

THE MANAGEMENT OF HOUSEHOLD HUMAN WASTE IN JAPAN

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ABSTRACT

The present status and recent progress of Japan's waste management have been overviewed. The current Waste Disposal and Public Cleansing Law is first discussed to give the general framework of waste management. Relevant data on generation, collection and disposal are then given in tables and figures for both municipal solid waste (MSW) and night soil. Latest new legislation authorizing local authorities to construct large-scale offshore land reclamation projects in the near future is also summarized.

KEYWORDS

Waste management; domestic waste; industrial waste; municipal solid waste (MSW); night soil; incineration; Large-scale Regional Land Reclamation Projects; Waste Disposal and Public Cleansing Law.

INTRODUCTION

Current Waste Disposal and Public Cleansing Law and Waste Management Administration

"Preserving the living environment and improving public health through appropriate disposal of wastes and conservation of a clean environment" is the purpose of the "Waste Disposal and Public Cleansing Law" enacted in 1970, under which waste management is carried out in Japan. Under the law, all waste materials (except radioactive ones) are classified into two categories, namely domestic waste and industrial waste.

The industrial waste is defined as the waste materials that are generated by various industrial (including agricultural) activities, and that are designated specifically by the Law and its Enforcement Ordinance. The remaining materials, which are discharged mainly from households, including night soil, are defined as the domestic waste.

Disposal and proper management of the industrial waste is basically the responsibility of the original generators. In practice, the industrial waste is disposed of by entrepreneurs at their own cost, or by licenced operators contracted by the entrepreneurs. On the other hand, the prefectural government is responsible for maintaining the general level of industrial waste management and taking measures, if necessary, for improved management within its administrative region. The Law also requires the prefectural

government to develop a master plan for proper management of the industrial waste in the region, and to supervise industrial generators and operators. Certain industrial wastes which contain toxic or hazardous substances are to be strictly controlled to ensure proper disposal.

The municipality has the principal responsibility for domestic waste management, i.e. to collect, transport and dispose of domestic waste in its administrative district in accordance with the "Standards for Collection, Transportation and Disposal of Domestic Wastes" and according to the Annual Waste Management Plan of the municipality. The plan contains fundamental items concerning waste management such as estimated waste discharge, waste management system, collection and transportation plan, treatment plan and disposal plan.

Although domestic waste management is the responsibility of the municipalities, the municipalities may entrust some parts of the waste management works to licenced undertakers or arrange contracts with qualified undertakers in certain conditions. In some cases, an intermunicipal organization which consists of several municipalities, carries out some waste management works.

Identification of Present Waste Management Problems

Several problems mentioned below were identified and pointed out in the report on "Overviews of the Future Waste Management Administration" recommended by the Minister's Advisory Council on the Living Environment, in October 1983:

- * Increase of difficulties in siting waste treatment facilities attributed to highly advanced land use.
- * Difficulties in gaining understanding and co-operation of residents for appropriate waste management.
- * Increase of wastes such as mercury-containing dry batteries, bulky household electrical devices and plastic goods, bringing about difficulties of proper management in the conventional treatment system.
- * Ambient water pollution caused by increased domestic wastewaters.
- * Litter, including soft-drink cans, etc.
- * Increase of waste management cost owing to decrease of collection efficiency, introduction of sophisticated treatment technology, etc.
- * Inappropriate treatment practices such as illegal waste dumping.
- * Increased need for waste recycling, resource recovery and utilization.

Current Major Programme

In order to promote further construction of waste treatment facilities, in 1981 the Cabinet officially approved the fifth Five-year National Programme for Construction of Waste Treatment Facilities. In this Programme, a total investment of ¥1,760 billion for the construction of waste treatment facilities is planned throughout the country for the 5 years starting from fiscal year (FY) 1981. The achievement rate of the plan is, unfortunately, estimated to be only 71% in terms of capital investment because of the recent national financial crisis. Another national programme of particular importance is the promotion of constructing large-scale regional offshore waste disposal (landfilling) sites. As stated before, the shortage of landfill sites has now become a serious problem. For this purpose, special legislation was passed in the Diet in 1981, i.e. the Law of Regional Offshore Environmental Improvement Centres.

