. The latter includes sludge from wastewater treatment, domestic trash, waste oil, and plastics unable to be recycled. Furthermore, organic solvents are stored as toxic waste products, and eventually taken by a licensed disposal contractor for incineration. Three incinerators are in operation in the city of Beijing as of 2003. Disposal by the contractor is followed up to ensure that the toxic waste has indeed been disposed off in the correct manner.

Section 4
Case Studies of Improvements Designed for Other than Environmental Protection

A number of Japanese companies are notable for the unique characteristics of their approach to the environment. Case studies of these companies include the resolution of social problems such as poverty and employment considered essential to the resolution of environmental problems, installation of equipment for stable wastewater treatment taking advantage of low power costs, dealing with the problem of truck exhaust from a point prior to gaining formal permission to conduct business, and improvements in noise levels in the working environment.

Case 10 Placement of Recovery Boxes outside Stores to Increase Awareness of Recycling

1) Outline of the company

Company J
Details of business: Large-scale retailing
Number of employees: 2500 (including employees and tenants)
Commencement of operations: 1996
Location of factory: North east area of city of Beijing (Chaoyang District, Beijing)
Japanese equity ratio: 51%

2) Background

The parent company of Company J has a chain of large retail stores throughout Japan. While other companies in the same business entering the Chinese market have foundered and withdrawn, Company J continues its development, and will soon open its third store in Beijing. The company plans for between seven and eight stores by the time the Olympics are held in Beijing in 2008.

The period of non-competitive state-owned retail stores was of considerable duration, and as a consequence, staff attitudes to customers, and product management, left much to be desired. Company J has resolved these problems in line with its management ideals, and developed a modern retailing business in China.

The resolution of social problems such as poverty are internationally recognized as being essential to environmental protection, and the various social contributions of Company J will prove useful in the resolution of such social problems, and by extension, to environmental protection.

3) Details of measures implemented

a. Waste products

As is the case in Japanese stores, the company has placed boxes for the recovery of recyclable waste products outside its stores to raise the awareness of customers of recycling. In practice, separate boxes for recovery of dry batteries, paper, plastic, and glass are employed. The contents of these boxes is sold to a waste recovery contractor each month.

Waste products from food counters are very few compared to Japan, fish are sold without removing the head, and vegetables not sold are taken by contractors.

Cardboard boxes are purchased by a contractor for a fixed price of RMB8,000/month. This price will be increased to RMB10,000 from next year. Cardboard boxes are used in recycled paper.

b. Tree planting

A group of approximately 20 employees planted 200 trees of three varieties including peach trees, in Daxing prefecture located in the area south east of the city of Beijing. Trees have also been planted in desert areas of Inner Mongolia.

c. Promoting employment

Of the 1.2 billion population of China, and between 800 and 900 millions are extremely poor farmers with an annual income of less than RMB400 (approximately JPY6,000). A stable society cannot be achieved without development including this part of the population. Furthermore, as restructuring of state-owned businesses proceeds, the number of citizens losing their jobs will increase. Many students graduating from university are currently unable to find work. Company J places great expectations in its employment promotion work, and receives requests from other cities asking the company to open stores. Company J's monthly salary for high school graduates is RMB800 (approximately JPY10,000).

Furthermore, a route for sales and distribution of regional agricultural products is necessary, and this is

being undertaken as a part of a large-scale distribution operation. The company is currently searching for direct links with farmers in order to eliminate intermediate costs.

d. Personnel training

Company J is placing considerable emphasis on the training of Chinese middle managers. It is engaged in the transfer of knowledge and skills in such areas as collection and analysis of data related to product management, personnel management, and accounting. The manager of the third store scheduled to open soon is Chinese. While some personnel are attracted to work for European companies in the same sector, they often state that they wish to return. Employees acquire a variety of knowledge and skills in parts, and as they work within a system such knowledge and skills is not immediately useful to their new employer.

e) Miscellaneous

Differences in wealth are considerable in China. Parents of children in poor households engaged in criminal activities may be arrested, and the children often left destitute. One former police officer has employed his own savings in creating a Children's Village for these children. The company received a request from the officer to sell jujube fruit picked by the children within the Village in its stores, and has continued to make contributions ever since. These contributions entail the supply three times each year of food and clothing etc to the equivalent of approximately JPY100,000 (RMB6,700). Some of the products supplied are damaged and could normally be returned to the manufacturer, however they are purchased by the company for the Children's Village. Upon hearing of a plan to construct a log house for the children to play in, the president contributed the costs from his own pocket.

