

**WASTE MANAGEMENT AND
RECYCLING BUSINESS IN
THE UNITED STATES AND JAPAN**

Yoshio Nakamura

USJP Occasional Paper 07-09

Program on U.S.-Japan Relations
Harvard University
61 Kirkland Street
Cambridge, MA 02138-2030

2007

ABOUT THE AUTHOR

Mr. Nakamura joined the Development Bank of Japan after earning his B.A. in sociology from the University of Tokyo. He served as deputy director of the Loan Division in the Hokkaido Branch for four years before becoming deputy director of the Environment and Energy Department in 2003. Mr. Nakamura has published several articles on issues related to waste management, including “Loans to Waste Management Businesses Using the PFI Method.” While at Harvard, he has examined the regulation and economic factors associated with the waste management and recycling businesses in the United States and Japan.

ON THE OCCASIONAL PAPERS OF THE PROGRAM ON U.S.-JAPAN RELATIONS

Established in 1980, the Program on U.S.-Japan Relations of the Weatherhead Center for International Affairs and the Reischauer Institute of Japanese Studies enables outstanding scholars and practitioners to come together for an academic year at Harvard University. During that year, Program Associates take part in a variety of activities and conduct independent research on contemporary U.S.-Japan relations, Japan's relations with the rest of the world, and domestic issues in Japan that bear on its international behavior.

The Occasional Paper Series is wide-ranging in scope. It includes papers that are valuable for their contributions to the scholarly literature; it also includes papers that make available in English the policy perspectives of Associates from government, business and banking, the media, and other fields on issues and problems that come within the scope of the Program.

Needless to say, all papers represent the views of their authors and not necessarily those of their home organizations, the Program, the Weatherhead Center for International Affairs, the Reischauer Institute, or Harvard University.

TABLE OF CONTENTS

Introduction	1
Chapter 1. Current Conditions and Problems of Waste Management in Japan	3
Chapter 2. Current Conditions of Waste Management in the United States and Comparison with Japan	19
Chapter 3. Success Factors in Outstanding Companies in the United States	32
Conclusion	36
Tables	40
Bibliography	43

TABLES AND FIGURES

Table 1. Changes in the Amount of Municipal Waste Generated in Japan	40
Table 2. Changes in the Amount of Industrial Waste Generated in Japan	40
Table 3. Changes in the Amount of Municipal Solid Waste Managed in the United States	41
Table 4. Features of Major Waste Management Companies in the United States	42

LIST OF ABBREVIATIONS

EPA	Environmental Protection Agency
FY	Fiscal year
PCB	Polychlorinated biphenyl
PFI	Private finance initiative
RCRA	The Resource Conservation and Recovery Act

INTRODUCTION

Effective utilization of natural resources is crucial for mankind because of today's society, which is based on mass production and mass consumption, as well as the expansion of populations and consumption in developing countries.

The production of large amounts of waste makes it difficult to maintain a ready supply of landfill area; at the same time, it is necessary to minimize destruction of the natural environment caused by the development of landfills. Thus, the significance of reducing the amount of waste bound for landfills is increasing.

No one wants to accept a decline in the quality of life. As a result, utmost efforts must be exerted to reduce the amount of resources we use, while maintaining the current standard of living. In addition to this, recycling and the construction of a sound material-cycle society need to be promoted. Therefore, efficiency in the waste management and recycling businesses is vital in order to harmonize environmental protection with economic growth.

Japan has seen great progress in incineration technology because it is particularly difficult to secure landfill sites there due to the lack of appropriate land. But the cost of waste management and recycling is high because the proportion of incineration is high, the scale of individual waste management companies is small (as a result of complicated regulatory policies), and a large part of municipal waste management is carried out by local governments. Consequently, the cost to society remains high. This situation must be improved in order to achieve sustainable development in Japan.

In the United States, on the other hand, waste management and recycling are carried out very efficiently by a sizeable number of large-scale private companies, though the fact that there

are geographical and other differences between the United States and Japan must be taken into consideration.

I think I can offer some useful ideas for the realization of an efficient system of waste management and recycling in Japan by analyzing the structure of U.S. regulation as well as the management methods of private companies and the strategies of resource recycling in the United States (with consideration for the geographical, historical, social, and economic differences between the two countries).

This research is focused on:

1. Analysis of the present conditions, regulation, and economic factors regarding waste management and recycling in the United States and Japan.
2. Investigation of waste management companies in the United States that run their businesses profitably and efficiently and identification of their success factors.
3. Determination of methods that could be applied in Japan to improve the efficiency of the waste management and recycling businesses.

Chapters 1 and 2 of this paper will survey the current conditions and problems of waste management in Japan and the United States, respectively. Chapter 2 will also make a comparison between the two countries. Chapter 3 will identify the success factors of outstanding companies in the United States. In the conclusion, I will present suggestions for methods to improve the waste management business in Japan.

CHAPTER 1

CURRENT CONDITIONS AND PROBLEMS OF WASTE MANAGEMENT IN JAPAN

Current Conditions of Waste Management in Japan

Categories of Waste

In Japan, waste management is carried out under the control of the Waste Management and Public Cleaning Law established in 1970. Waste is divided into two major categories: “industrial waste” and “municipal waste.”

Basically, the former is waste that is discharged from industrial activities. But more strictly, it is divided into 20 categories by the above-mentioned Waste Management Law.

Municipal waste is waste other than industrial waste. Waste that is discharged from a household is definitely municipal waste. But some kinds of waste discharged from industrial activities are categorized into municipal waste because they are not defined by law as industrial waste. Paper discarded from offices and garbage from restaurants or retail stores, for example, are considered municipal waste and fall into the category of what is called “commercial municipal waste.”

This complicated definition sometimes makes the situation difficult and confusing.

The Amount of Waste Generated

In Japan, the amount of both types of waste generated increased rapidly prior to 1990. Since then, however, it has remained roughly stable.¹ There are two main reasons for this. One is that Japanese society has become mature in terms of population and scale of economy. The other is the success of policies for waste reduction.

The amount of municipal waste produced annually has been a little more than 50 million tons in the last 15 years or so (Table 1), while that of industrial waste has been about 400 million tons (Table 2).² The per capita amount of waste generated has also been stable, with municipal waste at a little less than 900 pounds and industrial waste a little more than 7,300 pounds.

The Amount of Waste Generated by Category

According to the statistics on waste management in fiscal year 2003, the proportion of municipal waste from households was 67.2 percent of all municipal waste, i.e., about 35 million tons. The other 32.8 percent, or around 17 million tons, was from business.

On the other hand, there are many categories³ of industrial waste, listed below in the order of volume.

1. Excrement from domestic animals: 89 million tons
2. Sludge generated from sewage treatment and filtration plants: 82 million tons

¹Ministry of the Environment, Japan.

²Ministry of the Environment, Japan. *Sangyohaikibutsu Haishutsu Shori Jokyō Chosa Hokokusho; Ippanhaikibutsu no Haishutsu Oyobi Shori Jokyō Nado.*

³I defined these categories arbitrarily to expedite understanding of the situation. So they are different from the 20 categories set forth by the law.

3. Waste generated from construction: 75 million tons
4. Sludge generated from the paper industry: 34 million tons
5. Sludge generated from the chemical industry: 15 million tons
6. Slag generated from the steel industry: 15 million tons
7. Sludge generated from mining: 13 million tons
8. Sludge generated from the food and beverage industries: 9 million tons
9. Ash generated from electric power plants: 8 million tons
10. Sludge generated from the cement and ceramic industries: 7 million tons
11. Ash generated from the steel industry: 6 million tons
12. Others: 59 million tons

The Methods of Waste Management

In Japan, most waste is treated in incineration, dehydration, or milling plants. The amount of waste buried in landfills is limited and has been decreasing.

