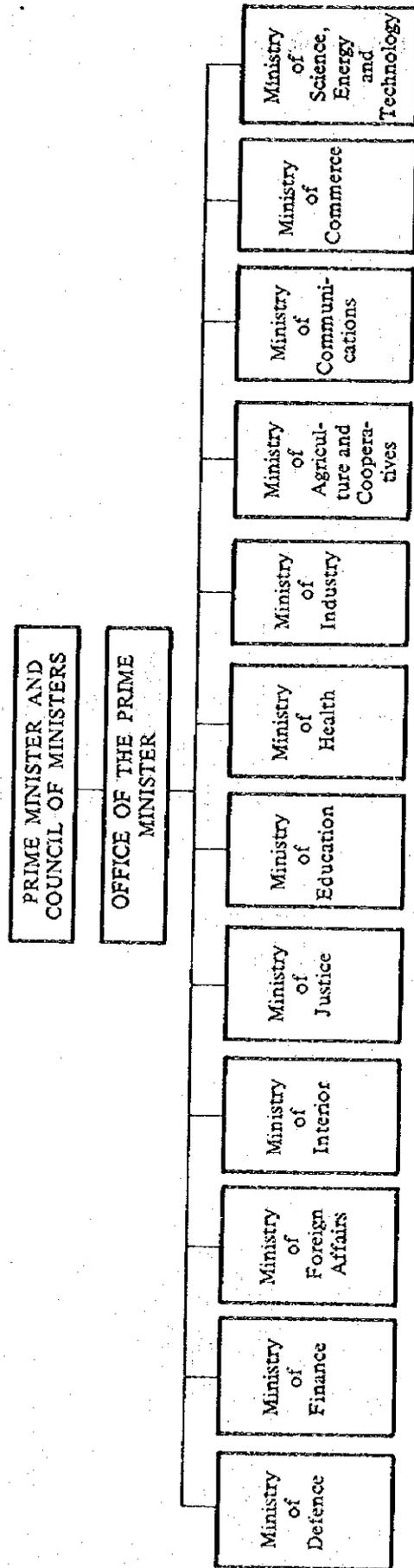


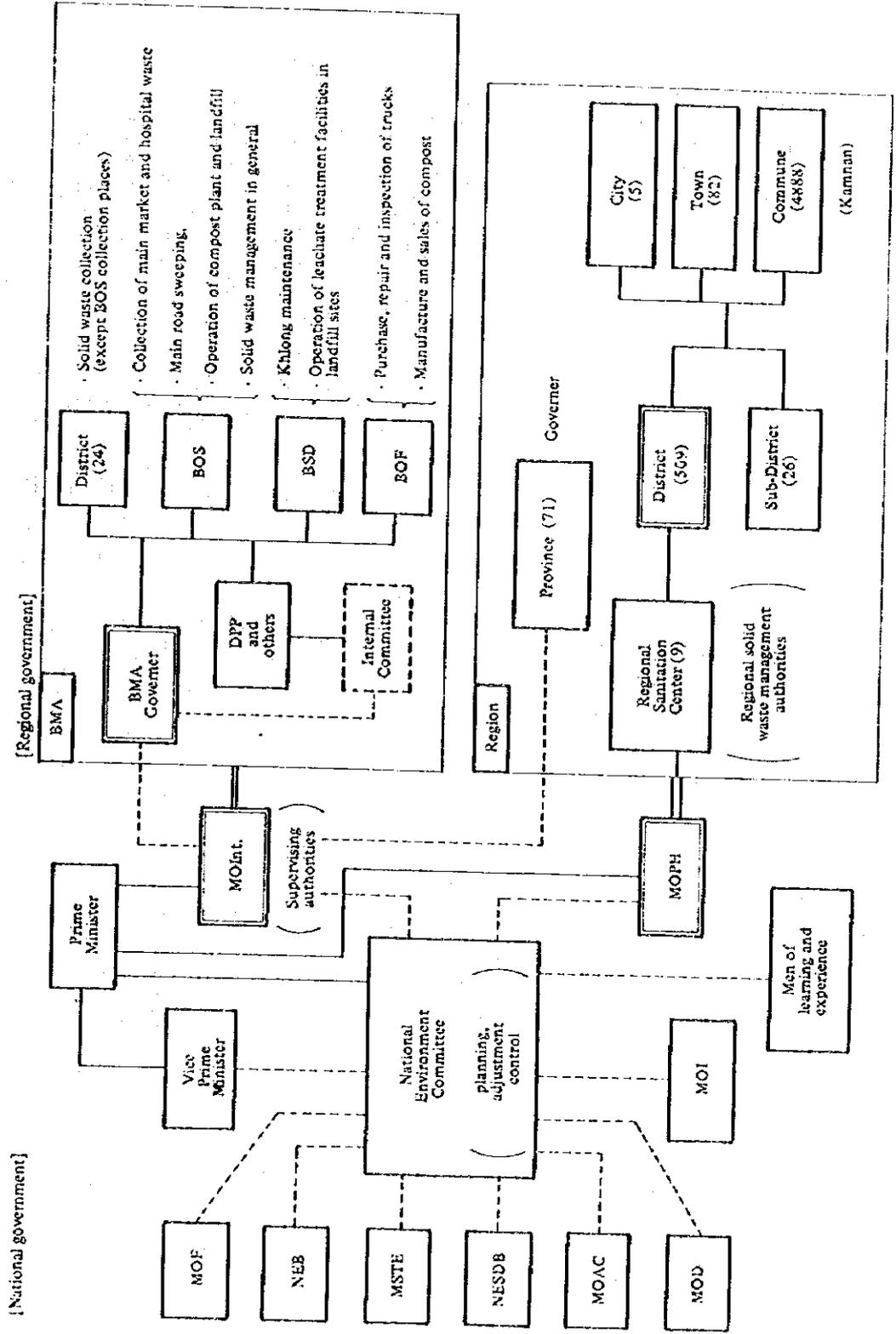
Appendix 9.10-(1) Administrative organization of the government of Thailand

Fig. AP 9.3 Administrative organization of the government of Thailand



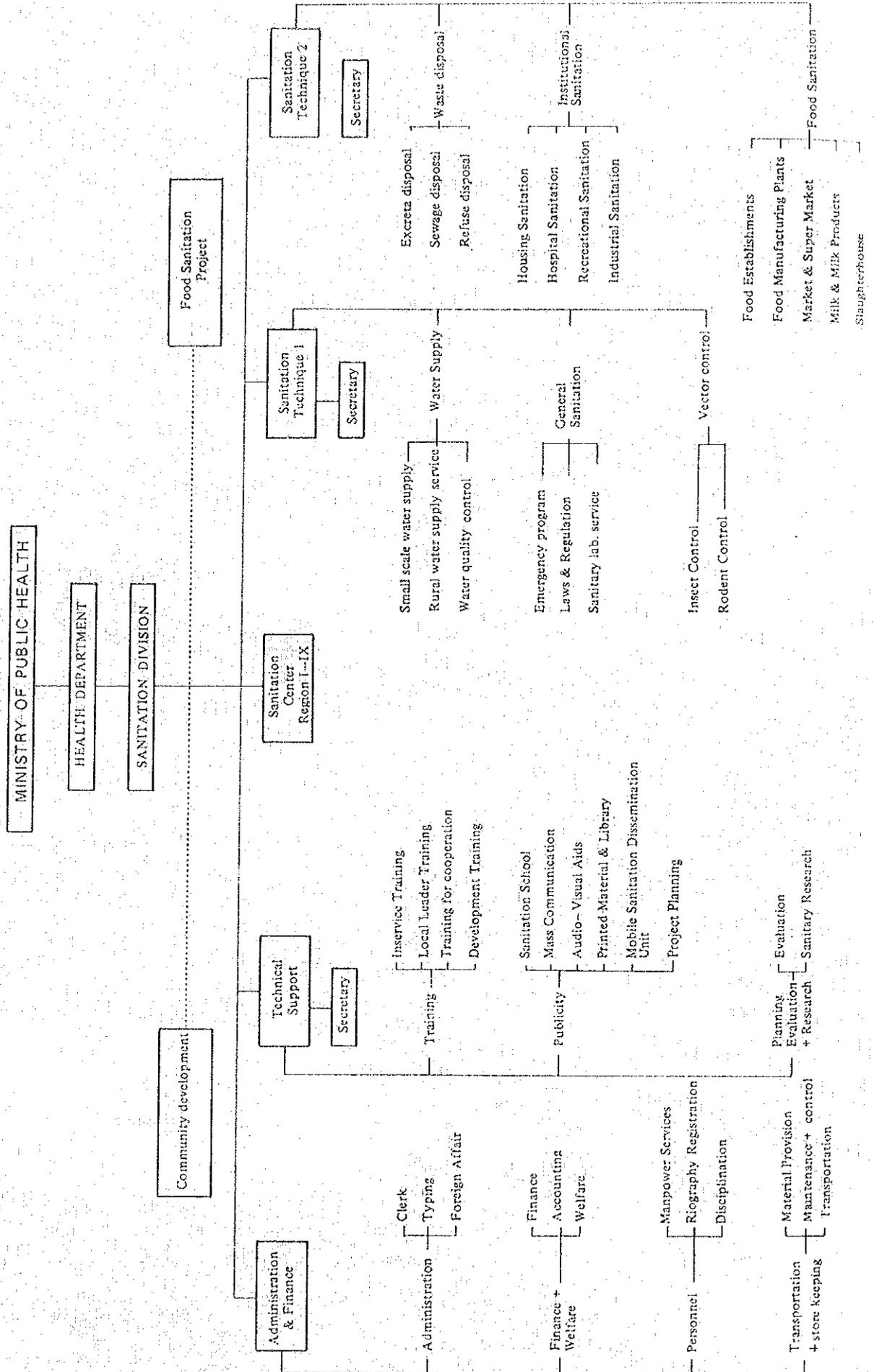
Appendix 9.10-(2) Framework of administration of solid waste management