Between 30 and 40 employees give blood each year. The company provides each of these employees with RMB1,000 out of welfare expenses. This contribution has been recognized and the company has received an award as a cooperating enterprise.

Case 11 Electrolytic Treatment of Wastewater Containing Oil – a Process Rarely Used in Japan

1) Outline of the company

Company K
Details of business: Manufacture and sale of automobile power transmission units.
Number of employees: 300
Commencement of operations: 1998
Location of factory: Dongli Economic Development Zone, Tianjin
Japanese equity ratio: 90%

2) Background

The components manufactured by company K are vital to the manufacture of automobiles by other companies in the group in China. The manufacturing process generates a considerable amount of wastewater highly polluted with cutting oil which must be treated to satisfy the relevant standard values. Halting of operations due to wastewater not satisfying these levels would have a disastrous effect on the group as a whole.

Since the costs of power necessary to satisfy the standard values is low in comparison with Japan, the electrolytic method was adopted for its ease of maintenance and stability in treatment.

3) Details of measures implemented

a. Treatment of waste products

Cutting oil is used within the factory in the cutting and drilling of metal materials, and wastewater polluted with the cutting oil is generated when the products are washed. This wastewater is subjected to primary treatment and then piped to the central wastewater treatment plant within the development zone. The items included in the wastewater regulations, and standard values, have been set by the Tianjin Environmental Protection Bureau as shown in Table 2-4-1.

Table 2-4-1: Wastewater standard values

(values other than pH are in mg/liter)

Items	pH	COD_{Cr}	BOD	SS	Oil	Sulfides (sulfur)
Standard values	6 - 9	500	300	400	30	2

These standard values are equivalent to Class III wastewater standards as determined by the Chinese government.

The standard values are satisfied by means of the wastewater treatment equipment shown in Figure 2-4-a. Since the wastewater received is in the form of an oil-water emulsion, a de-emulsifier is first added to break down the emulsion. The oil is then in a readily separated condition, and is piped to the electrolyzing tank. A DC current is passed between the stainless steel anodes and cathodes in the electrolyzing tank, and oxygen gas generated at the anodes, and hydrogen gas at the cathodes. These bubbles of gas adhere to the microscopic suspended particles of oil and float to the surface. The oxygen gas generated also contributes to oxidation and decomposition of the oil. Current is limited to 150 - 200A. Chinese power costs are lower than in Japan, being JPY6 - 7/kwh in the daytime, and half that at night. The wastewater from which oil has been separated is passed through a sand filter to remove suspended matter, and then passed through activated carbon to remove organic matter by absorption. The system currently treats approximately 1 ton of water daily, however it is designed for a capacity of 8 tons of water daily to cope with plans for expansion. The small amount of water treated and low power costs have permitted use of the electrolytic treatment, a method not commonly used in Japan. The equipment was designed in consultation with a Chinese manufacturer. This manufacturer was also responsible for construction.

COD before and after treatment is analyzed daily in the company lab. The standard value is satisfied by a