In FY2003, the final disposal amount of municipal waste, some 8.5 million tons, was about half the volume of 15 years earlier. And the final disposal rate was 16 percent. The final disposal amount of industrial waste in FY2003, about 30 million tons, was about one third of the volume of 15 years ago. And the final disposal rate was only 7 percent. This means that the final disposal rate of all waste in FY2003 was 8 percent.

On the other hand, large amounts of waste are recycled in Japan, and the recycling rate has increased gradually for both municipal and industrial waste. In FY2003, the recycling rate for municipal waste was around 17 percent compared to 5 percent in FY1990, and the recycling

rate for industrial waste was about 49 percent versus 38 percent, respectively. This means the recycling rate of all waste in FY2003 was 45 percent.

Though the reduction rate also increased slightly during the same period, it is clear that the progress of recycling recently has reduced the final disposal rate drastically. This trend has been mainly due to the enactment of several recycling laws in the past decade, especially the Containers and Packaging Recycling Law.

The most outstanding feature of the methods of waste management in Japan is the extremely low final disposal rate and the extremely high reduction rate. The major reason for this is limited space for landfills.

In Japan, it is very difficult to secure sites for landfills because there is a lack of level land, except in the northern part of the country. Therefore, most landfills are constructed in the mountains. In addition, in the western part of the country and the metropolitan areas, many landfills are constructed by reclaiming sea areas.

It is clear that the cost of construction is high when landfills are built in the mountains. In the case of landfills on the sea, the cost in the past was not so high because the new land made by landfills could be sold. But recently, this has become difficult since demand for land is limited. As a result, it will become more expensive to construct landfills on the sea. In addition to this, continuously securing appropriate sea areas will be difficult because of environmental protection considerations.

The Cost of Waste Management

In any case, the typical dumping price in highly regulated landfills in inland areas in Japan, except for Hokkaido, is from ¥20,000 (\$169) to ¥40,000 (\$338) per ton, and the typical dumping price in not-so-highly regulated landfills in inland areas, except for Hokkaido, is from ¥5,000 (\$42) to ¥8,000 (\$68) per cubic meter.⁴

Only five categories of industrial waste may be dumped in the not-so-highly regulated landfills in Japan: 1) plastics, 2) concrete debris, 3) glass and ceramics, 4) rubber, and 5) metals. Other categories of industrial waste, including ash, sludge, etc., and all municipal waste must be dumped into highly regulated landfills with liners and leachate treatment facilities.

Waste for highly regulated landfills – typically woods, waste oil, sludge, and so on – are usually burned in incineration plants to reduce the volume because the cost for such landfills is very high. But the cost for incineration itself is high too, typically from ¥25,000 (\$211) to ¥40,000 (\$338) per ton. In the case of waste oil, waste acid, waste alkali etc., in Japan they may not be dumped directly into landfills without burning or dehydrating them. The price of incineration for low-quality waste oil is especially high. Needless to say, in cases of particularly harmful waste like that from hospitals, incineration is extremely expensive, typically more than ¥100,000 (\$844) per ton.

In addition to the above expenses, transportation fees are very high in Japan. In the case of heavy materials, it costs from ¥3,000 (\$25) per ton to ¥5,000 (\$42) per ton to carry them over

⁴In Japan, the dumping price in highly regulated landfills is set per ton. The dumping price in not-so-highly regulated landfills, on the other hand, is set per cubic meter because a large amount of light items like plastics are included in waste dumped in not-so-highly regulated landfills.

a short distance, i.e., less than 100 km (62 miles); this figure, of course, rises when longer distances are involved.

The average per ton cost over the past five years⁵ for municipal waste management is about ¥45,000 (\$380).

Responsibility for Waste Management

In Japan, local governments undertake municipal waste management. Therefore, municipal waste is collected, incinerated, and finally disposed of directly by local governments. But some portion of municipal waste management – collection in particular – is relegated to private companies. According to the statistics on municipal waste management in FY2003, 27 percent of the total municipal waste management cost is consignment fees. This expense has increased consistently during the last 10 years because many local governments have begun to transfer waste management – not only of collection, but also of incineration and landfills – to private companies, sometimes using private financing initiative (PFI) methods, to reduce their costs.

The consignment cost of municipal waste management in FY2003, ¥529,341 million (\$4.471 billion), is the present market scale of the municipal waste management business in Japan. But there is a possibility that this will double or triple in the future because the average total cost of municipal waste management in the last five years has been about ¥2,300 billion

⁵I use the average cost for five years because the cost for construction included in total waste management cost changes considerably every year.

(\$19.4 billion), and local governments seem to be constantly increasing consignment to private companies in order to cut costs.

Concerning industrial waste, on the other hand, the generator has the responsibility for waste management. Most of this duty, therefore, is fulfilled by the generators themselves or by private waste management companies. Since the amount of industrial waste is about eight times that of municipal waste, the market scale of industrial waste management, at first glance, seems huge. But, because so much of this is assumed by the generators themselves, the market scale is not as large as it first appears.

For example, most of the excrement from domestic animals, which, in volume, is the largest category of industrial waste, is utilized as materials for compost by the generator, who is usually a farmer. Most of the sludge generated from sewage treatment and filtration plants, the second largest category, is dehydrated by the generator. Most of the sludge generated from the paper industry, which is the fourth largest category of industrial waste, is burned and reduced inside the site by the generator. Likewise, much of the other kinds of waste generated from material industries is recycled or burned by generators.

Thus, more than half of all industrial waste is reduced or recycled by the generators themselves. Therefore, the market scale of industrial waste management is about ¥4,000 billion (\$33.8 billion).

In Japan, the average waste management company is small. There are few huge companies whose main business is waste management. In fact, there are only two such companies listed: Daiseki Co., Ltd. and Fujikoh Co., Ltd.

Daiseki, whose headquarters are in Nagoya, is good at treating liquid waste discharged from factories and has original technologies with high standards. As a result, it has strong competitiveness in this business area and earns consistently high profits. The fact that Daiseki does not have any loans is clear evidence of its strong competitiveness and high profits. The firm's FY2005 revenues (from March 2005 to February 2006) were ¥21,644 million (\$183 million), and it is the largest private company in Japan whose main business is waste management.

Fujikoh, on the other hand, is relatively small. It performs several kinds of waste management, for example, milling and collection of waste from construction, making compost from garbage, operating incineration plants and so on, mainly in Chiba Prefecture, a suburban area adjacent to Tokyo. Though Fujikoh is a listed company, it is listed on the Equity Market for Emerging Companies, Tosho Mothers. Net sales of Fujikoh in FY2006 (from July 2005 to June 2006) were only ¥1,764 million (\$14.9 million).

Of course, there are several large unlisted companies whose main business is waste management. Such companies whose revenue is more than ¥10 billion (\$84.5 million) are:

- **Daiei Kankyo Co., Ltd.;** Headquarters/Osaka; Group Revenues/¥20.6 billion (\$174 million) (2004).
- **JFE Kankyo Corporation;** Headquarters/Yokohama; Revenues/N.A.
- **Ishizaki Sangyo Co., Ltd.;** Headquarters/Uozu, Toyama Prefecture; Revenues/N.A.
- **Miyama Inc.;** Headquarters/Nagano; Revenues/¥13.1 billion (\$111 million) (2005).
- **Nakadaya Co., Ltd.;** Headquarters/Tokyo; Revenues/N.A.
- **Sinsia Inc.;** Headquarters/Tokyo; Revenues/N.A.