STATUS OF MUNICIPAL SOLID WASTE TREATMENT

Municipal Solid Waste Generation

In Japan, approximately 122,000 tons of MSW are generated daily from residential, commercial and other sources. In the past, as is shown in Fig. 1 where MSW generated from households since FY 1966 is depicted, a steady increase had been observed until FY 1970 which was then followed by a gradual increase up to the present time. It is generally known that the per capita generation increases with the degree of urbanization, and is thus greater in larger cities.

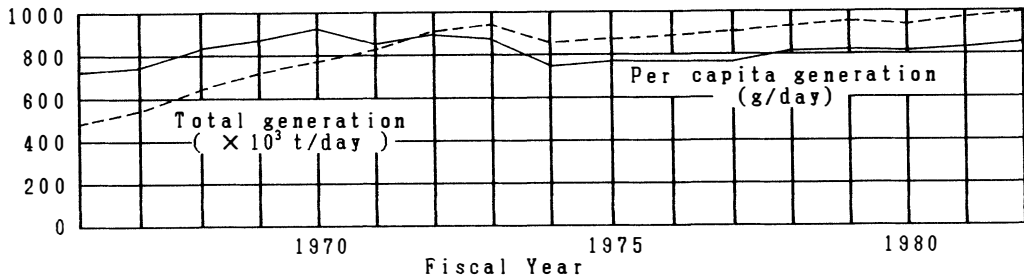


Fig. 1. Daily national and per capita generation of household MSW

TABLE 1 Trend of MSW Generation and Disposal Methods

	Fiscal year				
	1978	1979	1980	1981	1982
Per capita generation (g/day)	809	824	809	828	842
MSW generation from households (t/day)	93,110 (100)*	95,746 (100)	94,354 (100)	97,418 (100)	99,831 (100)
Collected by municipality and disposed of by:					
Incineration	59,781 (64.2)	62,417 (65.2)	63,177 (67.0)	65,487 (67.2)	69,105 (69.2)
Landfill	24,260 (26.1)	24,047 (25.1)	21,929 (23.2)	22,040 (22.6)	21,559 (21.6)
High speed composting	195 (0.2)	199 (0.2)	198 (0.2)	94 (0.1)	117 (0.1)
Composting and animal feed	19 (0.0)	66 (0.1)	76 (0.1)	42 (0.0)	43 (0.0)
Others	1,559 (1.7)	2,271 (2.4)	2,331 (2.5)	3,146 (3.2)	2,406 (2.4)
Total	85,814 (92.9)	89,000 (93.0)	87,771 (93.0)	90,809 (93.2)	93,230 (93.4)
Not collected and disposed of at source	7,296 (7.8)	6,746 (7.0)	6,643 (7.0)	6,609 (6.8)	6,601 (6.6)
MSW from other sources disposed of at municipal facilities	25,225	26,158	26,017	19,400	22,026