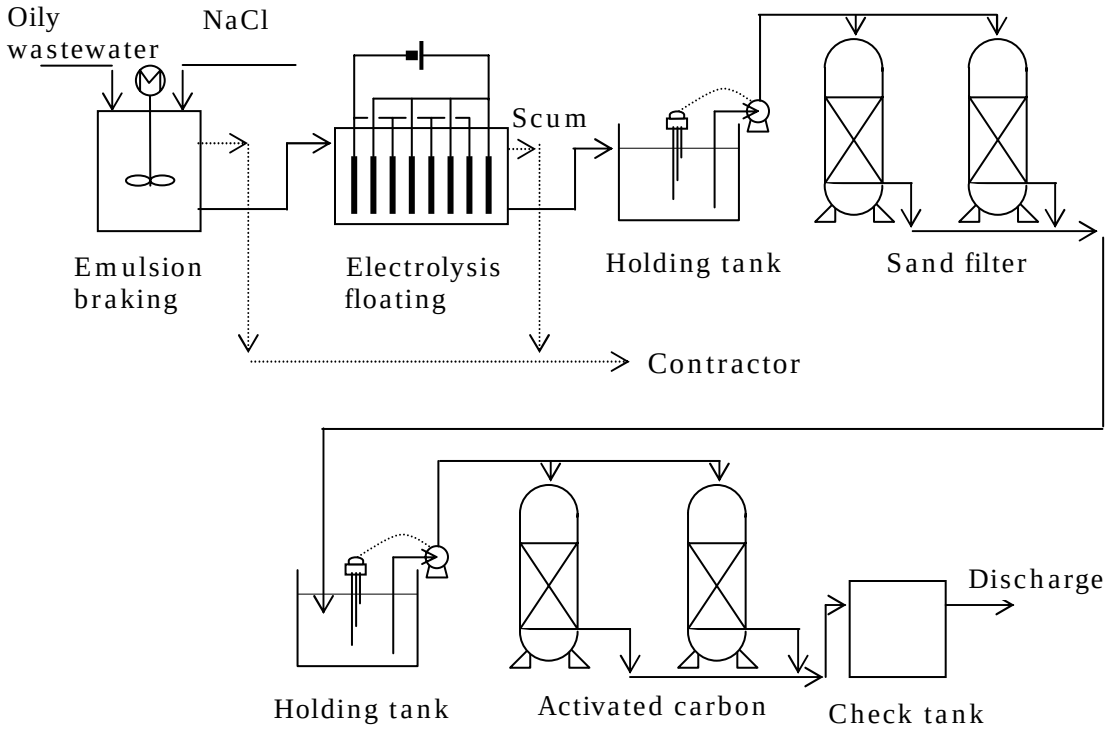
considerable margin.

The Tianjin Dongli Economic Development Zone Environmental Protection Bureau makes on-site visits without warning once every three months, and informs the company of the results of analysis.

The activated carbon employed in the system is not currently used. The central wastewater treatment facility was not yet complete during the planning and construction stages of the factory, and strict standards for discharge directly into rivers were set. The equipment was therefore installed to clear these standards.

The waste oil scum rising to the surface in the de-emulsifier tank and electrolysis floating tank is consigned to a licensed treatment contractor.