- **Takeei Co., Ltd.;** Headquarters/Tokyo; Revenues/¥10.2 billion (\$86 million) (2005).
- **Term Corporation;** Headquarters/Tokyo; Revenues/¥15.2 billion (\$128 million) (2005).

Some companies do not disclose their recent revenues, but they are believed to be more than ¥10 billion per year. Several waste management companies plan to be listed on the stock exchange in a few years, including some whose annual revenues are less than ¥10 billion.

Among the companies listed above, Term and JFE Kankyo are subsidiaries of huge listed companies. Specifically, Term is a subsidiary of Toshiba, and JFE Kankyo is a subsidiary of JFE Steel, the second largest steel company in Japan. This shows that several groups of major companies in other industries play an important role in waste management in Japan.

Strangely, the largest waste management company in Japan is not on the above list. It is Taiheiyo Cement Corporation, the top cement company in the nation. In FY2005, Taiheiyo Cement sold ¥67 billion (\$556 million) in the environmental business, most of it in waste management. Though it accounts for only 7 percent of the revenue of Taiheiyo Cement, by accepting large amounts of wastes as materials for cement, Taiheiyo Cement has not only increased its sales, but also cut the cost of buying materials.

The second largest waste management company, Dowa Kogyo (Mining) Co., Ltd., is also from another industry. In 2005, Dowa Kogyo sold ¥59 billion (\$498 million) in the environmental business, most of it in waste management. This accounts for 19 percent of the revenue of Dowa Kogyo. By utilizing technology for mining, Dowa Kogyo accepts various kinds of waste, especially products that are very difficult to deal with. In October 2006, Dowa Kogyo reorganized the group companies and founded Dowa Holdings Co., Ltd. as the holding company

of the Dowa Group. At the same time, the Dowa Group established Dowa Ecosystem Co., Ltd. as a core company for the waste management business within the group. This new company is not listed among the major waste management companies above because it has not yet completed its first fiscal year. But it will become Japan's largest company whose main business is waste management. I think this is a symbolic event because huge companies from other industries have dealt with waste management as one of their side businesses so far, but now the Dowa Group has become the first major company in the nation to include waste management as its one of its major components.

In addition, most major cement and mining companies handle waste management on a large scale. Mitsubishi Materials Corporation, in particular, deals with both cement and mining, and its sales revenues from waste management should be close to those of Taiheiyo Cement and Dowa Kogyo, although it does not disclose these particular figures.

Current Problems in Waste Management in Japan

The High Cost

As mentioned above, the cost of waste management in Japan is very high. There are several reasons for this; the most important and crucial of them is the lack of level land to use for landfills. Another, which cannot be ignored, is the high cost of transportation. Finally, one more explanation that cannot be overlooked is that a large part of municipal waste management is undertaken by local governments. On the whole, the market mechanism does not work well in local governments, where costs tend to be high.

The Lack of Landfills

Because of the sparseness of level land, there is a lack of landfills in Japan.

As for municipal waste, the remaining capacity of landfills as of the end of FY2003 was 137 million cubic meters, which will be sufficient for 13.2 years.⁶ This figure improved almost consistently over the previous 14 years from 8.0 years at the end of FY1989, reflecting the decreasing amount of final disposal. Thus, the level of the capacity of landfills for municipal waste seems to be adequate for the time being.

But the situation is more serious in industrial waste. The remaining capacity of landfills for industrial waste as of the end of FY2003 was 184 million cubic meters, which is projected to be enough for 6.1 years.⁷ This figure has also improved, especially in FY1998 – 2003 when it rose from 3.3 years, reflecting a decline in the amount of final disposal. In addition to this, many large landfills managed by public-related organizations have been constructed in recent years. This is another reason for the improvement in the remaining capacity. In any case, the remaining capacity of landfills for industrial waste is much less than that for municipal waste. The main reason for this is the difference of operators between landfills for municipal waste and those for industrial waste. Landfills for municipal waste are usually operated by local governments, which secure sufficient land for future needs within their area because they have the responsibility of dealing with municipal waste discharged from their own districts.

Landfills for industrial waste, on the other hand, are usually operated by private companies, most of which are small or medium-sized firms that do not have enough internal

⁶Ministry of the Environment, Japan. *Ippanhaikibutsu*.

⁷Ministry of the Environment, Japan. *Sangyohaikibutsu Haishutsu*.

reserves to develop landfills for the future. Thus, they usually get bank loans for construction of landfills. As a bank finances them for 10 years at most, they have to plan to get returns from their investment within that period. The term might be shorter than 10 years, perhaps eight years, considering that the construction period is approximately two years. Therefore, the scale of each landfill must be such that it can be filled within eight years.

Of course, the difficulty of securing sites for landfills cannot be overlooked. In most cases, plans for landfills are severely opposed by local residents, and it takes several years to complete the necessary negotiations and environmental assessments. Plans to construct landfills often have to be abandoned after large tracts of land have been procured. Therefore, it is very difficult for the companies involved to accumulate sufficient internal reserves. But several outstanding companies have formed good relationships with local residents by showing their excellent track records. As a result, they have consistently secured sites for landfills.

The problem is that even such companies do not have adequate internal reserves and cannot afford landfills that can be used for a long time.

Chronic lack of landfills is one of the major reasons for illegal dumping. As a result, the Japanese government has assisted public-related organizations, in most cases incorporated foundations founded by local governments, in constructing landfills by providing financial support to them both directly and indirectly. Consequently, several large-scale landfills, usually with an adjacent incineration plant, have been constructed by public-related organizations and have contributed to increasing the remaining capacity of landfills for industrial waste in recent years.

Illegal Dumping

In Japan, huge amounts of waste are dumped illegally. In the 10 years to the end of FY2004, approximately 5 million tons of such wastes were found. As of the end of FY 2004, approximately 16 million tons⁸ of such waste remained unremoved.⁹

This is a very serious problem because hazardous materials from such waste often penetrate into the soil, flow into the rivers, and cause environmental pollution. If measures are not taken immediately, this could cause serious health issues for the Japanese people.

In three major cases of illegal dumping – Teshima in Kagawa Prefecture, the boundary between Aomori and Iwate Prefectures, and in Gifu – the amount of waste dumped in each has been more than 500,000 tons, and all of the companies involved have gone bankrupt.

In such cases, therefore, the prefectures have to remove the waste themselves. Funds provided by the Japanese government and large private companies are the financial support for these efforts.

In the case of Teshima, it has taken about 10 years to remove all the waste at a cost of some ¥45 billion (\$380 million). Generally speaking, it is three times more expensive to remove and dispose of illegally dumped waste as compared to ordinary waste management. The economic burden this puts on Japanese society cannot be ignored.

Why is there so much illegal dumping in Japan? The major reasons are the lack of landfills, the resulting high price for waste management, and the existence of many places like mountains relatively near urban areas where illegal dumping can easily be carried out. But in addition to these factors, which are difficult to resolve, there are several systematic problems that

⁸This figure includes waste illegally dumped before FY1995.

⁹Ministry of the Environment, Japan. *Sangyohaikibutsu no Fuhotoki no Jokyō ni Tsuite*

could be improved. One is a lack of appropriate systems for generators to trace waste in each process undertaken by a waste management company. Another is the existence of waste management companies with close ties to gangsters.

Recently, the situation in relation to these issues has been gradually improving because the Ministry of the Environment has taken several measures to prevent illegal dumping.

One of these is the introduction of “the manifest system,” which enables dischargers to trace their waste in each process of waste management. Application of this system to “industrial waste under special control,” i.e., usually hazardous waste, started in April 1993 and to all industrial waste in December 1998 by revisions of the Waste Management Law.