Fig. AP 9.4 Framework of administration of solid waste management



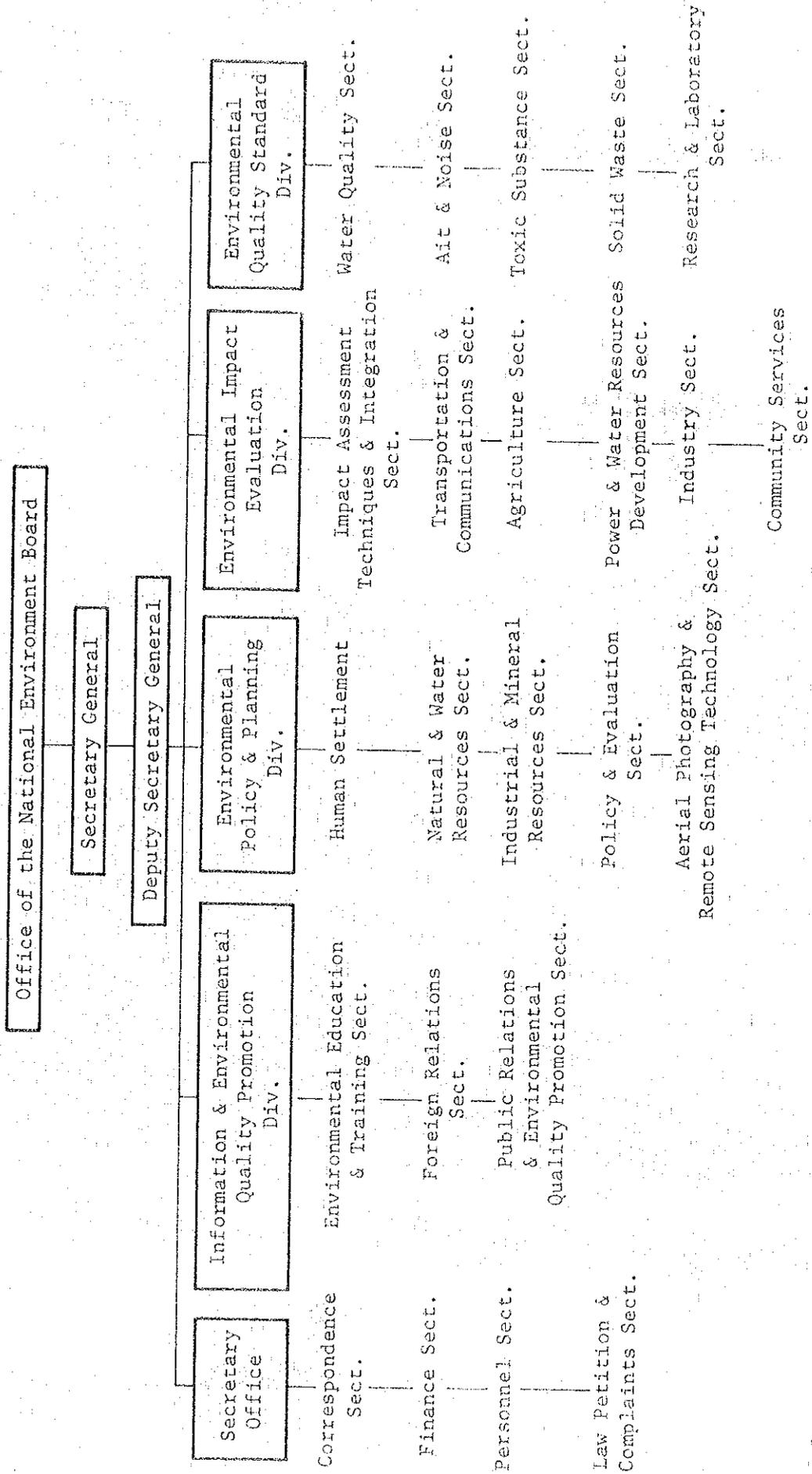
Appendix 9.10—(3) Organization of Ministry of Public Health

Fig. AP 9.5 Organization of Ministry of Public Health



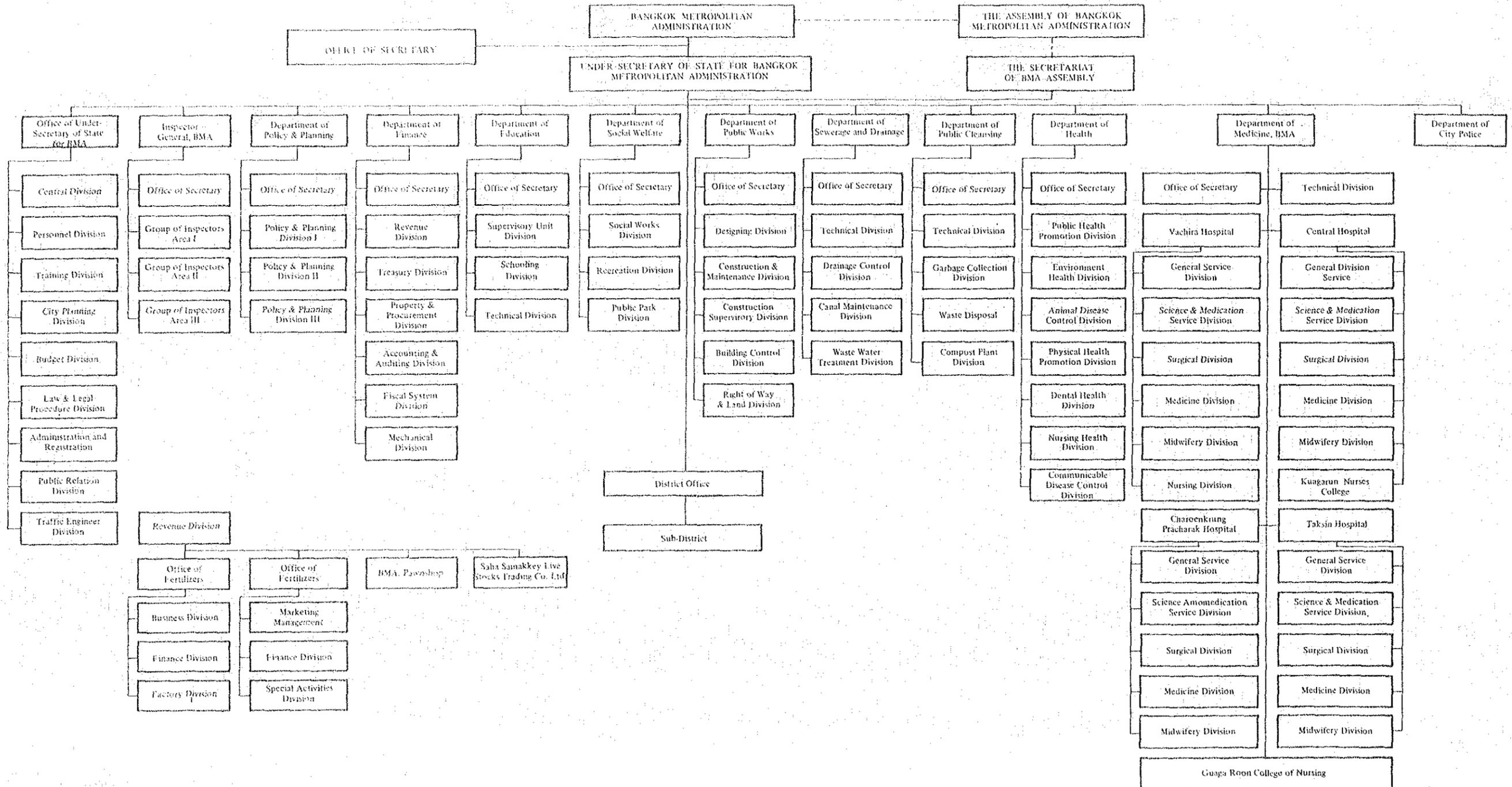
Appendix 9.10-(4) Organization chart of office of NEB

Fig. AP 9.6 Organization chart of office of NEB



Appendix 9.10--(5) Organization chart of BMA

Fig. AP 9.7 Organization chart of BMA



Appendix 9.10-(6) Allotment of waste management in each administrative bureau and district, BMA