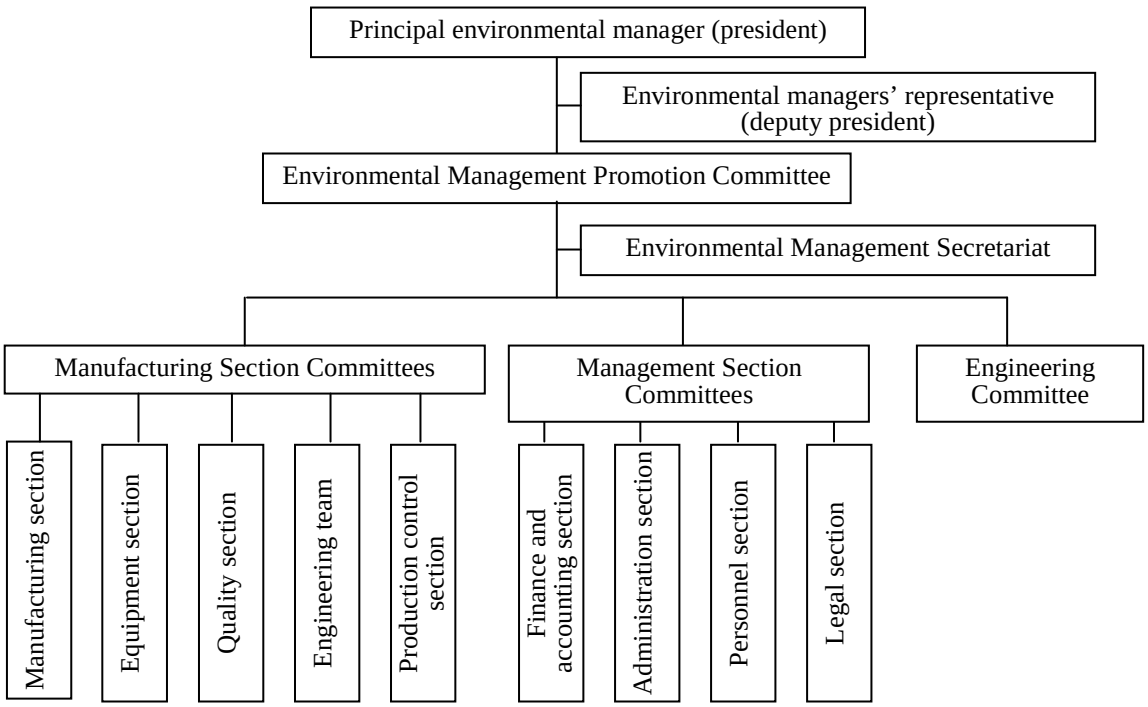
Figure 2-4-a: Wastewater Treatment Flow



b. Acquiring ISO14001 certification

Preparations commenced in May 2002 at the instruction of the Japanese parent company, and certification was acquired ten months later in March 2003. The organization for promoting ISO14001 is as shown in Figure 2-4-b. The organization is headed by the President, with the Environmental Management Promotion Committee positioned directly below. The committee has the same members as the Management Conference, and is the highest decision-making body in the company. The Environmental Management Secretariat is responsible for actual operations. The Manufacturing Section Committees and Management Section Committees are under the jurisdiction of the Environmental Management Promotion Committee. Each section committee holds monthly meetings to consider ISO14001 planning, implementation, evaluation, and reviews. Results are received by the Environmental Management Promotion Committee and decisions made accordingly.

Figure 2-4-b: Environmental management organization



Actual items and numerical targets for 2003 are shown in Table 2-4-2. Nine items are listed, each with an actual numerical target and description of the relevant methodology. Numerical targets are relative to unit production. Actual work is the responsibility of the related division, and names of persons responsible for promotion are clearly stated (omitted in this table). Reuse of hardening oil, a product unique to this factory, is proceeding in parallel with product quality management in a rational manner.

The current year is the first since ISO14001 certification, and much is expected from the initial activities.

c. Miscellaneous

As gas is used to fire the heating furnace used in the hardening process, problems with waste gas regulations are avoided. Organic solvents are discharged in the painting area, however the concentrations of the regulated chemicals benzene, toluene, and xylene discharged are extremely low. Measurements taken on-site by the Dongli District showed that concentrations were low, and they were therefore not included as measurement items. Information on environmental regulations is obtained periodically at meetings held by the Tianjin Dongli District Environmental Protection Bureau, and also from meetings of the group.

Table 2-4-2: ISO14001 targets for 2003

	Items	Target	Management method	Responsible division
1	Observance of regulations	No contravention of regulations	Observance of work standards, and thorough environmental management.	Environmental management secretariat
			Rapid response to changes in regulations and standards.	
2	Reduction in power consumption	Reduction of 7% in power consumption per production unit in comparison with 2002.	(1) Switch off unused equipment.	Manufacturing and technical sections, and technical department.
			(2) Reduction in defect rate by observance of work standards.	
			(3) Power savings by changes in machining processes.	
			(4) Use of low-pressure air.	
3	Reduction in water consumption	Reduction of 6% in water consumption per production unit in comparison with 2002.	(1) Observance of internal water conservation regulations.	Administration section
			(2) Thorough water conservation work.	
			(3) Periodic inspection of equipment.	
			(4) Investigation of monthly water consumption records.	
4	Reduction in waste lubrication oil	Reduction of 6% in waste lubrication oil per production unit in comparison with 2002.	(1) Measurement and control of amounts used by each item of equipment.	Equipment section
			(2) Inspection and repair of each item of equipment to prevent leaks.	
5	Reuse of hardening oil	Complete reuse	(1) Equipment necessary for recirculation.	Equipment section
			(2) Performance testing with reused oil.	
6	Reduction in solid waste	Reduction of 12% in solid waste per production unit in comparison with 2002.	(1) Thorough management of defective products.	Quality section
			(2) Promotion of measures for important items.	
7	Observance of wastewater standards	COD < 500mg/liter Sulfides < 2mg/liter	(1) Clean canteen waste oil tank.	Administration section
			(2) Clean purification tank.	
			(3) Measure water quality before and after treatment.	Equipment section
			(4) Increase number of measurements of water quality by external contractors.	Administration section
8	Observance of standards for canteen wastewater and waste oil	Wastewater concentration < 2mg/liter	(1) Periodic cleaning of waste oil tank.	Administration section
			(2) Installation of equipment to purify used oil.	Environmental management secretariat
			(3) Voluntary measurement annually.	Administration section
			(4) Manage usage of edible oil.	
9	Reduction in paint usage	Reduction of 5% in paint usage per production unit in comparison with 2002.	(1) Investigate possibility of reducing stock.	Engineering section
			(2) Optimize ratio of paint to solvent.	
			(3) Develop manual documenting methods of reducing paint usage.	