Another is the strengthening of licensing conditions for waste management businesses. Through revisions of the Waste Management Law in 1997 and 2000, the regulations concerning qualifications for waste management businesses have been reinforced to exclude companies that are affiliated with organized crime.

In addition to these measures, from FY2005, the Ministry of Environment started a new system to evaluate top-quality waste management companies. This system requests companies to disclose data about their financial and operational conditions if they want to be evaluated as top-quality. The spread of this system is expected to facilitate such disclosure by waste management companies.

Insufficient Disclosure of Data

As mentioned above, the majority of waste management companies, except for several cement and mining enterprises, are unlisted. In most cases, therefore, it is very difficult to get

sufficient information about these firms when considering which company to choose as a contractor.

Generators have to undertake careful research if they want to choose proper waste management companies as their contractors. Large companies discharging large amounts of waste can do this because it is worthwhile in consideration of cost effectiveness. Dischargers with small amounts of waste, on the other hand, cannot afford to do this. In many cases, they simply choose the least expensive firm. Sometimes, however, this results in illegal dumping in the mountains.

The enhancement of the level of disclosure can make it easier for dischargers to choose proper waste management companies. And, as a result, illegal dumping will decrease. As has already been mentioned, the evaluation system introduced in FY2005 will facilitate disclosure by waste management companies and play an important role in improving the situation.

Immature Companies

As mentioned above, there are no huge companies in Japan whose main business is waste management. And, of the small ones that do exist, only two are listed on the stock exchange.

This immaturity of the waste management industry has caused low reliability and a lack of disclosure. There are several reasons why this immaturity will be difficult to remedy.

The most important seems to be the licensing system in Japan. Waste management companies have to get a license from each prefecture to undertake industrial waste management in that jurisdiction. In addition, they have to get a license from each local government to perform general waste management in different local areas that cross the borders of the respective

locations. This is very time-consuming and expensive. Therefore, most waste management companies undertake their main business within a limited area. Although some large companies have licenses from many prefectures for collection and transportation, there is no company that carries out waste management all over Japan.

The second reason seems to be the risk inherent in waste management. Facilities for waste management produce harmful substances and have serious effects on the environment if they are not operated correctly. As the morals of waste management companies have not been high so far, the possibility for risk has also been sizeable in general. M&A appears to be a suitable method for active waste management companies to expand their business because they can avoid complicated procedures involved in getting licenses and thereby save time. But actually they hesitate to undertake M&A's, worrying about facing hidden risks and expenses.

The third reason seems to be the prejudice against waste management. In general, jobs in waste are dangerous and dirty work. People tend to avoid these kinds of jobs and have prejudices against them. Thus, even though they may have seen certain business possibilities, huge companies in other industries have hesitated to get into large-scale waste management because of concerns about hurting their corporate image.

CHAPTER 2

CURRENT CONDITIONS OF WASTE MANAGEMENT IN THE UNITED STATES

AND COMPARISON WITH JAPAN

Categories of Waste and the Amount of Waste Generated

In the United States, waste management is done under the control of the Resource Conservation and Recovery Act (RCRA) established in 1976, and waste is divided into two major categories: hazardous and non-hazardous.

Hazardous waste is defined by the RCRA and strictly managed. Most hazardous waste is discharged from manufacturing processes. In 2005, the total amount of such waste generated was approximately 38 million tons. It is difficult, however, to compare the amount between 2005 and the years before 1999, in particular, because the earlier amount included waste water and the range of hazardous waste has expanded in recent years.

The range of hazardous waste is almost same as the range of the category termed “industrial waste under special control” in Japan. It contains ignitable waste oil, corrosive waste acid liquid, corrosive waste alkali liquid, infectious waste generated from hospitals, and waste containing hazardous substances like polychlorinated biphenyl (PCB), asbestos and heavy metals. The industrial wastes in this category are treated very strictly. Unfortunately it is difficult to compare the amount of hazardous waste between the United States and Japan because there are no statistics on this category in Japan.

Non-hazardous waste, on the other hand, is waste other than hazardous waste. It is divided into several categories, including municipal solid waste and several kinds of industrial waste.

The definition of municipal solid waste in the United States seems to be almost that same as the definition of municipal waste in Japan. The amount of municipal solid waste generated in 2005 was approximately 245.7 million tons. Per person, this came to a little more than 1,800 pounds (about twice the amount in Japan).

In the United States, yard trimmings are a major component of municipal solid waste, about 13 percent of all. In 2005, this amounted to 32.1 million tons. In Japan, on the other hand, the amount of yard trimmings is negligible. This is because of the difference in the size of yards and gardens in the two countries. If the amount of yard trimmings is deducted from municipal solid waste in the United States, the amount of municipal solid waste per person during that year came to a little less than 1,600 pounds (about 1.8 times the amount in Japan).

The total amount of municipal solid waste generated has increased about 12 percent since 1990, when it was 205.2 million tons (Table 3). The amount of municipal solid waste generated per person, however, has been stable over this period, at a little more than 1,800 pounds. These figures show that the increase was caused by the rising population in the United States. The amounts of waste generated per person have been stable both in the United States and in Japan over the past decade and a half, reflecting the maturity of the two societies.

Non-hazardous industrial waste is not managed so strictly in the United States, and the Environmental Protection Agency (EPA) has not collected or confirmed the data about its

volume,¹⁰ so the exact amount is unclear. But, in an old survey probably conducted in the 1990's, the agency estimated the amount at approximately 7,600 million tons, 97 percent of which was waste water.¹¹ Therefore, the amount of industrial solid waste generated seemed to be approximately 228 million tons at that time.

Because of the lack of statistics, it is difficult to compare the amount of industrial waste – both hazardous and non-hazardous – in the United States and Japan. In addition, for the same reason, it is difficult to ascertain the change in the amount of industrial waste in the United States over the past 15 years.

It is believed, however, judging from the trend of municipal solid waste, that the amount of industrial waste generated per person has been stable in the United States during this period.

Methods of Waste Management

There are no statistics to show the percentage of methods used in waste management in the United States as a whole. There are, however, statistics and research that show the percentage of methods used in municipal solid waste management and all off-site solid waste management.

The recycling rate, including recovery for composting for municipal solid waste in 2005, was 32.1 percent, twice the 16.2 percent of 1990.¹² This is almost double the recycling rate for municipal waste in Japan. In the United States, the reduction rates have been relatively low, e.g., 13.6 percent in 2005,¹³ because the cost for incineration is much higher than that for landfills and

¹⁰Zero Waste America. <http://www.zerowasteamerica.org/Statistics.htm>.

¹¹EPA. <http://www.epa.gov/epaoswer/non-hw/industd/questions.htm>.

¹²EPA. *Municipal Solid Waste in the United States: 2005 Facts and Figures*.

¹³This figure contains only combustion with energy recovery and does not contain that without energy recovery. The exact percentage, therefore, is a little bit larger than this.

there is a strong fear about air pollution caused by emission of waste gases from incineration plants. In the United States, about 50 percent of the total volume of municipal solid waste is buried in landfills.¹⁴ This rate is almost three times the final disposal rate for municipal waste in Japan.

According to research by the Environmental Research and Education Foundation about solid wastes managed off-site, including both municipal and industrial solid waste, 63.5 percent of solid waste is managed in municipal solid waste landfills, 5.1 percent in construction and demolition landfills, 20.9 percent in material recycling facilities, 4.8 percent in compost facilities, and 5.8 percent in incinerators.¹⁵ This means that 68.6 percent of solid waste is buried in landfills and 25.7 percent of it is recycled. The recycle rate for all solid waste in the United States may be higher than this, and the final disposal rate may be lower, since these figures do not include on-site waste management performed by generators, which tends to include a high portion of recycling. In any case, judging from these statistics and research, the final disposal rate of all solid waste in the United States seems to be more than 50 percent.