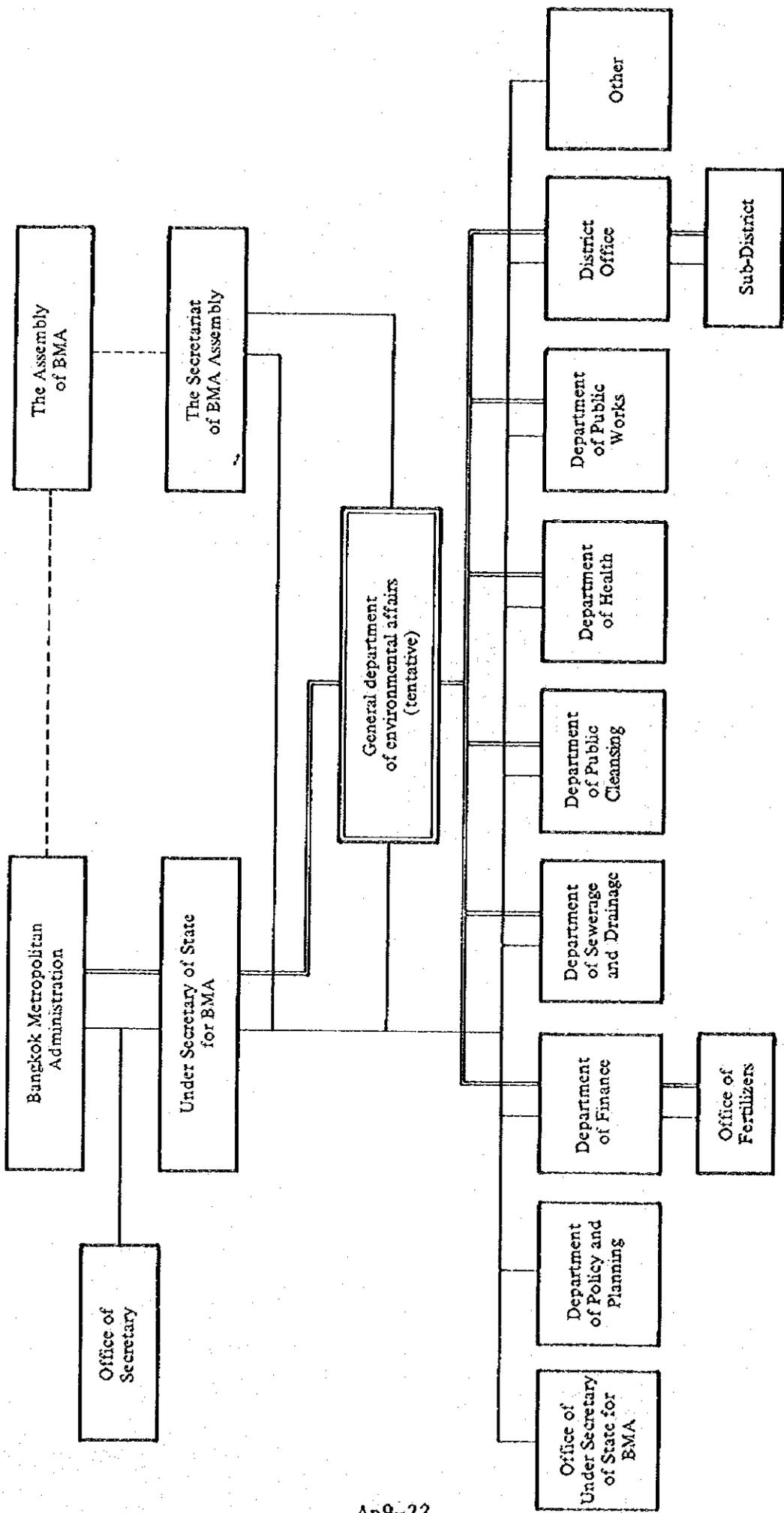
Table AP 9.7 Allotment of waste management in each administrative bureau and district, BMA

Bureau & District	a: Public area cleaning	b: Collection	c: Transport	d: Intermediate treatment	e: Final disposal	f: Others
(A) 24 districts	<ol style="list-style-type: none"> Cleaning of roads, sidewalks, foot-bridges and parks Cleaning of temples and markets Cleaning of rivers and Khlongs (Not under the Jurisdiction of BDC) 	<ol style="list-style-type: none"> Collection of household waste, business waste and other waste which are not under the jurisdiction of BDC Collection of carcasses along roads Collection of solid waste from the public area (Item: a) 	<ol style="list-style-type: none"> Transport of solid waste described in Item: b (A majority of solid waste is conveyed to the compost plants or landfill sites which are under the jurisdiction of BDC, and a part of solid waste is conveyed to the landfill sites which are under the jurisdiction of individual administrative districts). Control of vehicles 	<ol style="list-style-type: none"> Primary treatment (fermentation of solid waste for composting) Incineration and treatment of rejected waste Retrieval and sales of retrieved ferrous metals Incineration and treatment of carcasses Operation, management and control of compost plants 	<ol style="list-style-type: none"> Tung Kru and Muburi districts dispose their solid waste by landfill in small-size landfill sites located in their districts. Management of Tung Kru and Muburi landfill sites. 	<ol style="list-style-type: none"> Collection of solid waste collection fee (Revenue Section in charge) Sanitary Section is in charge of fee collection. The utilizable materials are selected and retrieved during the stages of b and c.
(B) BDC	<ol style="list-style-type: none"> Cleaning of trunk and small roads in business areas 	<ol style="list-style-type: none"> Collection of solid waste from main markets and hostels Collection of solid waste from the public area (Item: a) 	<ol style="list-style-type: none"> Transport of solid waste described in Item b (Convey to compost plants or landfill sites) Investigation, arrangement and control of vehicles 	<ol style="list-style-type: none"> Primary treatment (fermentation of solid waste for composting) Incineration and treatment of rejected waste Retrieval and sales of retrieved ferrous metals Incineration and treatment of carcasses Operation, management and control of compost plants 	<ol style="list-style-type: none"> Landfill of carried-in solid waste, compost residue and incineration residue Disposal of residue in night soil purification tank by Landfill Management and adjustment of final disposal sites 	<ol style="list-style-type: none"> Establishment of soil waste management plan Investigation and compiling of solid waste management data Readjustment of related laws and regulations Management of personnel and budget The utilizable materials are selected and retrieved during the stages of b, c, d and e.
(C) BDC	<ol style="list-style-type: none"> Cleaning of waste from rivers and Khlongs Procurement of cleaning boats for rivers and Khlongs 	<ol style="list-style-type: none"> Unloading the collected solid waste on the bank and drying under the sun and collection of the solid waste after drying Purchasing of collection and transport vehicles Repair and periodical inspection of collection and transport vehicles Procurement and control of spare trucks (Mechanical Division is in charge.) 	<ol style="list-style-type: none"> Transport of solid waste described in Item: b by vehicles (Destination is compost plants or disposal sites) 	<ol style="list-style-type: none"> Manufacturing (secondary fermentation), sales and control of compost (Revenue Division is in charge) Plant management and control of secondary fermentation process (Office of Fertilizer is in charge) 	<ol style="list-style-type: none"> Planning, construction, maintenance and control of waste water treatment facilities at final disposal sites 	<ol style="list-style-type: none"> Management and collection of solid waste collection fee
(D) BOF						

(Remarks) The above three authorities (A), (B) and (D) are directly sharing the solid waste management work, and (C) is indirectly concerned with the solid waste management work in terms of procurement and maintenance of materials, manufacturing and sales of compost and collection of fee. BPP and Committee, etc. are participating in general administration of cleaning indirectly.