Case 12 Continuing Sophisticated Treatment to Reuse Wastewater

1) Outline of the company

Company L
Details of business: Manufacture and sale of pharmaceuticals.
Number of employees: 404
Commencement of operations: 2000
Location of factory: Economic and technical development zone south east of the city of Beijing.
Japanese equity ratio: 100%

2) Background

The manufacture of pharmaceutical products by Company L generates wastewater in the process of washing containers employed in pharmaceuticals. The central wastewater treatment facility in the development zone was not yet complete when permission was obtained to construct the factory, and standard values for wastewater were severe since discharge was directly into the public water area. A treatment facility was therefore constructed within the factory to satisfy these standard values. The central wastewater treatment facility was subsequently completed and the standard values were relaxed, and it is now permitted to discharge wastewater without treatment at the factory. Despite this relaxation, treatment is still undertaken at the factory, and the treated water is reused by spraying on vegetation on-site etc.

3) Measures taken by the company

a. Wastewater treatment

The wastewater standard values to be satisfied as a condition for granting permission for construction of the factory, and the wastewater standard values revised in 2002, are shown in Table 2-4-3.

Table 2-4-3: Wastewater standard values

(values other than pH are in mg/liter)

Items	pH	COD_{Cr}	BOD	SS	Fats and oils	Fluorine
Standard values to be satisfied for plant construction	6 - 9	150	30	160	15	5
Revised standard values	6 - 9	500	300	300	-	-

The wastewater standard values to be satisfied as a condition for granting permission for construction are Class II standard values for direct discharge into the public water area, and are very strict for both COD and BOD. The COD_{Cr} of 150mg/liter equates to approximately 50mg/liter when converted into COD_{Mn} in accordance with the Japanese system of measurement. The central wastewater treatment facility was subsequently completed, and was based on the premise of final treatment of the wastewater, so that standard values for COD, BOD, and SS were considerably relaxed. Records show discharge of fats and oils, and fluorine, to be minimal, and as such these items are no longer subject to control.

A wastewater treatment facility as shown in Figure 2-4-c was previously constructed to satisfy the initial standard values. Approximately 140 tons/day of wastewater (including wastewater from the production process and domestic wastewater) is generated. Process wastewater is first pre-aerated, a coagulant is added to flocculate the suspended matter which is then separated out. Domestic wastewater is supplied to a tank where the coagulant is added, and air then injected to assist microorganisms in decomposing the organic matter. The floc consisting of microorganisms is then separated out, the supernatant fluid removed as the treated water, checked for pH, and then discharged to the central wastewater treatment facility via the sewerage system. The feature of this treatment process is the use of pre-aeration to promote oxidation of pollutants.