This high final disposal rate is caused by the fact that there are large amounts of level land in the United States; thus, it is easy to find space for landfills. Actually, 10 years ago the remaining capacity of landfills, on average, seemed to be sufficient for more than 10 years for both municipal and industrial waste. But the situation is deteriorating every year and is especially

¹⁴According to EPA statistics, the rate for discards to landfill and other disposal in 2005 was 54.3 percent. This rate contains a small portion of combustion without energy recovery.

¹⁵R.W. Beck Chartwell Information Publishers. *Size of the U.S. Solid Waste Industry* (Alexandria, VA: Environmental Research and Education Foundation, April 2001).

serious in large cities like New York where there are no landfills and they depend on facilities in other states.

There are no recent data about the remaining capacity of landfills. In 1999, the remaining capacities for municipal solid waste were more than 10 years in most states.¹⁶ But the number of landfills for municipal solid waste in the United States was 1,654 in 2005, down from 2,216 in 1999. The amount of municipal solid waste disposed in landfills, on the other hand, remained almost unchanged during those six years.

In addition, there is an outstanding difference in the number of landfills between the northeast and the other parts of the United States. There are 581 landfills in the south, 515 in the west, and 425 in the Midwest, but only 133 in the northeast.^{17, 18} This suggests that the remaining capacity of landfills has become seriously limited, especially in northeastern part of the United States.

The situation concerning landfills in the United States is not as serious as in Japan, where most landfills are in the mountains, as shown by the fact that 50 percent of waste is disposed of in landfills in the United States. But it has become patently more difficult year by year to keep finding sites for landfills in the United States as well.

¹⁶*Bio Cycle Magazine 1999.*

¹⁷*Bio Cycle Magazine April 2006.*

¹⁸The south includes: Delaware, Maryland, the District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas. The west includes: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, and Hawaii. The Midwest includes: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas. The northeast includes: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania.

Differences Between the United States and Japan in Landfill Methods by Category

In the United States, industrial waste is divided into two categories, hazardous waste and non-hazardous waste. When hazardous waste is disposed of in landfills, the landfills must have double liners, leachate treatment facilities, a leak detection system, and so on. The standards of waste treatment for hazardous waste, not only in landfills, but also in the other treatment systems, seem to be more stringent than the standard for “industrial waste under special control” in Japan.

Non-hazardous industrial waste, on the other hand, is not necessarily treated so strictly in the United States. The RCRA sets the guidelines for treatment for non-hazardous waste, but the regulations are determined by each individual state. The design criteria in the RCRA require each landfill for non-hazardous solid waste to have a liner consisting of a flexible membrane and a minimum of two feet of compacted soil as well as a leachate collection system.¹⁹ Landfills for municipal solid waste seem to be constructed according to these criteria. But as for industrial waste, regulations differ depending on the states. Some states set more rigid regulations than the RCRA guideline; others do not.

In Japan, as shown in Chapter 1, five categories of industrial waste (plastics, concrete debris, glass and ceramics, rubber, and metals) are dumped in the not-so-highly regulated landfills without liners or leachate treatment facilities. But, except for the landfills, even these five categories are treated under the same strict system as other categories in Japan. In addition, industrial waste other than these five categories, for example, sludge and wood, must be dumped in highly regulated landfills typically with liners and leachate treatment facilities, even if they do not contain hazardous substances.

¹⁹John W. Teets, Dennis Reis, and Danny G. Worrell. *RCRA Resource Conservation and Recovery Act* (Chicago: American Bar Association, 2003).

In some U.S. states, non-hazardous industrial waste is treated as strictly as or more strictly than in Japan. In other states, it is not. In brief, as regards industrial waste management, the system in Japan is rigid, while that in the United States it is more flexible.

The Cost of Waste Management

In the United States, the cost of waste management seems to be low. According to an investigation by *Solid Waste Digest*, the average solid waste tipping fee in 2001 was a little less than \$40 per ton. Of course, the prices differ depending on the areas. The price in the northeast, for example, is rather high, at a little less than \$60 per ton. In addition, the price for landfills is different from that for incineration. In general, the price for incineration is about \$20 per ton higher than that for landfills.

The price for incineration is from \$50 to \$60 per ton except in the western states, where it is about \$40 per ton. The price for landfills, on the other hand, varies depending on the area. In the western states, the average landfill price is about \$20 per ton. In Nevada, the price is particularly low, at \$10.54 per ton. In the northeast, however, the average landfill price is about \$55 per ton, almost that same as for incineration, which is about \$60 per ton. The price is the highest in Massachusetts, at \$69.25 per ton. This difference is caused by the difference in land price. In states where there are large amounts of level land, the price of land is low and it is relatively easy to construct landfills. In other states with a high population density and not a lot of level land, the price of land is high and it is relatively difficult to construct landfills.

Of course, the tipping fee varies depending on the quality and category of the waste. The price for hazardous waste, for example, is much higher than the average price shown here, although I cannot find data about tipping fees by categories.

In any case, the cost of waste management in the United States is definitely much lower than in Japan, even in the northeast.

Responsibility for Waste Management

In the United States, waste management is mainly undertaken by huge private sector companies, although a certain amount of waste management for municipal solid waste is done by local governments.

In the United States, private sector companies own 52.6 percent of the off-site facilities that manage solid waste, and the public sector owns 47.5 percent. According to a 2001 report, among the facilities owned by private sector companies, 40.9 percent were owned by publicly traded companies (whose stocks are listed on the stock exchange) and 11.7 percent were owned by privately held companies.²⁰

In the United States, 544.7 million tons of solid wastes were managed by waste management companies in the private and public sector in 1999.²¹ Other than this, large amounts of wastes were managed in-site by generators. But the amount of the wastes is not clear because there are no statistics or research available. Among the solid wastes managed by waste management companies and the public sector, 69.2 percent (376.9 million tons) was managed by private sector companies and 30.8 percent (167.8 million tons) by the public sector. Among the

²⁰Beck and Chartwell.

²¹Beck and Chartwell.

solid wastes managed by private sector companies, 40.2 percent was managed by publicly traded companies and 29.0 percent by privately held companies.²²

All of the solid wastes in the United States managed by the private sector were municipal solid waste because all industrial wastes are managed by private sector companies. The amount of municipal solid waste generated in 2000 was 237.6 million tons according to the statistics. About 70 percent of municipal solid waste was, therefore, managed by the public sector in 2000. This percentage is about the same as in Japan in 2003, when the percentage of the consignment fee in the total cost for municipal waste was 27 percent; this means that the cost in the public sector was 73 percent. But, as for municipal solid waste management in the United States, the consignment to the private sector has advanced rapidly in the past several years. It seems that only a little more than 50 percent of municipal solid waste management was undertaken by the public sector in the first several years of this century.²³

Both in the United States and in Japan, the public sector still plays an important role in municipal waste management. But the level of privatization in municipal waste management is more marked in the United States than in Japan. In addition, as for solid waste management as a whole, large publicly traded companies play a major role in the United States.

Major waste management companies in the United States are listed below in order of revenues.

- **Waste Management, Inc.**; Headquarters/Houston; Revenues/\$13.07 billion (2005).

²²Beck. and Chartwell.

²³Shinya Nagasawa and Kensei Moriguchi, *Haikibutsu Bijinesu Ron* (Tokyo: Doyukan 2003).