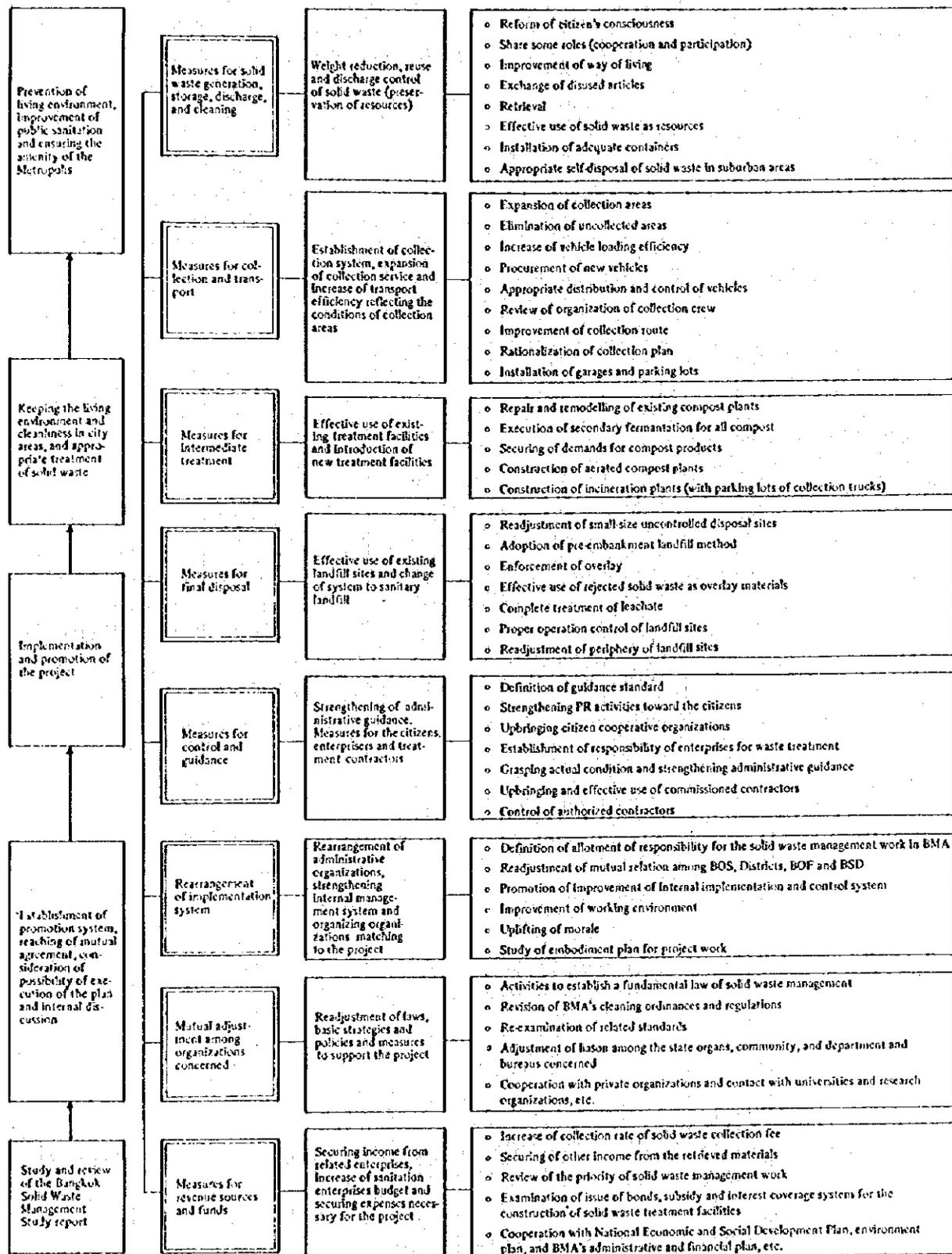
Appendix 9.10-(7) Establishment plan of General Department of Environmental Affairs

Fig. AP 9.8 Establishment plan of General Department of Environmental Affairs



Appendix 9.10-(8) System of solid waste management plan in Bangkok

Fig. AP 9.9 System of solid waste management plan in Bangkok



Appendix 9.11 Analysis of the current condition of solid waste collection fee

(1) Basic Data (fiscal 1980)

- a. Population of Bangkok city: 5,153,902
- b. Total number of households: 825,000
- c. Average number of person per household: 6.18
- d. Daily total volume of solid waste discharged: 2,380 t/d
- e. Daily total volume of solid waste collected: 1,966 t/d
- f. Mean collection rate: $e/d \times 100 = 82.6\%$
- g. Daily volume of solid waste collected but not subject to fee collection: 58.7 t/d \div 59 t/d

Note:

Road cleaning; 33.7 t/d River cleaning; 22.5 t/d
Park cleaning; 2.5 t/d

- h. Daily volume of solid waste collected and subject to fee collection: $e - g = 1,907.3 \text{ t/d} \div 1,907 \text{ t/d}$

Note:

General households; 1,315 t/d Markets; 135 t/d Hotels; 20.2 t/d Others (Restaurants, supermarkets, department stores, amusement centers, recreational facilities, schools, airports and civic centers, etc.); 326.6 t/d

- i. Number of fee-collected households: 97,752 household
- j. Gross income from solid waste collection fee (BMA revenue budget): 13,973,000 Baht/year or 38,282 Baht/d

(2) Analysis of the current condition of solid waste collection fee

- k. Solid waste management cost: Total cost; 489 Baht/t
Net cost; 313 Baht/t
- l. Average solid waste discharge volume per person per day: 315 g/person·d
- m. Average household income in Bangkok (assumption): 67,814 Baht/household·month or 5,651 Baht/household·month

Note:

41,350 Baht/household·year (statistical figure in 1975) \times 1.64 (increase rate of national consumption expenditure in the past 5 years)

- n. Number of households subject to collection work (assumption): $b \times f = 510,000$ households
- o. Average solid waste volume per household (including business waste): $h/n = 3,739 \text{ g/d}\cdot\text{household}$
- p. Average solid waste volume per household (household waste only): $c \times l = 1,947 \text{ g/d}\cdot\text{household}$

- q. Intensive percentage of business waste in the case of o:

$$\frac{o - p}{o} \times 100 = 47.9\%$$
- r. Average amount of collection fee borne by a household (including business waste): $j/i = 143$ Baht/year·household or 11.9 Baht/month·household
- s. Average amount of collection fee borne by a household (household waste only): 4 Baht/month·household

Note:

The monthly discharged volume " $(p \times 365)/12 = 59$ kg/month·household" is less than "20 liter (minimum container used) $\times 0.3$ (apparent specific gravity) $\times 30$ day = 180 kg/month·household" when it is checked with the fee standard in the present cleaning ordinance.

Consequently, it is ranked at the minimum fee of 4 Baht/d·household. This amount is approximately 1/3 of r.

- t. A rate of solid waste collection fee levied household: $i/n \times 100 = 19.2\%$
- u. Percentage of solid waste collection fee in average household income per household (including business waste): $r/m \times 100 = 0.21\%$
- v. Percentage of solid waste collection fee in average household income per household (household waste only): $s/m \times 100 = 0.07\%$
 (Approximately 1/3 of u.)
- w. Income from collection fee per ton of collected solid waste subject to fee collection: $j/h = 20$ Baht/t
- x. Percentage of fee income (including business waste) in solid waste management cost (net cost): $w/k \times 100 = 6.4\%$
- y. Estimated amount of collection fee uncollected (including business waste): $(n \times r) - j = 58,957,000$ Baht/year

Appendix 9.12 Results of analysis of present condition of solid waste collection fee

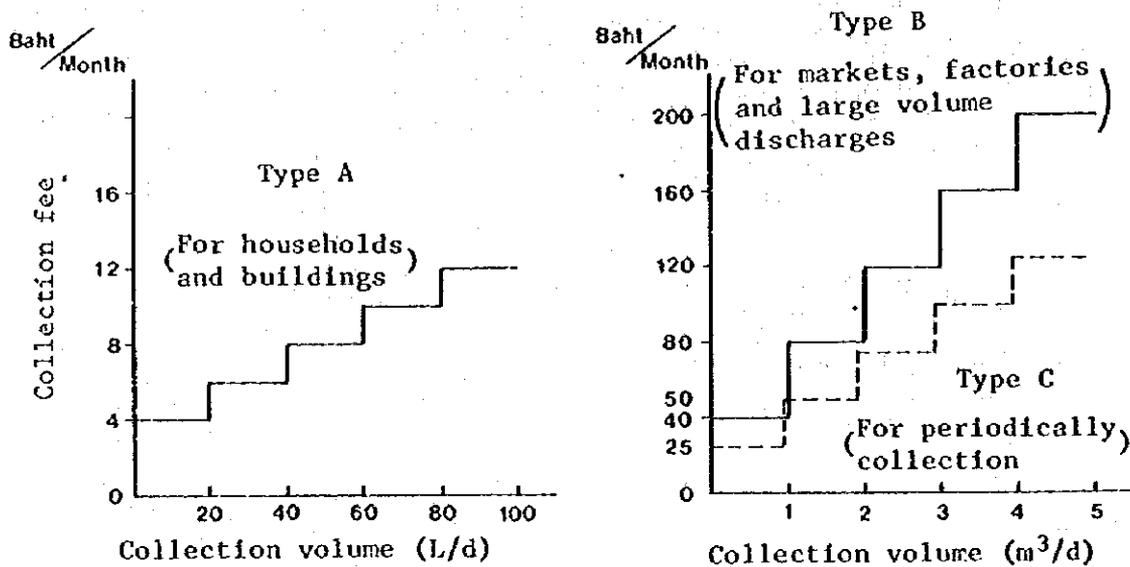
(1) Analysis method

Present condition of solid waste collection fee was examined by the correlative analysis and the present collection fee system described below.

(2) Present solid waste collection fee system

The collection fee system stipulated in the Cleaning Ordinance of Bangkok city is as illustrated below. (Refer to the levied solid waste collection fee in Chapter 3.) The present solid waste collection fee system is divided into 3 categories; Type A, Type B and Type C, upon which a collection fee is determined according to a difference of type of collection work and discharge volume.

Fig. AP 9.10 Present solid waste collection fee



The analysis was made based on the assumption that Type A is applied to the household waste, and Type B and Type C are to the business waste under the present solid waste collection fee system.