The sediment from the suspended matter floc and microorganism floc is dried with a dehydrator, and disposed of to a contractor as dried sludge. Since the wastewater treatment facility has an image incompatible with the cleanliness and purity required of pharmaceuticals, the treatment equipment is installed out of site inside a building. Treated water is piped to a tank where it used in raising goldfish to

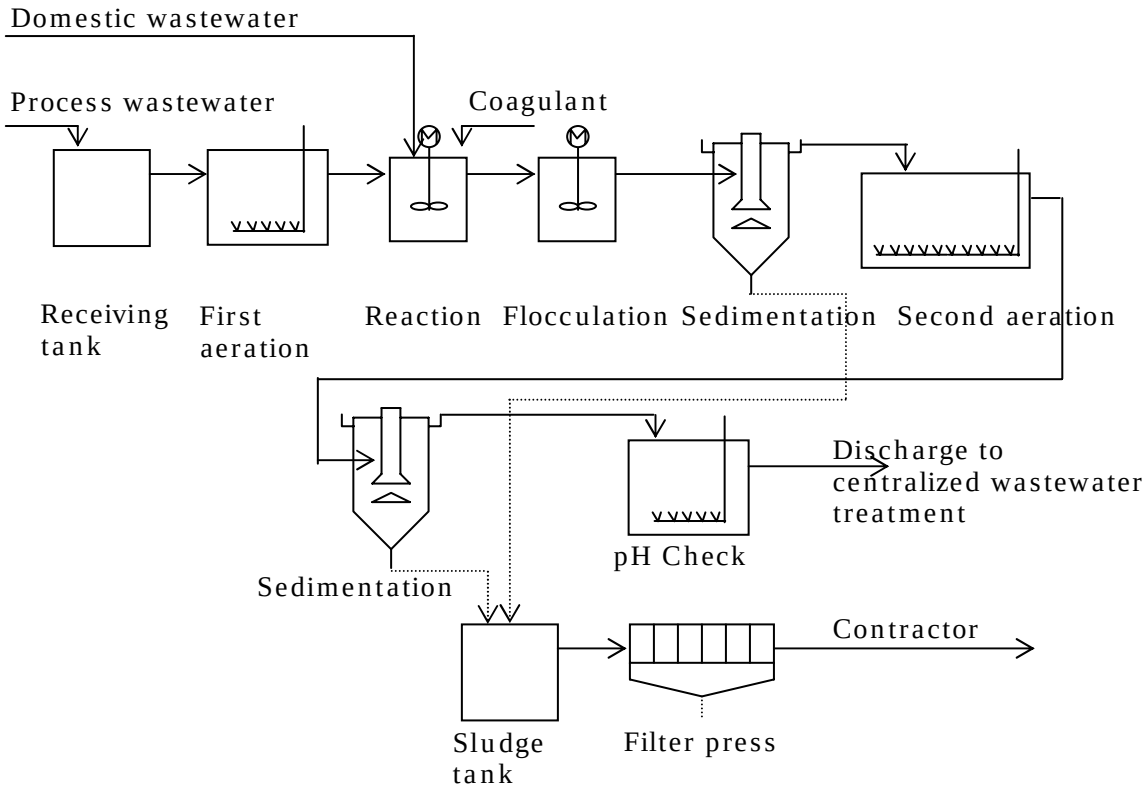
illustrate its compatibility with living organisms.

This equipment was designed and constructed, and is operated and managed, by a wastewater treatment manufacturer in Beijing. One person within the company is also responsible for wastewater treatment.

Personnel from the Beijing Environmental Protection Bureau visit twice each year to inspect water quality. One visit is at random without notification, and one visit is regular, samples being taken and analyzed on both visits, and the company informed of the results. Furthermore, water quality is analyzed twice weekly for internal company purposes, and is required for operating permission.

The quality of the water generated within the factory is such that the revised standard values are satisfied without further treatment.

Figure 2-4-c: Wastewater treatment flow



b. Environmental procedures when construction permission was granted

When requesting permission to construct the factory, a plan describing environmental policy was submitted to the Beijing Environmental Protection Bureau. This plan was thoroughly examined before permission was granted. Temporary permission to begin operations was obtained two months after completion, and measurements taken to determine the amounts of wastewater, waste products, waste gas, and noise, and concentrations of pollutants before and after treatment, while in operation. Full permission to operate the factory was granted after it was determined that these amounts were satisfactory. A document describing the method of discharge management, covering standard values, frequency of analysis, methods of measurement, and locations of measurement was then issued.