- **Allied Waste Industries, Inc.;** Headquarters/Scottsdale, AZ; Revenues/\$5.73 billion (2005).
- **Republic Services, Inc.;** Headquarters/Fort Lauderdale, FL; Revenues/\$2.86 billion (2005).
- **Veolia Environmental Services North America Corp.;** Headquarters/Lombard, IL; Revenues/\$1.60 billion (2005).
- **Metal Management, Inc.;** Headquarters/Chicago; Revenues/\$1.59 billion (FY2005).
- **Covanta Holding Corp.;** Headquarters/Fairfield, NJ; Revenues/\$0.98 billion (2005).
- **Waste Connections, Inc.;** Headquarters/Folsom, CA; Revenues/\$0.72 billion (2005).
- **Clean Harbors, Inc.;** Headquarters/Norwell, MA; Revenues/\$0.71 billion (2005).
- **Stericycle, Inc.;** Headquarters/Lake Forest, IL; Revenues/\$0.61 billion (2005).
- **Casella Waste Systems Inc.;** Headquarters/Rutland, VT; Revenues/\$0.48 billion (FY2005).

The revenue of the top company, Waste Management, Inc., is more than 60 times that of Daiseki, the top Japanese company whose main business is waste management and about 20 times that of Taiheiyo Cement, the top waste management company in Japan. Thus, it is clear that the scale of waste management companies is totally different between the two countries.

In addition to this, all 10 of the above companies are listed on the stock exchange and disclose detailed data about the various aspects of their corporate activities. As a result, generators are able to sign contracts with these waste management companies without undue worry or suspicion.

The market share of Waste Management, Inc. seems to be approximately 20 percent.²⁴ Therefore, the market share of the top 10 companies including Waste Management, Inc. seems to be more than 40 percent. It is certain, therefore, that more than 40 percent of solid waste management, other than that done by the generators themselves, is undertaken by large publicly traded waste management companies in the United States both as regards the amount of money and the amount of waste. This fact shows that the waste management business in the United States is mature as compared with that in Japan.

Calculating from the revenues of Waste Management, Inc. and its market share, the market scale of the waste management business including the public sector in the United States seems to be about \$65 billion. The market scale seems to be about \$45 billion if the share of public sector, 30.8 percent, is excluded.

These figures are not so different from the market scale of the waste management business in Japan, which is about \$53 billion including the public sector and about \$38 billion excluding it. This also shows that the cost of waste management in Japan is much higher than that in the United States.

In the United States, on the other hand, cement companies use a certain amount of waste as materials for cement; this is the same as in Japan. But the fees that cement companies earn to treat waste seem to be small in the United States because the price of waste management is low. Therefore, the presence of the cement industry in waste management seems to be weaker than that in Japan. The situation is the same as with the mining industry in the United States. Mining

²⁴Nagasawa and Moriguchi.

companies may treat a certain amount of waste, but the fees they earn from this seem to be small for the same reason.

Current Problems in Waste Management in the United States

In the United States, waste management regulations are more flexible than in Japan. But flexibility sometimes causes problems.

Hazardous Waste Generated from Small-quantity Generators

In the United States, conditionally exempt small-quantity generators producing less than 100 kg of hazardous waste on a monthly basis do not have to ask a waste management company with permission under the RCRA for hazardous-waste management. As a result, these small-quantity hazardous wastes are disposed into landfills for non-hazardous waste. There are some estimates that the amount of these hazardous wastes disposed into landfills for non-hazardous waste is about 120,000 tons per year.²⁵ Serious environmental problems may be caused if hazardous substances are dispersed from insufficient landfill systems into water supplies.

Export of Discarded Items Including Hazardous Substances into Developing Countries

Large amounts of discarded computers and other electric equipment are exported from the United States into developing countries, especially western Africa and China. These items are disassembled and useful parts are recycled. But large amounts of residues are dumped illegally or

²⁵“Managing Industrial Solid Wastes from Manufacturing, Mining, Oil and Gas Production, and Utility Coal Combustion.” Background Paper, U.S. Congress, Office of Technology Assessment, February 1992.

harmfully. In addition, the recycle processes are sometimes unsafe, with harmful effects on workers and the surrounding environment.

In the United States, the export and import of waste are not regulated strictly. There is an international agreement about control of trans-boundary movements of hazardous waste called the “Basel Convention.” The United States signed, but has not ratified it. This situation may promote the excessive export of waste into developing countries.

CHAPTER 3

SUCCESS FACTORS IN OUTSTANDING COMPANIES IN THE UNITED STATES

Table 4 shows several features of the top 10 waste management companies in the United States.²⁶ All of them seem to be outstanding because they earn large incomes and have sufficient accumulated shareholder's equity. In addition, as for the scale of revenue, no waste management company in Japan earns more revenue than even the 10th largest of these firms, Waste Industries USA, Inc., which earned \$311 million in 2005. This shows they are successful waste management companies and that there are not any companies in Japan that achieve such good results. Through investigating the features of these companies, certain success factors in waste management companies in the United States can be ascertained.

First, all of these companies are publicly traded and disclose detailed data about their operations. In this way, they can not only earn the trust of the generators, but also obtain capital to invest in the acquisition and construction of large facilities.

Second, all of them have grown into large companies through acquisitions, especially after the mid-1990's, and, as a result, all of them do business in a broader area than a single state, half of them almost nationwide.

²⁶Table 4 excludes Veolia Environmental Services North America Corp. because it is a subsidiary of Veolia Environmental Services, the world's second-largest waste services company with 71,000 employees in 34 countries generating revenues of \$8.4 billion. The headquarters is in Paris, and the data about business in the United States published by this group are not as clear as those of the other waste management companies in the United States and it is, therefore, difficult to make comparisons among them.

Instead Table 4 includes information about Waste Industries USA, Inc., 14th-largest waste management company in the United States by revenue.

In addition, Table 4 excludes three companies, BFI Canada Income Fund, Norcal Waste Systems Inc., and Rumpke Consolidates Companies Inc. BFI Canada Income Fund is excluded because it is a Canadian company and the data about its business in the United States are not clear. The other two companies are excluded because they are privately owned companies and the disclosed information is limited.

The order of the revenue of waste management companies was investigated referencing Reuters.com, and annual reports of companies.

The market for the waste management industry is mature and highly competitive. In addition, the waste management business involves inevitable risks because construction and management of facilities like landfills and incinerators are likely to cause opposition and lawsuits from local residents. Extending their areas geographically and enlarging the scale of their business makes it possible for them to reduce costs through finding the best place for their facilities and enhancing efficiency, as well as bearing risks through diversification.

Third, almost all of them specialize in their main business except for Waste Management, Inc., the top company, which owns various kinds of facilities and undertakes various kinds of waste management. For example, Metal Management, Inc. is an expert in metal recycling, Covanta Holding Corporation in electric power generation using waste combustion, Clean Harbors, Inc. in hazardous waste management, and Stericycle, Inc. in medical waste management. They all determined their area of expertise through acquisitions concentrating in this particular field and became the top company in their respective specialty.

The other five companies, Allied Waste Industries, Inc., Republic Service, Inc., Waste Connections, Inc., Casella Waste Systems, Inc., and Waste Industries USA, Inc. have all focused on non-hazardous waste management. The market scale of this business area is quite large, and it is relatively easy to start business in this area, but difficult to survive because of the severe competition. Relatively smaller companies, therefore, target their business at specific geographic areas. Waste Connections, Inc., for example, targets suburban and rural areas in the western and southern United States, Casella Waste Systems, Inc. the northeast, and Waste Industries USA, Inc. the southeast.

To concentrate on their expert business area, they have sometimes sold their marginal businesses to other companies. For example, Browning Ferris Industries, Inc. (BFI), now Allied Waste Industries, Inc. through consolidation, sold its medical waste business to Stericycle, Inc. in November 1999. Two years earlier, BFI also sold five operations in Washington and Idaho to Waste Connection, Inc. Through selection and concentration in their business area, they have strengthened their competitiveness.