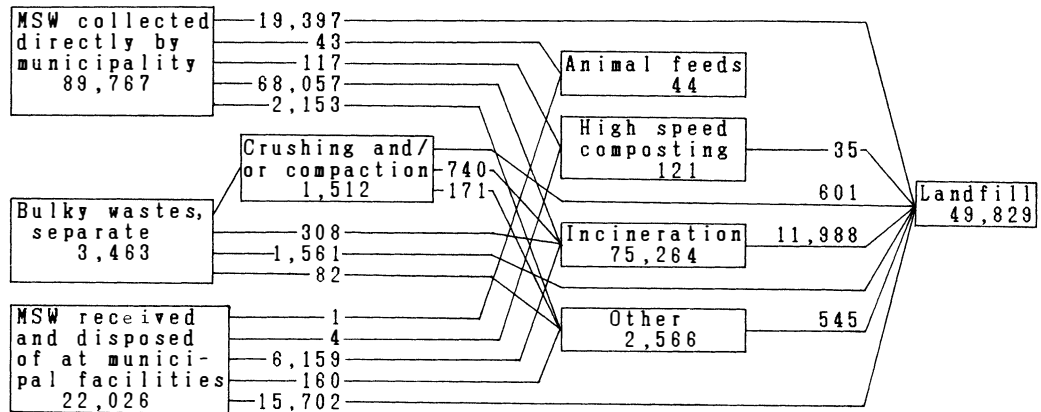
*Figures in parentheses = %

Treatment Methods and Waste Flow

The latest national picture for MSW disposal methods and flow are clearly shown in Table 1 and Fig. 2, which are compiled by the Ministry of Health and Welfare from the data reported annually by local government. For example, in (FY) 1982, municipalities were responsible for the daily collection of 93,000 t of MSW (see Table 1) while, in the same year, 22,000 t, mostly MSW from commercial and institutional establishments, were brought directly by the dischargers themselves and disposed of at facilities owned and operated by the municipalities.

Out of 93,000 t of MSW collected daily by municipalities, mainly from households, more than 69,000 t are incinerated. Including other MSW collected by licenced contractors from commercial and other sources, the overall incineration rate turns out to be 65%. On the other hand, 32% of all MSW collected is directly bound for landfill sites. In addition, ashes and residues from incineration and other minor disposal methods are also used as landfill.

Figure 2(a) indicates various waste flows from collection to landfill, through intermediate disposal paths, and Fig. 2(b) shows the waste reduction effected by intermediate processing.



(a) Generation to disposal flow diagram (unit: t/day)

Incineration 75,264 (65.3)	Other (2.4)	Direct landfill 37,261 (32.3)
(b) Reduction by processing (unit: t/day (%))		Total landfill disposal 49,829 (43.2)

Fig. 2. Collection to disposal: Flow diagram of MSW in Japan

Facilities and Management Costs

As shown in Table 2, the total number of incineration facilities has remained constant for the past several years at about 2000. The total design capacity of the facilities, however, has been increasing and in FY 1982 was 152,000 t/day. In the same year, facilities for shredding and/or compaction operations for mainly bulky wastes were numbered at 440, and total capacity more than 17,000 t/day. Similarly, the total number and capacity of mechanical composting plants was 20 and 424 t/day.

Annual changes in the number and capacity of public landfill sites operated by municipalities for the past several years are shown in Table 3. Both the number and capacity have gradually been decreasing, and site location tends to be distant from the collection areas.

TABLE 2 Total Number of Incineration Facilities for MSW Disposal

Fiscal year	Number of facilities	Total design capacity (t/day)
1978	2,025	138,767
1979	1,984	144,573
1980	1,999	146,894
1981	1,983	148,380
1982	1,942	151,353

TABLE 3 Total Number of Public Landfill Sites and Capacity for Ultimate Disposal of MSW

Fiscal Year	Total area (x 10 ³ m ²)	Total volume (x 10 ³ m ³)	Remaining volume (x 10 ³ m ³)
1978	51,946	392,656	239,191
1979	46,625	425,761	214,168
1980	52,086	356,109	191,945
1981	53,581	403,156	181,578
1982	53,929	377,583	175,975

Usually, all operating and maintenance costs associated with collection and disposal of MSW from households are paid from the annually appropriated expenditure from the ordinary municipal treasury. In some municipalities, however, the local authority collects the waste disposal fee directly from the residents in the service area. National average of per capita and per ton costs are estimated to be ¥5,700 and ¥19,700, respectively.

STATUS OF NIGHT SOIL TREATMENT

Night Soil Treatment System

Sanitary disposal of night soil is essential from both environmental and aesthetic points of view. In Japan, night soil is treated by three systems: public sewerage system; individual sewage treatment tank system; and collection and treatment system. In FY 1982, public sewerage systems served about 25% of Japan's total population, and individual sewage treatment tanks were used by another 25%. That meant that about half of the population utilized the flushing type of toilet, while the remaining half still relied on the traditional holding tanks for night soil.