3) Results of analysis

Table AP 9.8 Present situation of existing solid waste collection fee (Assumption)

	Item	Total	Household waste	Business waste
Fee collected	Number of household (1,000 household)	Less than 97.75	Less than 97.75	-
	Number of business	X	-	X
	Solid waste collection volume (1,000 t/year)	133.4	Less than 69.5	More than 69.3
	Collected solid waste collection fee (1,000 Baht/year)	13,973	4,692	9,281
Fee uncollected	Number of household (1,000 household)	Less than 412.25	Less than 412.25	-
	Number of business	Y	-	Y
	Solid waste collection volume (1,000 t/year)	562.6	Less than 292.9	More than 269.7
	Collected solid waste collection fee (1,000 Baht/year)	58,957	19,788	39,169
Total	Number of household (1,000 household)	Less than 510.0	Less than 510.0	-
	Number of business	X + Y	-	X + Y
	Solid waste collection volume(1,000 t/year)	696.0	Less than 362.4	More than 333.6
	Collected solid waste collection fee (1,000 Baht/year)	72,930	24,480	48,450
Index	Collecting volume (%)	100	52.1	47.9
	Collection fee (%)	100	33.6	66.4

Table AP 9.9 Levy index for household and business waste collection fee (Assumption)

		Mix	Household waste	Business waste
Basic fee	(Baht/t-year)	105	68	145
	(Baht/t-d)	0.288	0.186	0.397
Collection volume	(kg/month,unit)	113.7	59.2	173.1
Levied collection fee	(Baht/month-unit)	11.9	4.0	32.5
Unit fee	(Baht/kg)	0.105	0.068	0.188
	(kg/Baht)	9.55	14.8	5.3

Appendix 9.13 Public utilities charges and consumers' price index

Table AP 9.10 Public utilities charges and consumers' price index

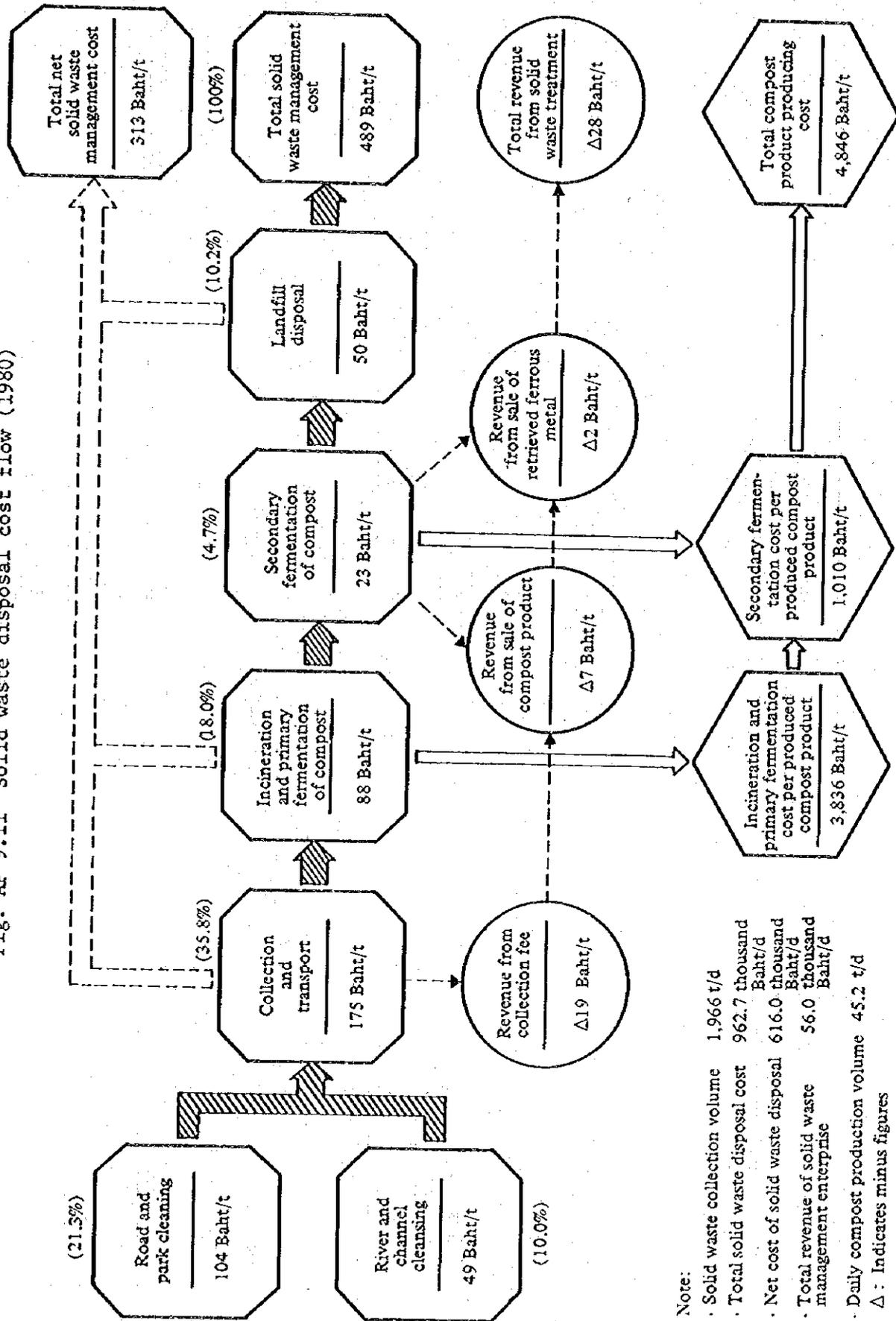
Items	Index weight (1/10,000)	Items	Index weight (1/10,000)
Rice (nonglutinous)	498	Transportation fee	294
Rice (glutinous)	6	Postage	21
Salt	6	Telegram fee	1
House rent (public)	26	Telephone fee	63
Water supply	47	School fee (public high school)	118
Electricity	210	School fee (public university)	11
Gas	92	Television reception fee	74
Doctor's fee	241	Cigarettes fee	147
Public bath fee	66		
Solid waste collection fee	29	Total	1,950

Note: Based on the 18 sorts of consumers' price index announced by the Prime Minister's office, Japan.

The rate of solid waste collection fee in Japan, including night soil treatment cost, account for 0.15 to 0.09 percent $\left\{ \frac{29}{10,000} \times \left(\frac{1}{2} \sim \frac{1}{3} \right) \right\}$ of total household expenditure.

Appendix 9.14 Solid waste disposal cost flow (1980)

Fig. AP 9.11 Solid waste disposal cost flow (1980)



- Note:
- Solid waste collection volume 1,966 t/d
 - Total solid waste disposal cost 962.7 thousand Baht/d
 - Net cost of solid waste disposal 616.0 thousand Baht/d
 - Total revenue of solid waste management enterprise 56.0 thousand Baht/d
 - Daily compost production volume 45.2 t/d
 - Δ : Indicates minus figures

Appendix 9.15 Summary of solid waste disposal cost (1980)

Table AP 9.11 Summary of solid waste disposal cost (1980)

(Unit: thousand Baht)

Organization	Road, park, rivers and canal cleaning	Collection and transport	Primary fermentation	Secondary fermentation	Landfill	Total	Excluding cost	Remarks
BOS	(22.1%) 3,485	(78.9%) 12,284	-	-	-	(100%) 15,769	-	Percentage of road, park, river, canal cleaning cost and collection, transport cost was determined proportionally to the number of workers.
Compost Plant Division	-	-	(58.3%) 48,127	-	(41.7%) 34,424	(100%) 82,551	-	
Office of secretary, Technical Division	(7.4%) 644	(26.2%) 2,270	(24.8%) 2,154	-	(17.8%) 1,541	(76.2%) 6,609	(22.8%) 2,064	
Districts	(50.2%) 66,466	(49.8%) 65,937	-	-	-	(100%) 132,403	-	
BOF	(4.2%) 3,843	(40.0%) 36,603	-	-	-	(44.2%) 40,446	(55.8%) 51,061	
Fertilizer Section	-	-	-	(100%) 13,606	-	(100%) 13,606	-	
BMA	-	-	-	(100%) 1,612	-	(100%) 1,612	14,508	
Compost Plant (Depreciation)	-	-	(90.0%) 13,009	(10.0%) 1,445	-	(100%) 14,454	274,584	
Central Fund (for BOS)	-	(100%) 6,630	-	-	-	(100%) 6,630	-	
BSD	(95.0%) 35,424	(5.0%) 1,864	-	-	-	(100%) 37,288	-	
Total (thousand Baht)	109,862	125,588	63,290	16,663	35,965	351,368	-	
Unit Cost (Baht/t)	153	175	88	23	50	489	-	Total cost
Compost Product Cost (Baht/t)	-	-	3,836	1,010	-	4,846	-	Net cost (Excluding road, park and canal cleaning, and second fermentation cost)

Appendix 9.16 Rule and standard for establishment of public utility charges
(Tokyo Metropolitan Government)

(1) Rule of the charges and standard for determination of fees

i) Principle of fair imposition

A fee shall be settled at a reasonable level according to degree of public interests derived from administrative service, taking into consideration a balance between the tax imposition and beneficiary's pay.

ii) Principle of free or low charge for the essential public services

The essential services shall be rendered at a low charge as possible; especially, the essential service provided to the citizens shall be rendered free of charge as the case maybe.

iii) Principle of imposition according to payability

In case that there are great differences in payability among the beneficiaries, the principle of imposition according to payability shall be introduced from a standpoint of equity.