Thus, the success factors in these companies are the enlargement of the scale of the companies through listing their stocks and acquisitions, selection and concentration in a business area, and enforcement of reliability and competitiveness by the former two factors. Then, why have the waste management companies grown in the United States?

The first reason seems to be the reinforcement of regulations for waste management. Since the establishment of the RCRA in 1976, these regulations have been reinforced. This has assisted waste management companies in enlarging their scale because it has become more difficult for small companies to constantly invest in up-to-date facilities according to new stricter regulations, while enlarging the scale of the company has been more advantageous than before. In addition, strict regulations and increased opposition to waste management facilities have increased the risks in the waste management business. This situation has also facilitated the enlargement of scale in an effort to avoid risks.

The second reason seems to be the existence of Waste Management, Inc., a good example of expansion through acquisitions and consolidations. Waste Management, Inc. was listed on the stock exchange in 1971 and acquired hundreds of waste management companies in the 1970's before the RCRA was established. The only word to describe the actions of Waste Management,

Inc. is foresight. This company was an excellent model for other large waste management firms in their efforts to expand.

CONCLUSION

In Japan, the level of regulations for waste management now seems to be about the same as in the United States. As noted above, however, U.S. regulations are more flexible. For example, although the standards for non-hazardous waste management facilities are uniform throughout Japan, in the United States they depend on the states. In Japan, even if the amount of hazardous waste created by a single generator is small, it must be treated strictly, the same as that from a large-quantity generator. In the United States, on the other hand, this is not the case.

These differences in the stringency of regulations, however, which result from the difference of social structure and geographic features between the two countries, influence the quality of waste management to some extent, but do not seem to be the major factors in determining the differences between the two countries in the waste management business.

Looking at the time when the regulations were reinforced in Japan, the categories of landfills for each type of waste were set in 1977, and the manifest system that enables generators to trace the process of waste management was started in 1993 by drastic amendment to the Waste Management Law. As to the quality and time of reinforcement of regulations, there does not seem to be any remarkable differences between the two countries.

Thirty years ago, most waste management companies in the United States and Japan were small or medium-sized. Then why have waste management companies in Japan not developed very much since then, while those in the United States have drastically changed along with the reinforcement of the regulations?

One possible reason is the rigid licensing system in Japan. As noted in Chapter 1, it is very time-consuming and expensive for waste management companies in Japan to get licenses in multiple areas. But I do not think this is the crucial reason.

There are several factors involved. It is not easy even in the United States to construct landfills and incinerators, though it is easier than in Japan. In the United States, only those waste management companies treating hazardous waste are required to get permission from the EPA and they do not have to deal with individual states if they conduct waste management business in multiple states, but they do have to conduct business and construct facilities according to various state standards and regulations. This difference between states seems to bother waste management companies conducting business in more than one state. Taking this into consideration, the situation of the waste management companies in the United States is not necessarily advantageous compared to Japan.

I think the most probable reasons are risks in waste management, prejudice about this kind of business, and economic conditions in Japan.

As to risks, the situation is the same in both countries. But in Japan, people are very cautious in general and do not like to take risks. In addition, until the beginning of the 1990's in Japan, there were many better opportunities for investment than waste management. Moreover, acquisition and consolidation were not common until several years ago in Japan. Due to these factors, the average scale of waste management companies in Japan has remained small up to now. Deep-rooted prejudice against the waste management business has also intensified this tendency.

In view of these factors, recently the situation for the waste management business seems to have improved considerably in Japan. Acquisition and consolidation have been common, and there are not so many other profitable opportunities for investment these days. Prejudice about waste management has remained, but weakened, because people have become conscious of environmental issues and begun to think that waste management is important to facilitate recycling and protect the natural environment. In addition, projects aimed at fostering and evaluating top-quality companies undertaken by the Ministry of the Environment to encourage the disclosure of data by waste management companies and improve the people's understanding. The time is now ripe for waste management companies in Japan to become more sophisticated.

Outstanding companies in the United States are a good example for waste management companies in Japan. The latter should train or get human resources that can ascertain the value of other waste management companies for acquisition, find their specific business area in a broad sense to enhance the efficiency of their business, and reinforce their function for consulting to enhance client satisfaction. The last point, in particular, seems to be a typical weak point among waste management companies in Japan as compared to the United States and must be improved.

To promote changes in the waste management business, on the other hand, both government and financial institutions need to be involved.

The Waste Management Law has been amended many times since it was established in 1970, and the system of the law has become too complicated for people other than officers in charge in the Ministry of the Environment to understand. The situation of waste management has changed considerably in recent years as reduction and recycling of waste have become important. The law should be reformed drastically into what is in accordance with the concept of resource

conservation. At the same time, excessively rigid and irrational regulations, such as the licensing system, should now be changed.

Through giving advice and providing human resource and information, financial institutes should assist high-quality waste management companies in acquiring other companies, being listed on the stock exchange, and in restructuring their business. Assistance for M&A's, in particular, is very important because waste management companies do not have sufficient know-how for this at the moment.

Waste management in Japan can be improved dramatically through the efforts of all involved.

Table 1

Changes in the Amount of Municipal Waste Generated in Japan

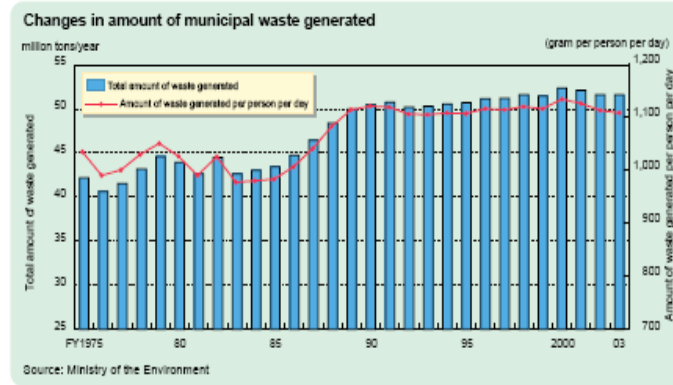


Table 2

Changes in the Amount of Industrial Waste Generated in Japan

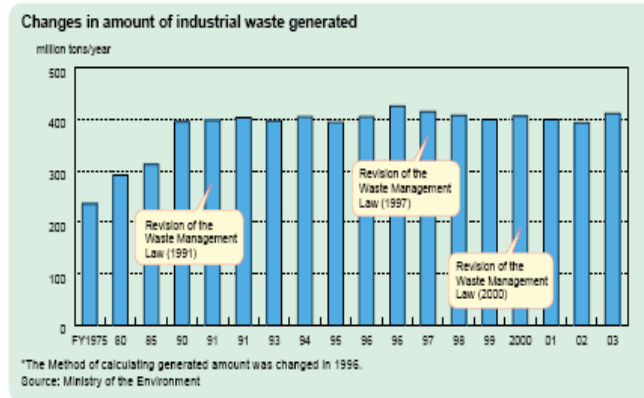


Table 3

Changes in the Amount of Municipal Solid Waste Managed in the United States

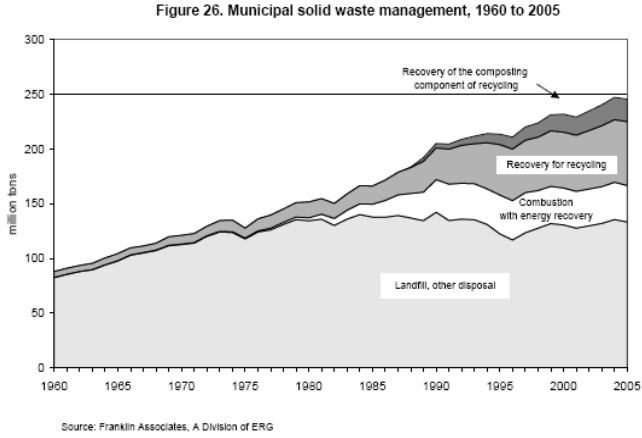


Table 4

Features of Major Waste Management Companies in the United States

(Unit: \$ million)