Treatment Methods and Night Soil Flow

Night soil treatment methods are shown in Table 4 and Fig. 3, which are produced from the same data as used for the MSW. In FY 1982, 84,000 m³ of night soil (88% being collected by municipalities) and 24,000 m³ of individual sewage treatment tank sludge were discharged daily (see Fig. 3). Of this, 71% was treated at municipal night soil treatment plants, 5% at public sewerage treatment plants, 12% was disposed of at sea and 0.5% utilized as fertilizer on farmland.

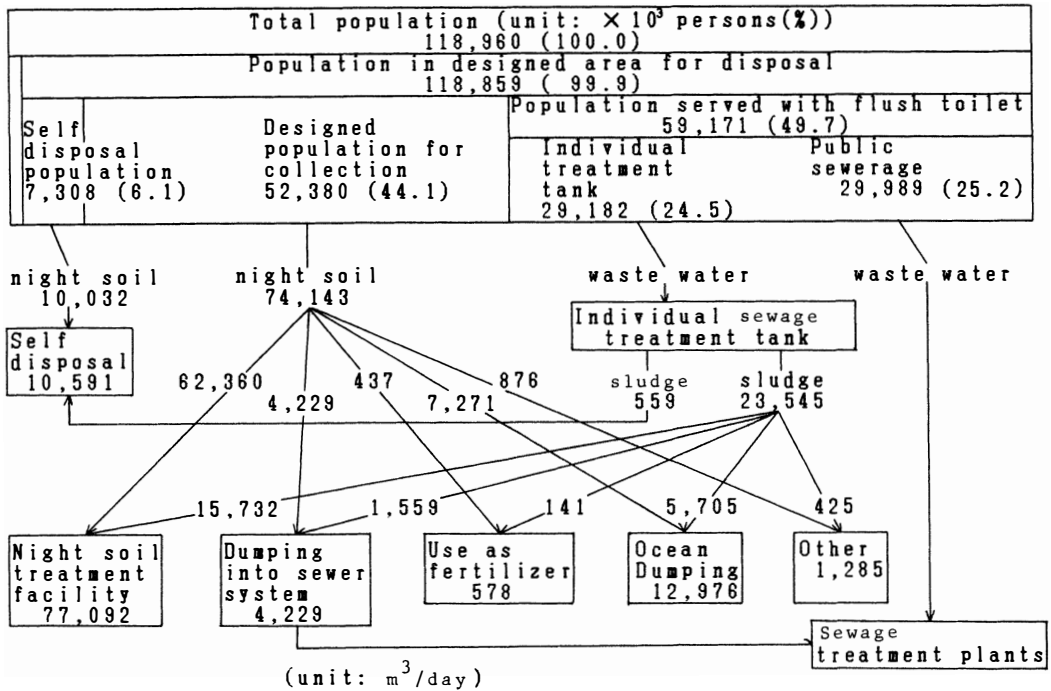


Fig. 3. Collection to disposal: Flow diagram of night soil in Japan

TABLE 4 Trend of Night Soil Generation and Disposal Methods

	Fiscal year				
	1978	1979	1980	1981	1982
Night soil generation (m^3 /day)	115,553 (100)*	117,107 (100)	111,147 (100)	109,136 (100)	108,309 (100)
Collected by municipality and disposed of by:					
Treatment facility	78,953 (68.3)	81,402 (69.5)	76,770 (69.1)	76,649 (70.2)	77,092 (71.2)
Dumping into sewer system, etc.	6,458 (5.6)	6,350 (5.4)	6,658 (6.0)	5,934 (5.4)	5,788 (5.3)
Use as fertilizer	3,060 (2.6)	3,089 (2.6)	2,497 (2.2)	2,542 (2.3)	1,862 (1.7)
Ocean dumping	12,433 (10.8)	12,937 (11.1)	13,158 (11.8)	12,757 (11.7)	12,976 (12.0)
Total	100,904 (87.3)	103,778 (88.6)	99,084 (89.1)	97,882 (89.7)	97,718 (90.2)
Self disposal	14,694 (12.7)	13,329 (11.4)	12,063 (10.9)	11,254 (10.3)	10,591 (9.8)

*Figures in parentheses = %

Facilities and Management Costs

As shown in Table 5, both the total number of night soil treatment plants and their total design capacity have remained constant since FY 1977, along with the construction of public sewerage systems and the rapid increase of individual sewage treatment tanks. National average per capita and per m³ costs are estimated to be ¥2,400 and ¥3,600 respectively.