(2) Fee classification and the policy

(A) Fees related to services for daily life

i) Administrative services essential for daily life of citizen

a. Services which are supplied to every citizen → Free of charge or low charge

b. Services which are supplied to limited citizens → Some services are free of charge, and some other services are made on fee basis according to the principle of imposition according to payability.

Example: Treatment and disposal of night soil
Fee for use of sewerage facilities

ii) Administrative services which were optional or selective but have become indispensable due to a change of social condition and rise of living standard → Set a charge as low as possible.

Example: Senior high school tuition

iii) Items which originally fall under the category of essential administrative service but, owing to physically scarce necessity of administrative service, a reasonable fee should be charged in order to achieve the better result. → A fee shall be set at a minimum level to attain the purpose.

Example: Entrance fee of garden parks

iv) Items which originally fall under the category of essential administrative service and to which a different payment system from others is introduced → The tax imposition and beneficiary paying burden should be balanced, and at the same time, the principle of imposition according to payability should be applied.

Example: National health insurance

- v) Administrative services to which the citizens have an option whether to receive or not, and which benefit the limited citizens only → The tax imposition and beneficiary payment should be balanced and, in the case of beneficiaries having a little chance to enjoy benefits, the cost principle should be adopted.
- (B) Fees related to services for economic activities (The beneficiaries of administrative services are the economic sectors who pay the fees for services as a part of economic activities.)
- i) Services for economic activities but related to the citizen's life or services which are rendered mainly to small to medium-sized enterprises → A fee should be determined based on the cost system which is applied to the direct personnel expense, operating expense for the service and the depreciation of equipment directly related to the service only.
Example: Inspection fee of sanitary laboratory and industrial laboratory, etc.
 - ii) Administrative services to extensively assist the industrial activities and the same for facilities which are exclusively used for the business purpose → Complete cost system should be adopted taking a limitation of these facilities for public use into consideration.
Example: Charge for use of the port facilities, charge for treatment of business waste, charge for occupancy of road
 - iii) Administrative services which are directed to semi-economic activities.
Services which are carried out by the administrative authorities for historical reason despite they ought to be carried out by private organizations by nature. → Complete cost system should be adopted.
Example: Parking charge, toll road charge
- (3) Criteria for revision of fees
- i) Concerning the administrative services for daily life, consideration should be made on rise of prices during the fee unredeemed period. The fees should be revised in such a manner that the burden of new fee sharing in household economy is not larger than that of previous fee.
As a rule, increase of quality improvement of administrative service during the above period should not be reflected in increase of fee.
 - ii) In the case of fee based on the payability, the rate should not be lower than that of the previous fee as far as there is no reason to raise it.
 - iii) Appropriate measure should be taken to avoid sudden change in level of fee.

- iv) A trend of level of miscellaneous charges set by other organs should be taken into account.
- v) Even in the case of fee based on the payability, deliberate considerations should be made in the following cases.
 - a. When there is political necessity to unredeem the fee.
 - b. When it is difficult, due to change of original costs, to cope with social and economic change without revision of fee.
 - c. When there is possibility of inequity due to confusion of the service.
 - d. When it is necessary to maintain the facilities on a level of a satisfactory condition.
 - e. When a service is closely related to the citizens' life and holds an essential portion of the life.

Appendix 9.18 Division of establishments

Division of Establishments

Commercial establishments and industries for this investigation were selected from the following categories:

- Category A : Hotels, markets, retail stores, office buildings
- Category B : Automobile assembly factories, sawmills, textile factories
- Category C : Civil engineering contractors, beer breweries, soft drinks bottlers, ice manufacturers, purified water manufacturers, rice mills, flour mills, noodle factories, meat products manufacturers, fruit canning and preserving factories, dairy products manufacturers, candy factories, tobacco products manufacturers, feedstuff manufacturers, fertilizer manufacturers, wood products manufacturers, pulp, paper & paper products manufacturers, printing & publishing factories, plastics manufacturers, rubber products manufacturers, agricultural chemicals manufacturers, adhesives manufacturers, printing ink manufacturers, paint manufacturers, medicine & cosmetics manufacturers, oil and coal by-products manufacturers, tanning & leather products manufacturers, stone, clay & ceramics products manufacturers, glass products manufacturers, steel manufacturers, non-ferrous metal products manufacturers, metal products manufacturers, gilders, general machinery manufacturers, electrical machinery manufacturers, automobile & bicycle parts manufacturers, gasoline stations, railway companies, road transportation businesses, road forwarding businesses, automobile repair shops, laundry & dry cleaning plants, water supply plants, gas producing plants.

Appendix 9.19 Number of visited establishments

Table AP 9.13 Number of visited commercial establishments according to districts (Category A)

District	Hotels	Markets	Stores	Offices	Total	Percentage
Phra Nakhon	-	-	1	-	1	5
Pathum Wan	2	-	-	1	3	14
Bang Rak	3	-	-	3	6	28
Dusit	-	1	-	-	1	5
Phayathai	-	-	1	-	1	5
Huai Khwang	-	-	-	1	1	5
Phra Khanong	1	1	3	-	5	24
Bang Kapi	-	2	-	-	2	9
Minburi	-	1	-	-	1	5
Total	6	5	5	5	21	100

Table AP 9.14 Number of visited factories according to districts

District	No. of Factories		Total	Percentage
	Category B	Category C		
Pathum Wan		3	3	2.6
Bang Rak		1	1	0.9
Yannawa		2	2	1.7
Dusit		2	2	1.7
Phayathai		2	2	1.7
Huai Khwang		1	1	0.9
Phra Khanong		13	13	11.4
Bang Khen		1	1	0.9
Bang Kapi	1		1	0.9
Minburi	3	46	49	43.0
Lat Krabang	1		1	0.9
Bangkok Noi		1	1	0.9
Rat Burana	3	34	37	32.5
Total	8	106	114	100.0

Appendix 9.20 Kinds of waste generated from commercial and industrial establishments

Table AP 9.15 Kinds of waste generated from commercial and industrial establishments

(1/3)

Kind of Waste	Market	Hotel; Store	Office	Textile factory	Sawmill; Wood prod. manuf.	Auto assem.; Vehicle parts manuf.	Civil eng. cont.	Brewary	Soft drink bottler	Ice manuf. Pure water manuf.	Rice mill Flour mill
Ash & residue		-									1
Hazardous sludge								0			
Organic sludge											
Inorganic sludge											
Waste oil						X	-				
Waste acid & alkali											
Plastic waste	X	0	1	X	X	1	X	X	X	0	-
Paper waste	X	0	0	1	X	0	X	X	1	1	-
Wood waste	1	X	X	X	0	1	1	-	X	-	-
Textile waste	-	1	X	0	-	X	X	-	-	X	X
Animal & plant waste	0	1	-	-	-	-	-	X	-	-	0
Rubber waste	-	X	-	-	-	-	-	-	-	-	-
Metal waste	X	X	-	X	-	0	X	X	X	-	-
Glass ceramic waste	X	X	-	-	-	-	-	1	0	0	-
Construction waste							0				

Legend : 0 = Major; 1 = Secondary; X = Tertiary; - = Minor

(Cont'd)

(2/3)

Kind of waste	Food prod. manuf.; Feedmill; Tobacco manuf.	Pulp & Paper prod. manuf.	Printing & publ. factory	Plastic prod. manuf.	Rubber prod. manuf.	Oil refinery	Tannery	Stone, clay & ceramic prod. manuf.	Glass prod. manuf.	Steel foundry	Metal prod. manuf. Machinery manuf.
Ash & residue		-								-	
Hazardous sludge											
Organic sludge		X					1				
Inorganic sludge											
Waste oil						0					
Waste acid & alkali											
Plastic waste	1	1	1	0	X	-	X	-	1	X	1
Paper waste	1	0	0	1	X	-	X	-	1	X	1
Wood waste	X	X	X	-	-	-	-	-	X	-	1
Textile waste	-	-	-	-	-	-	X	-	-	-	X
Animal & plant waste	0	-	-	-	-	-	0	-	-	-	-
Rubber waste	-	-	-	-	0	-	X	-	-	-	-
Metal waste	X	X	X	-	X	X	-	-	X	0	0
Glass & ceramic waste	X	-	-	-	-	-	-	0	0	-	-
Construction waste								1			

Legend : 0 = Major; 1 = Secondary; X = Tertiary; - = Minor

(Cont'd)

(3/3)

Kind of waste	Chemical & pharmaceutical prod. manuf.	Petrol station	Railway co. Road trans. business	Road forwarding business	Auto repair shop	Laundry & dry cleaning plant	Water supply plant	Gas producing plant	Gilder
Ash & residue	-	0	1		1	X	0		0
Hazardous sludge	-								
Organic sludge	-								
Inorganic sludge	-								
Waste oil	0								1
Waste acid & alkali	1	1	0	0	X	1	X	X	X
Plastic waste	1	1	0	0	X	1	X	X	X
Paper waste	X	X	X	0	-	-	-	-	-
Wood waste	-	X	X	X	-	0	-	-	-
Textile waste	-	X	X	X	-	-	-	-	-
Animal & plant waste	X	X	1	-	-	-	-	-	-
Rubber waste	1	X	-	-	1	-	-	-	-
Metal waste	X	1	X	X	0	-	-	0	1
Glass & ceramic waste		-	X	-	-	-	-	-	-
Construction waste		-							