Name of the company	Headquarter	Year of foundation	Revenue (FY2005)	Net income (FY2005)	Total asset (end of FY2005)	Share holder's equity (end of FY2005)	Number of employee (2005 or 2006)	Area	Main business	Main facility	Other features
Waste Management, Inc.	Huston, TX	1968	13,074	1,182	21,135	6,121	48,000	Whole of the United States	Non-hazardous waste management Hazardous waste management	413 collection 370 transfer 283 landfills (including 6 Hazardous-waste landfills) 131 recycling 17 waste-to energy (650Mw)	The biggest waste management company doing various kind of waste management
Allied Waste Industries, Inc.	Scottsdale, AZ	1989	5,735	194	13,626	3,439	24,200	37 states (Almost all area in the United States)	Non-hazardous waste management	304 collection 161 transfer 169 landfills 57 recycling	Integrated management for non-hazardous solid waste
Republic Service, Inc.	Fort Lauderdale, FL	1998	2,864	254	4,551	1,606	13,000	21 states (midnorth, southeast, texas, southern carifornia)	Non-hazardous waste management	140 collection 92 transfer 59 landfills 32 recycling	Integrated management for non-hazardous solid waste
Metal Management, Inc.	Chicago, IL	around 1900	1,702	92	479	313	1,734	Middle, east (around NY), south	Collect scrap and metal recycling	50 recycling	The biggest metal recycling company dealing with ferrous and non-ferrous metals
Covanta Holding Corporation.	Fair Field, NJ	1992	979	59	4,702	599	3,300	15 states (east, a part of middle)	Electric power generation using waste combustion	41 waste-to energy (1,050 MW) 2 landfills 1 water treatment	The biggest company of electric power generation using waste combustion
Waste connections, Inc.	Folsom, CA	1997	722	84	1,676	718	4,104	Almost all area except northeast especially west and midwest	Non-hazardous waste management	114 collection 36 transfer 33 landfills 26 recycling	Integrated management for non-hazardous solid waste targeting secondary market
Clean Harbors, Inc.	Norwell, MA	1980	711	25	614	116	3,900	37 states (east, west, south)	Hazardous waste management	9 landfills 6 incinerator 6 water treatment	Good at hazardous waste management
Stericycle, Inc.	Lake Forest, IL	1989	609	67	1,048	522	4,320	Almost all area in the United States	Medical waste management	105 transfer 45 treatment	The biggest medical waste management company
Casella Waste Systems, Inc.	Rutland, VT	1975	482	39	712	139	2,900	East especially northeast	Non-hazardous waste management	39 collection 33 transfer 9 landfills 2 landfills for construction waste 39 recycling 1 waste-to energy	Integrated management for non-hazardous solid waste
Waste Industries USA, Inc.	Raleigh, NC	1970	311	12	368	130	1,600	Southeast	Non-hazardous waste management	34 collection 28 transfer 10 landfills 12 recycling	Integrated management for non-hazardous solid waste

Source: Annual report of each companies

BIBLIOGRAPHY

Allied Waste Industries, Inc. <<http://www.disposal.com/>>.

Beck, R.W., and Chartwell Information Publishers. *Size of the U.S. solid Waste Industry*. Alexandria, VA: Environmental Research and Education Foundation, April 2001.

Bio Cycle Magazine. Various issues.

Casella Waste Systems, Inc. <<http://www.casella.com/>>.

Chartwell Solid Waste Group. *Solid Waste Digest: National Edition*. Alexandria, VA: Chartwell Information Publishers, 2001.

City of Cambridge, MA.

<<http://www.cambridgema.gov/TheWorks/departments/SolidWaste/index.html>>.

Clean Harbors, Inc. <<http://www.cleanharbors.com/>>.

Clean Japan Center. *Nippon no Machiriaru Baransu 2003* [The Material Balance of Japan, 2003]. Clean Japan Center, 2006.

Council of Local Authorities for International Relations. *Amerika ni Okeru Ippanhaikibutsu Shori to Risaikuru*. Council of Local Authorities for International Relations, 2001.

---. *Amerika no Sangyohaikibutsu Shori ni Tsuite*. Council of Local Authorities for International Relations, 2005.

Covanta Holdings Corporation. <<http://www.covantaholding.com/>>.

Energy and Resources. American Bar Association, 2004.

EPA. <<http://www.epa.gov/osw/>>.

---. *Municipal solid Waste in the United States: 2005 Facts and Figures*.

---. *The National Biennial RCRA Hazardous Waste Report (Based on 2003 Data)*. EPA, 2004.

Garrett, Theodore L., ed. *The RCRA Practice Manual*. Chicago: Section of Environment.

Hickman, H. Lanier. *American Alchemy: The History of Solid Waste Management in the United States*. Forester Press, 2003.

“Managing Industrial Solid Wastes from Manufacturing, Mining, Oil and Gas Production, and Utility Coal Combustion.” Background Paper, U.S. Congress, Office of Technology Assessment, February 1992.

Massachusetts State Government.

<<http://www.mass.gov/?pageID=mg2topic&L=3&L0=Home&L1=Resident&L2=Environment&sid=massgov2>>.

Metal Management, Inc. <<http://www.mtlm.com/>>.

Ministry of the Environment, Japan. <<http://www.env.go.jp/recycle/waste/>>.

---. *Ippanhaikibutsu no Haishutsu Oyobi Shori Jokyo Nado* [State of Discharge and Treatment of Municipal Solid Waste]. Ministry of the Environment, Japan, 2006.

---. *Junkangata Shakai Hakusho* [Annual White Paper on Sound-Material-Cycle Society]. Ministry of the Environment, Japan, 2006.

---. *Sangyohaikibutsu Haishutsu Shori Jokyo Chosa Hokokusho* [State of Discharge and Treatment of Industrial Waste]. Ministry of the Environment, Japan, 2006.

---. *Sangyohaikibutsu no Fuhotoki no Jokyo ni Tsuite* [Survey on Illegal Dumping of Industrial Waste]. Ministry of the Environment, Japan, 2005.

Nagasawa, Shinya, and Kensei Moriguchi. *Haikibutsu Bijinesu Ron*, [Discussion About the Waste Management Business]. Tokyo: Doyukan, 2003.

National Solid Waste Management Association <<http://www.nswma.org>>.

Republic Services, Inc. <<http://www.republicservices.com/>>.

Stericycle, Inc. <<http://www.stericycle.com/>>.

Tchobanoglous, George, and Frank Kreith. *Handbook of Solid Waste Management*. New York: Mc Graw-Hill, 1994.

Tchobanoglous, George, Hilary Theisen, and Samuel Vigil. *Integrated Solid Waste Management*. New York: Mc Graw-Hill, 1993.

Teets, John W., Dennis Reis, and Danny G. Worrell. *RCRA: Resource Conservation Recovery Act*, Chicago: American Bar Association, 2003.

Waste Connections, Inc. <<http://www.wasteconnections.com/>>.

Waste Industries USA, Inc. <<http://www.waste-ind.com/>>.

Waste Management, Inc. <<http://www.wm.com/>>.

Zero Waste America. <<http://www.zerowasteamerica.org/>>.