TABLE 5 Total Number of Night Soil Treatment Facilities

Fiscal Year	Number of facilities	Total design capacity (m ³ /day)
1978	1,251	99,676
1979	1,253	103,107
1980	1,244	104,836
1981	1,244	106,838
1982	1,226	104,257

In order to promote sanitary treatment of night soil, further construction of night soil treatment plants and proper construction and maintenance of individual sewage treatment tanks are very important. As for the latter, new systems, based on the newly enacted "Individual Sewage Treatment Tank Law", are to start in October this year.

LARGE-SCALE REGIONAL LAND RECLAMATION PROJECTS

Four Metropolitan Regions and their Waste Disposal Projects

Tokyo, Nagoya, Osaka and Northern Kyushu, are the four principal metropolitan areas, and they are the Japanese economic centres. In spite of their limited area, these four Metropolitan Regions generate more than half of the national MSW and industrial waste.

However, land acquisition for landfilling has now become extremely difficult in these regions because of generally congested land use and population. According to a recent survey by the Ministry of Health and Welfare, nearly half of the municipalities in the Tokyo and Osaka regions have difficulties in getting landfill sites in their own administrative districts. In the near future, the shortage of landfill sites in these regions will become a serious problem.

Since all these regions have the bay area at their centre, the only possible solution to this landfill site shortage may be offshore land reclamation within the port, by waste disposal. In order to achieve this large-scale offshore land reclamation, the Ministry of Health and Welfare (MHW) and Ministry of Transportation (MOT) created a new law for waste disposal and port development, as outlined below.

The Law on Regional Centres for Waste Reclamation

In June 1981, the National Diet passed the Law of Regional Offshore Environmental Improvement Centres. The new Law is aimed not only at proper disposal of solid waste (which includes MSW, industrial waste, excavated soil from construction sites, and salvaged soil from harbours), but also at providing good reclamation sites for port and urban development. In order to achieve this goal, the Law authorizes the establishment of a public organization called "the Centre", which will be responsible for planning, construction and operation of the regional offshore land reclamation sites. One centre will be established for each metropolitan region with the authorization and financial sponsorship of local governments and port authorities.

Osaka Bay Centre

In March 1982, the Osaka Bay Regional Centre for Waste Reclamation was formally established by six prefectures, 159 municipalities and four port authorities. Osaka Bay Centre will start construction work in accordance with the legal procedures at the end of 1985. The artist's concept of the large-scale regional land reclamation is shown in Fig. 4. In the other three regions, the MHW and MOT have been conducting preliminary studies for constructing large-scale regional land reclamation sites. Especially in the Tokyo metropolitan area, many local governments are now considering the establishment of a new Centre in this region.