Legend : 0 = Major; 1 = Secondary; X = Tertiary; - = Minor

Appendix 9.21 Special wastes generated from factories

Table AP 9.16 Special wastes generated from factories

Kind of waste	Material	Name of factory	Generation rate	Disposal Method
Hazardous chemical	Chromium Hydroxide	New Thai Piston Ring Co.	4-5 t/5 year	Boxed and dumped on own premise
	Plating waste	Dyna Metal Co., Ltd.	200 kg/month	Dumped on premise
Sludge	Water treatment sludge (98% M.C.)	Boon Rawd Brewery	50 m ³ /d	Dumped at On-Nooch
	Water treatment sludge	Thai Amarit Brewery	4-6 m ³ /d	Dried in drying bed at own treatment facility
	Cleaning water treatment sludge (plastics & textile pieces)	Sin Chai Hua Cleaners	—	Dumped once every half or one year on own land
	Water treatment sludge	MWWA Bang Khen Treatment Plant	40 t/d	Landfilled on premise as fertilizer. Plan to sell in future.
Waste Oil	Lube oil	Sethasarn L.P. Gasoline station	0.1 - 0.2m ³ / month	Sold at Baht 100/200 L
	Lube oil	Pattanakarn Service Station	0.1 - 0.2m ³ / month	Sold at Baht 400/200 L
	Lube oil	Bangkok Mass Trans. Auth.	1.4 m ³ /month	Sold
Debris	Construction waste	Kay Thai Co. Ltd.	few	Landfilled on construction site
	Cement scraps	Prakobsilp	—	Landfilled on factory ground
	Molding sand	New Thai Piston Ring Co.	20 t/month	Landfilled on own premise
	Dirt (from washing cars)	Sethasarn L.P.	30 L/d	Collected by district truck (once/week) along with other refuse
Ash and Residue	Incinerator residue	Y.M.C. Assembly Ltd.	0.2 m ³ /d	Collected by district truck
	Incinerator residue	Bangchan Gen. Ass.	—	Dumped on own land
	Incinerator residue	Tobacco Monopoly	—	Dumped in water
	Ash	Huan Kiam Heng	—	Dumped in Samuthprakarn
	Ash	Kao Thong Charoenkij	—	Sold as landfilling material & soil Conditioner
	Slag	Saeng Charoen Steel fact.	—	Dumped in nearby stream

Appendix 9.22 Private collection for factories

Table AP 9.17 Private collection for factories

Factory Name	Collector Name	Collector Address	Collected Materials	Collection Rate	Cost	Usage
Karnasuta Gen. Ass.*	Damrongsak	Bangna	Paper & plastics	once/week	Free	Dump
Art-Serina Piston*	—	—	Ash, slag, aluminum scrap	—	Free	—
Tang Tarnyawat	—	Ayudthaya	Rice hulls	—	Free	—
T. Charoen Panich	—	—	Rice hulls	—	—	Soil conditioner
Kao Thong Charoenkij	—	Ayudthaya	Rice hulls	—	Free	Mix into bricks
Thai Nam Thip Co.	Government (army)	—	Wood scraps	2 1/3-4 month	Free	Fuel
Home Crafts Co., Ltd.	Government (Correction dept.)	—	Rattan pieces & shells	3m ³ /3 d	Free	Fuel
Sukosol & Mazda	Self disposal	—	All refuse	1.5 t/d	—	Dump
Thai Paper Ind.	Self disposal	—	Paper & Plastic	18m ³ /week	—	Dump
Thai Glass Ind.	Self disposal	—	All refuse	10m ³ /d	—	Dump
Boon Rawd Brewery	Self disposal	—	Sludge	50m ³ /d	—	Dump

* The private collectors for these factories collect refuse free of charge in return for receiving recyclable materials.

Appendix 9.23 Recycling information for hotels

Table AP 9.18 Recycling information for hotels

Material	Hotel name	Recycling rate	Selling Frequency	Selling price	Buyer	End use
Corrugated paperboard	Sheraton	30 kg/week	Everyday	1 Baht/kg	Dealer	-
	Erawan	30 kg/week	-	2 Baht/kg	Vendor	Reproduce paper
	Oriental	100 kg/week	Thrice a month	1.7 Baht/kg	Dealer	-
	Fortuna	-	Twice a month	1 Baht/kg	-	-
Newsprint	Sheraton	-	Everyday	1.5 Baht/kg	Dealer	Make paper bags
	Erawan	80 kg/week	-	2 Baht/kg	Vendor	Reproduce paper
	Oriental	100 kg/week	Thrice a month	2 Baht/kg	Dealer	-
	Fortuna	-	Twice a month	-	-	-
Other paper	Erawan	20 kg/week	-	1 Baht/kg	Vendor	Reproduce paper
	Oriental	200 kg/week	Thrice a month	1 Baht/kg	Dealer	-
Glass containers	Erawan	200/week	-	0.75 Baht/kg	Vendor	-
	Oriental	1500/week	Twice a month	0.55 Baht/kg (big) 0.25 Baht/kg (small)	-	-
Food waste	Erawan	1.5m ³ /d	Everyday	-	Farmer	Feedstuff
	Oriental	1.6m ³ /d	Everyday	2000 Baht/month	Farmer	Feedstuff
	President	0.4m ³ /d	Everyday	3000 Baht/month	Farmer	Feedstuff
	Fortuna	0.1m ³ /d	Everyday	-	Private	Feedstuff
Construction debris	Ambassador	-	Once in 2 weeks	20 Baht/t	Private	-

**Appendix 9.24 Refuse generation volume from industries in
Bangkok Metropolitan Area in the year 1980**

**Table AP 9.19 Refuse generation volume from industries in
Bangkok Metropolitan Area in the year 1980**

Work Status	No. of Workers (thousand person)	Refuse Generation Original Unit (m ³ /worker)	Refuse Generation Volume (m ³)	Remarks
1. Professional technicians and related workers	142.2	0.0028	398.2	Office Building
2. Administrative, executive and managerial workers	80.7	0.0028	226.0	" "
3. Clerical workers	195.3	-	-	-
4. Sales workers	479.8	-	8,156.6	-
a. Hawkers, peddlers and newsboys	125.3	0.017	2,130.1	Market
b. Others	354.5	0.017	6,026.5	"
5. Farmers, fishermen, hunters loggers and related workers, miners, quarrymen and related workers	252.6	-	-	-
6. Workers in transport and communication occupations	127.4	0.005	637	Railway Com. & Road Transportation
7. Craftsmen, production process workers	630.6	-	11,643.4	-
a. Tailors, dress makers and related workers	93.4	0.001	93.4	Textile
b. Carpenters and related workers	51.0	0.009	459.0	Sawmill
c. Food processing and beverage workers	38.2	0.001	38.2	Flour Mill
d. Laborers	6.4	0.002	12.8	Plastic Products
e. Other craftsmen and production-process workers	441.6	0.025	11,040.0	Automobile Assembly
8. Service, sports and recreation workers	214.4	0.006	1,286.4	Retailing Store
9. Workers not classifiable by occupation	-	-	-	-
Total	-	-	22,347.6	-

Appendix 9.25 Management criteria for business waste (Criteria for landfill disposal – excluding waste containing hazardous substances)

Table AP 9.20 Management criteria for business waste (Criteria for landfill disposal – excluding waste containing hazardous substances)