Standard values for wastewater are described above, while standard values for dust in waste gas are as shown in Table 2-4-4, and standard values for noise are as shown in Table 2-4-5. Dust is generated in the

processes of handling, weighing, granulation, and packaging of powered pharmaceuticals, and installation of filters for the waste gas was required. The pump in the cooling tower is subject to noise standards.

Table 2-4-4: Standard values for dust in waste gas

Measurement item	Smokestack height (m)	Dust concentration (mg/m^3)	Discharge (kg/hr)
Dust	13	120	2.63

Table 2-4-5: Standard values for noise at site boundary

(dBA)

Classification	Day	Night
Standard	65	55

Measurements showed that all controlled items were well within the standard values, for example dust concentration before filtering was a maximum of $42mg/m^3$, and $12mg/m^3$ after filtering.

c. Waste products

Waste products generated are of three types - toxic waste products, reusable waste products, non-reusable waste products. Toxic waste products include pharmaceuticals beyond their shelf life, and waste chemicals from the analysis lab, and amount to a few hundreds of kilograms annually. Such waste products are consigned to a licensed waste disposal contractor for incineration. Disposal is tracked to ensure that the waste products have been properly incinerated, and to ensure that they have not been resold. Reusable waste products include plastic, cardboard boxes, and metals, and are purchased by a contractor. A contractor is paid to dispose of non-reusable waste products which include wastewater treatment sludge and domestic trash. Processing of food scraps from the canteen is consigned to the canteen contractor.

One person is assigned to management of waste products.

d. Miscellaneous

A booklet providing guidelines for activities is given to each employee as a means of developing awareness of environmental matters. This booklet describes efforts in dealing with environmental matters such as contributions to global environmental protection, effective use of resources, reduction in amounts of waste products generated, and development of a plentiful and civilized society. At completion of the factory, seedlings were purchased with contributions from employees and planted on the site.

Case 13 Considering the Environment Prior to Full Commencement of Operations

1) Outline of the Company

Company K Details of business: Transport Number of employees: 745 Commencement of operations: 1996 Location of factory: Airport Industrial Zone close to Beijing International Airport Japanese equity ratio: 50%

2) Background

Company M is a representative example of a Japanese transport company, and has established operations in China in association with the move to China of its Japanese customers. Foreign investment in the transport industry in China has been delayed both for reasons of national security, and its position as a key industry. Investment has been limited to such areas as warehousing, and the core of Company M's business is still the transport of international airfreight. The company owns less than 20 trucks, and the majority of domestic transport is contracted to local operators.

China has promised deregulation of the service sector in association with its joining the WTO in December 2001. It is thought that this liberalization will occur by 2005, and this, in combination with the rapid pace of change in China, has prompted the company to make preparations for commencing domestic transport operations. These preparations include environmental measures associated with truck transport.

3) Details of measures implemented

a. Following guidelines from the Japanese parent company

Guidance for overseas operations by the Japanese parent company in environmental matters began in 1994 with the establishment of an environmental measures group in the Quality Management Division. The role of this group includes making international contributions in the environmental field.

A variety of examples of environmental measures both in Japan and overseas operations are sent as guidelines from the parent company. These examples are also recorded in the environmental report issued by the parent company, and include a commentary on, and training in, environmental regulations for drivers, modal shifts to obtain the optimum combination of transport methods, and examples of implementation of joint transport.

These guidelines are implemented in accordance with Chinese conditions, and are in observance of Chinese legislation such as waste gas regulations, vehicle inspections, and labor regulations. Internal company regulations are established if Chinese legislation is insufficient. Waste gas legislation exists in China, however it does not function in practice due to lack of a measurement system for monitoring.

All trucks currently owned by the company are of Chinese manufacture, and are fueled with gasoline. They were selected for the fact that gasoline vehicles are readily obtainable, and are of the specifications necessary for transport. These vehicles are currently employed in short-range operations such as transport between the airport and the company warehouse, and in collection of freight from customers within the city. The company has a target to reduce gasoline consumption per unit distance traveled by 10% over the previous year. An aim is to reduce idling, and this has the added benefit of reducing theft of gasoline. Drivers are instructed to take the shorter routes, and if the odometer distance is abnormally high, another driver is instructed to drive the same route to provide a comparison.