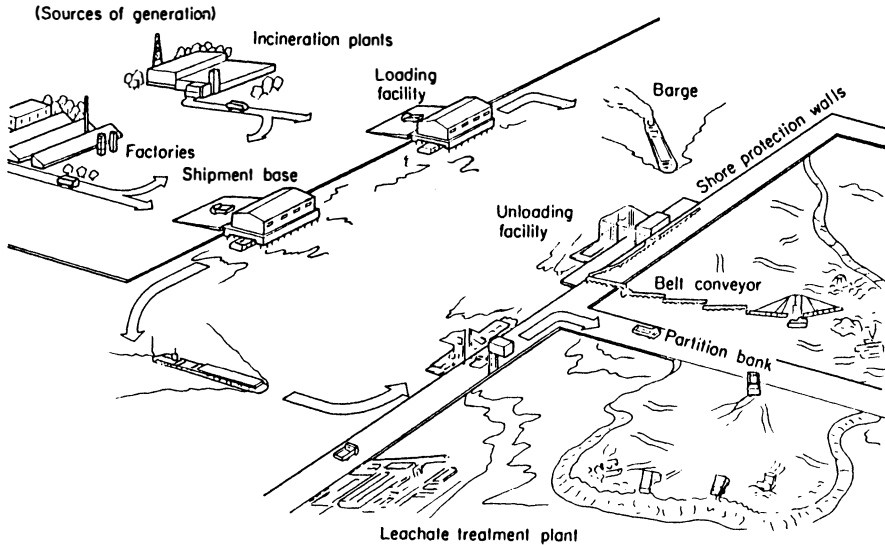


Fig. 4. Artist's concept of an offshore land reclamation site in the bay area (in this case of the island type)

CONCLUSION

After about 15 years of enforcement of the current Waste Disposal Law, the basic framework of waste management, i.e. domestic waste managed by the municipal authority and industrial waste managed with public guidance and supervision, has been well set in place. Under the Law, the National Government, with the Ministry of Health and Welfare as the leading agency, has made a constant co-ordinated effort to assist the local government both financially and technically.

In particular, the Ministry's subsidy to municipalities to construct MSW treatment plants and night soil treatment plants is playing a very important role to promote rational treatment of waste. Today, along with the increase in quantity of waste and diversification of its characteristics, in the field of domestic waste management the items listed below have been of particular concern recently.

Waste Dry Batteries

From autumn 1983, incineration and reclamation of waste mercury-containing dry batteries has been causing concern among people as a potential threat to the environment. Although research on mercury's environmental concentration and discharge from waste treatment processes does not prove the threat, the following measures were taken in order to secure the smooth implementation of waste management:

Mercury batteries (button-shaped) are to be collected and disposed of by battery manufacturers.

- * Mercury content of alkaline-manganese dry batteries is to be reduced to 1/6th of the 1983 content by September 1987.
- * Systems to promote rational disposal of waste dry batteries are to be established by municipalities with the co-operation of battery manufacturers.

Dioxins

In Japan, since the autumn of 1983 when MSW was detected in incinerator residue, people in general have become aware of dioxins. An ad hoc Council of Experts on Dioxins and Waste Management established the evaluation guideline of dioxins in the field of waste treatment (0.1 ng/kg/day as 2, 3, 7, 8 - TCDD) and concluded that the maximum potential exposure to incinerator workers and people in general would be lower than the guideline. Investigations and research are currently being carried out on the formation, decomposition and behaviour of dioxins in waste treatment processes.

Recent Countermeasures against Water Pollution

Rational treatment of non-excremental domestic wastewater and prevention of lake eutrophication are the two main issues of water pollution control today. With the introduction of stringent effluent standards on industrial wastewater, non-excremental domestic wastewater is a significant organic load on public water bodies, causing deterioration of people's living environment and aesthetic problems. In order to cope with the problem, construction of facilities to collect and treat only non-excremental domestic wastewater are also promoted with subsidies from the Ministry of Health and Welfare, as well as sewerage construction. Regarding eutrophication control: night soil treatment plants, individual sewage treatment tanks (with treatment capacity of either greater than or equal to the equivalent of 501 people), MSW incineration plants and landfill sites are all subject to newly introduced nitrogen and phosphate restrictions. This is applied to effluent water discharged to the specified eutrophic lakes and their upstream water bodies.

Environmental Impact Assessment

In Japan, environmental impact assessments (EIA) prior to construction of public works such as water reservoirs, highways, ports and railways, are not legally institutionalized in general. In August 1984, the Cabinet decided to conduct an EIA prior to public works carried out, or authorized, by National Government and the like. Based on this decision, the Ministry of Health and Welfare is now establishing the method to carry out EIAs on the construction of landfill sites with an area of more than or equal to 30 ha. In addition, guidelines of EIAs, regarding MSW incinerator construction, are now being studied by the Ministry.

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