Kind of waste	Disposal method		Remark
Common Standards	<ol style="list-style-type: none"> 1. Landfill shall be made in such a way that prevent wastes from scattering or flowing out. 2. Necessary measures shall be taken to prevent offensive odor from leaking out of the landfilling sites. 3. Necessary measures shall be taken to prevent the growth of rats, mosquitoes, flies, or other vermin at landfilling sites. 4. Landfill shall be made in the sites which are enclosed by enclosures and which can be identified as landfilling sites by billboards. 5. Necessary measures shall be taken to prevent leachate from landfill sites from polluting public waters and underground water. 6. Decomposable matter should be disposed of by landfill. A thickness of one layer of waste should be approximately 3 meters or less (in case the waste consists of more than 40% of decomposable matter, a thickness of one should be approximately 50 cm), and each layer of waste should be covered with approximately 50 cm of soil and sand. In the case of incineration, necessary measures shall be taken to prevent such pollutants as offensive odor and hazardous substances in exhaust gas from discharging to the environment. 		<p>[Fundamental objectives for solid waste management]</p> <ol style="list-style-type: none"> 1. Discharge of solid waste should be controlled and reduced by means of changing materials in use, reuse of materials and improving the production process, etc. 2. The solid waste should be discharged separately by the kinds specified. 3. The solid waste should be reused as resource. 4. The solid waste which can be treated intermediately should be treated as much as possible to stabilize the solid waste and reduce its weight.
	Disposal method	Standards for disposed-of materials	
Cinders	Intermediate treatment is not needed.	Ignition loss: 15% or less	Controlled landfill
Sludge	Inorganic sludge	Dehydration or drying	Water content: 85% or less
	Organic sludge	Dehydration or incineration by using incineration facilities (in case of landfilling on surface water, incineration is always required.)	In the case of dehydration, the water content should be less than 85%. In the case of incineration, the ignition loss should be less than 15%.
Waste oils	Incineration by using the incineration facilities (intermediate treatment is not needed for tar-pitch)	Ignition loss: 15% or less	Controlled landfill
Waste acid and waste alkali	-	-	
Waste plastics	Crushing, cutting, or incineration by using the incineration facilities (including thermal decomposition).	In the case of crushing or cutting, the disposal form of solid waste should be free from hollowness, and the maximum size should be approximately less than 15 cm.	Stabilized landfill
Rubber waste	Other methods than incineration should be avoided provided that the circumstances permit incineration.	In the case of incineration, ignition loss should be less than 15%.	
Waste paper	Incineration by using the incineration facilities	Ignition loss: should be 15% or less	Controlled landfill
Waste pieces of wood			
Waste pieces of fiber			
Solid waste related to animals or plants which have been used as raw materials			
Waste metal	Crushing or compacting	It should be free from hollowness.	Stabilized landfill
Waste pieces of glass and ceramics	Crushing		
Slag	Crushing or compacting	It should be free from hollowness.	Controlled landfill
Demolition wastes	Intermediate treatment is not needed.	-	Stabilized landfill
Dusts	Intermediate treatment is not needed.	Countermeasures should be taken to prevent scattering.	Controlled landfill

Appendix 9.26 Judgement criteria for hazardous substances

Table AP 9.21 Judgement criteria for hazardous substances

The waste is judged to be hazardous business waste when the content of each hazardous substances exceeds the following criteria.

No.	Hazardous substances	Judgement criteria (Elusion test)
1	Alkyl mercury compounds (R-Hg)	Not detectable
	Mercury or its compounds (Hg)	Mercury in 1 liter test solution: 0.005 mg max.
2	Cadmium and its compounds (Cd)	Cadmium in 1 liter test solution: 0.3 mg max.
3	Lead and its compounds (Pb)	Lead in 1 liter test solution: 3 mg max.
4	Organic phosphorous compounds (O-P)	Organic phosphorous compound in 1 liter test solution: 1 mg max.
5	Chromium (VI) compounds (Cr ⁶⁺)	Hexavalent chromium in 1 liter test solution: 1.5 mg max.
6	Arsenic or its compound (As)	Arsenic in 1 liter test solution: 1.5 mg max.
7	Cyanides (CN)	Cyanogen in 1 liter test solution: 1 mg max.
8	PCB	PCB in 1 liter test solution: 0.003 mg max.

Appendix 9.27 Disposal criteria for business waste (Criteria for landfill disposal-waste containing hazardous substances)

Table AP 9.22 Disposal criteria for business waste (Criteria for landfill disposal-waste containing hazardous substances)

Kind of waste	Disposal method	Standards for disposed-of materials	Remark
Common standards	<p>1. Landfill shall be conducted in such a way that prevent wastes from scattering or flowing out.</p> <p>2. Necessary measures shall be taken to prevent offensive odor from leaking out of the landfilling sites.</p> <p>3. Necessary measures shall be taken to prevent the growth of rats, mosquitoes, flies or other vermin at landfilling sites.</p> <p>4. Landfill shall be conducted in the sites which are enclosed by enclosures and which can be identified as landfilling sites by billboards.</p> <p>5. Necessary measures shall be taken to prevent leachate from landfill sites from polluting public waters and underground water.</p> <p>6. In case of incineration, necessary measures shall be taken to prevent such pollutants as offensive odor and hazardous substances in exhaust gas from discharging to the environment.</p>	<p>[Fundamental objectives for solid waste management]</p> <p>1. Discharge of solid waste should be controlled and reduced by means of changing materials in use, reuse of materials and improving the production process, etc.</p> <p>2. The solid waste should be discharged separately by the kinds of solid waste or by the kind of hazardous substance.</p> <p>3. Heavy metals should be recovered for reuse when the circumstances permit.</p> <p>4. The harmful object which can be decomposed, should be decomposed as much as possible. Concerning the harmful object which cannot be decomposed, countermeasures should be taken to make it insoluble.</p>	
Cinders and dusts	<p>1. The waste should conform to the standard stipulated in an ordinance of the Prime Minister's Office.</p> <p>2. In case the waste does not conform to the above standard;</p> <p>a) In the case of waste containing Hg, it should be solidified.</p> <p>b) In the case of waste containing harmful object other than Hg.</p>	<p>(Cinders) Ignition loss: 15% or less</p> <p>(Dusts) Countermeasures should be taken to prevent scattering.</p>	<p>1. Controlled landfill</p> <p>2. a) When the waste conforms to the standard, controlled landfill. When the waste does not conform to the standard, shielded landfill.</p> <p>b) Shielded landfill (This shall not apply to O-P, CN and PCB.)</p>
Slag	<p>1. It should be crushed or compacted. In addition, it should conform to the standard stipulated in an ordinance of the Prime Minister's Office.</p> <p>2. In case the waste does not conform to the above standard.</p>	<p>It should not be in hollow condition.</p>	<p>1. Controlled landfill</p> <p>2. Shielded landfill (This shall not apply to O-P, CN and PCB.)</p>
Waste acid and waste alkali	-	-	Landfill disposal is prohibited.
Sludge	<p>1. Inorganic sludge should be dehydrated or dried. Organic sludge should be dehydrated or incinerated by using the incineration facilities. In either case, the treated waste should conform to the standard stipulated in an ordinance of the Prime Minister's Office.</p> <p>2. In case the waste does not conform to the above standard:</p> <p>a) In the case of waste containing Hg and CN, it should be solidified.</p> <p>b) In the case of waste containing Cd, Pb, O-P, Cr⁶⁺, As and PCB.</p>	<p>In case the waste is to be dehydrated or dried, the water content should be 85% or less.</p> <p>In case the waste is to be incinerated, thermal cubic volume reduction should be 15% or less.</p>	<p>1. Controlled landfill</p> <p>2. a) When the waste conforms to the standard, controlled landfill. When the waste does not conform to the standard, shielded landfill.</p> <p>b) Shielded landfill</p>
Waste PCB and others	<p>After incineration by using the incineration facilities, the incineration residue should conform to the standard stipulated in an ordinance of the Prime Minister's Office.</p>	<p>Ignition loss: 15% or less</p>	Controlled landfill
PCB contents	<p>1. PCB should be removed. After removing of PCB, the waste plastics should be crushed or cut, and the waste metal should be crushed or compacted.</p> <p>2. In case of incineration by using the incineration facilities, the incineration residue shall conform to the standard stipulated in an ordinance of the Prime Minister's Office.</p> <p>3. In case it is difficult to treat the solid waste by the methods mentioned above, the solid waste should be treated by a method which is specified separately by the Director General of the Environment Agency.</p>	<p>When the solid waste is to be crushed, care should be taken to avoid hollow condition. In the case of waste plastics, the maximum size should be approximately 1.5 cm.</p> <p>When the solid waste is to be incinerated, ignition loss should be 15% or less. (Excluding waste metal)</p>	<p>1. Waste plastics } Stabilized landfill</p> <p>2. Waste metal } Waste paper } Cinders } Controlled landfill</p>

Note: 1. The "hazardous substance" referred to in this standard denotes "R-Hg or Hg (alkyl-mercury compounds, or mercury or its compounds)", "Cd (cadmium or its compounds)", "Pb (lead or its compounds)", "O-P (organic phosphorous compounds)", "Cr⁶⁺ (hexavalent chromium compounds)", "As (arsenic or its compounds)", "CN (cyanides)" and "PCB".

2. "Stabilized landfill, controlled landfill and shielded landfill" denote the landfill disposal methods in disposal sites (a. Shielded type, b. Stabilized type and c. Controlled type) stipulated in Items a, b and c of No. 1.4, Article 7 in the "Enforcement Ordinance of Law of Solid Waste Disposal and Cleaning (Government Ordinance No. 300 in 1971)".

3. The clause "should conform to the standard stipulated in an Ordinance of the Prime Minister's Office" means that the result of tests conducted in accordance with the "Testing Method of Metals Contained in Industrial Solid Waste (the Notification No. 13 of the Environment Agency in 1973)" should conform to the criterion values of landfill disposal stipulated in the "Judgement Criteria for Industrial Solid Waste Containing Metals (the Prime Minister's Office Ordinance No. 5 in 1973)".

4. The term "solidification" denotes solidification in accordance with the "Criteria for Solidification of Industrial Solid Waste Containing Metals (the Notification No. 5 of the Environment Agency in 1977)".

5. When there are any special laws and ordinances concerning the treating method and disposal form, the pertinent laws and ordinances shall apply.

6. The solid waste may be disposed of by a method other than specified in this Table when the criteria in this Table are recognized to be unsuitable from a standpoint of environment of landfill site and its periphery, or when the method is recognized to be more suitable than the method in this Table in the light of environmental protection.

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