The number of vehicles will increase if it becomes possible to expand operations throughout China in future. Low-pollution vehicles powered by LPG etc are not yet available, and even if such vehicles are

imported from Japan, the lack of refilling stations prevents their use. Chinese trucks are cheaper than passenger vehicles.

Competing on cost with local transport operators while properly implementing measures in response to the various regulations is not an easy matter. Services such as collection of freight, ensuring that is delivered correctly, and driving on the specified paved roads are considered a matter of course in Japan, and the basis of trust on which the business is developed. If it becomes possible to expand operations throughout China, freight collection depots will be developed in each area, and freight will be loaded on return trips to reduce costs, and it will then be possible to contribute to a reduction in CO_2 emissions.

b. Miscellaneous

The most recent information on revisions to regulations is available on the Internet. Chinese government organizations, and administrative organizations at provincial level, publish regulations and legislation on their websites, the majority being in Chinese, and therefore checked by local staff. When information is necessary in more detail a visit is made to the city office and questions asked in person. Some information has recently become available in English.

Industry organizations are gradually developing, and an organization for the customs clearance industry was formed recently. Company M is a member of this organization, and serves as a director. These industry organizations are a source of information on changes in the regulations, and also a path for transmitting opinions to the appropriate authorities.

ISO14001 certification is a topic for the future. China is characterized by the tendency of employees to follow a system well once it is formed. The formation of a system of environmental management will prove useful in management.

Case 14 Use of Inverter Control in Measures to Deal with Noise

1) Outline of the Company

Company N Details of business: Manufacture and sale of pharmaceuticals. Number of employees: 237 Commencement of operations: 1994 Location of factory: Industrial areas in Xiqing District, city of Tianjin Japanese equity ratio: 100%

2) Background

Since company N's factory is engaged in the manufacture of pharmaceuticals, its entire working area of approximately 4,000m^2 operates as a clean room. In order to maintain the cleanliness of this working area, large volumes of air are fed by blowers at positive pressure and passed through fine filtering cloth. Conventionally, blower rooms were very noisy, to the extent that conversation is impossible. The company has therefore implemented measures to deal with noise as part of a program to improve the working environment.

3) Details of measures implemented

a. Inverter control

Blowers are generally selected with a performance margin (1.2 - 1.5) in the design stage. If the volume of air supplied is too great, problems such as localized turbulence develops so that particulate matter is lifted into the air. In practice, dampers are therefore employed for adjustment and thus obtain optimum flow, however even if operation is at a flow below the blower performance, little benefit is obtained in terms of reduced power consumption. Furthermore, a throttled damper presents resistance to the airflow, resulting in vibration which may cause noise. Resonance in ducting may produce noise far beyond expectations.

The fact that torque of the blower is proportional to square of the rpm (round per minute), and shaft power is proportional to the cube of the rpm, is therefore used to change the blower rpm in accordance with load and thus reduce power consumption of the drive motor. Rpm is controlled by changing the AC power frequency. Since no damper is used, noise is considerably reduced, and a stable difference between interior and exterior pressure is facilitated.

An initial investment is, however, required for installation of the equipment employed in detecting the load and changing the frequency of the power supply. As power costs in Japan are approximately JPY15/kWh, the initial investment is recovered over a period of between three and four years through cost savings due to reduced power consumption. In China, however, power costs are low at JPY6 - 7/kWh and a long period is necessary to recover the initial investment, so that this method does not always prove to be a beneficial energy-saving measure and is therefore not broadly common.

In this factory, it has been adopted to deal with noise, reducing the noise level in the blower room considerably so that normal conversation is possible.

b. Boiler waste gas

The use of coal in the small boilers installed in Company N's factory is prohibited under Tianjin's Blue Sky Program, and low-sulfur heavy oil was therefore used as fuel from the initial stage of operation. While waste gas standard values for sulfur dioxide are set at 400mg/m^3, emissions are a maximum of 20mg/m^3. Personnel from the Environmental Protection Bureau of Xiqing District in the city of Tianjin visit the site annually to take measurements, and the company voluntarily requests measurement by an external contractor annually.