M.2 Description of the Master Plan

M.2.1 Projection until 2010

M.2.1.1 Population

Table M-14 presents the population data and forecast from 1999 to 2010.

Table M-14: Population forecast in AMSS (1999 – 2010)

Muni.		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SS	T	473,374	479,605	485,845	492,001	497,844	503,143	507,666	510,367	512,681	513,869	513,488	512,873
	U	473,374	479,605	485,845	492,001	497,844	503,143	507,666	510,367	512,681	513,869	513,488	512,873
	R	0	0	0	0	0	0	0	0	0	0	0	0
MJ	T	185,204	189,392	193,400	197,273	200,917	204,240	207,153	209,708	211,878	213,779	215,528	217,248
	U	185,204	189,392	193,400	197,273	200,917	204,240	207,153	209,708	211,878	213,779	215,528	217,248
	R	0	0	0	0	0	0	0	0	0	0	0	0
CD	T	149,394	153,350	157,094	160,684	164,069	167,196	170,014	172,570	174,825	176,873	178,808	180,727
	U	149,394	153,350	157,094	160,684	164,069	167,196	170,014	172,570	174,825	176,873	178,808	180,727
	R	0	0	0	0	0	0	0	0	0	0	0	0
CT	T	90,079	94,062	97,758	101,276	104,640	107,876	111,011	114,077	117,013	119,877	122,727	125,618
	U	90,079	94,062	97,758	101,276	104,640	107,876	111,011	114,077	117,013	119,877	122,727	125,618
	R	0	0	0	0	0	0	0	0	0	0	0	0
AY	T	38,158	39,953	41,616	43,201	44,720	46,189	47,622	49,034	50,395	51,731	53,068	54,427
	U	28,000	29,663	31,203	32,663	34,056	35,397	36,700	38,014	39,276	40,512	41,748	43,005
	R	10,158	10,290	10,413	10,538	10,664	10,792	10,922	11,020	11,119	11,219	11,320	11,422
SM	T	69,660	70,610	71,575	72,542	73,452	74,246	74,864	75,326	75,635	75,838	75,979	76,106
	U	69,660	70,610	71,575	72,542	73,452	74,246	74,864	75,326	75,635	75,838	75,979	76,106
	R	0	0	0	0	0	0	0	0	0	0	0	0
ST	T	152,723	158,207	163,793	169,515	175,286	181,023	186,636	192,131	197,568	202,935	208,225	213,431
	U	138,723	144,025	149,441	154,991	160,588	166,149	171,584	176,944	182,244	187,473	192,624	197,690
	R	14,000	14,182	14,352	14,524	14,698	14,874	15,052	15,187	15,324	15,462	15,601	15,741
AC	T	42,773	45,123	47,578	50,140	52,790	55,507	58,273	61,090	63,969	66,906	69,899	72,950
	U	42,773	45,123	47,578	50,140	52,790	55,507	58,273	61,090	63,969	66,906	69,899	72,950
	R	0	0	0	0	0	0	0	0	0	0	0	0
SY	T	283,598	285,286	287,034	288,694	290,412	292,333	294,604	297,183	299,275	301,885	305,729	309,772
	U	283,598	285,286	287,034	288,694	290,412	292,333	294,604	297,183	299,275	301,885	305,729	309,772
	R	0	0	0	0	0	0	0	0	0	0	0	0
IL	T	127,434	132,231	136,696	140,945	144,985	148,822	152,465	155,957	159,232	162,370	165,452	168,554
	U	127,434	132,231	136,696	140,945	144,985	148,822	152,465	155,957	159,232	162,370	165,452	168,554
	R	0	0	0	0	0	0	0	0	0	0	0	0
SMT	T	101,086	107,212	112,906	118,362	123,663	128,898	134,152	139,463	144,722	150,008	155,396	160,949
	U	73,000	78,761	84,114	89,224	94,175	99,056	103,952	108,991	113,976	118,985	124,094	129,365
	R	28,086	28,451	28,792	29,138	29,488	29,842	30,200	30,472	30,746	31,023	31,302	31,584
AP	T	163,974	171,833	179,122	186,064	192,728	199,180	205,488	211,715	217,733	223,652	229,580	235,614
	U	163,974	171,833	179,122	186,064	192,728	199,180	205,488	211,715	217,733	223,652	229,580	235,614
	R	0	0	0	0	0	0	0	0	0	0	0	0
NJ	T	31,466	32,172	32,849	33,504	34,119	34,680	35,171	35,601	35,966	36,285	36,578	36,866
	U	15,000	15,492	15,969	16,421	16,831	17,185	17,466	17,737	17,941	18,098	18,227	18,350
	R	16,466	16,680	16,880	17,083	17,288	17,495	17,705	17,864	18,025	18,187	18,351	18,516
TN	T	39,871	41,277	42,588	43,836	45,020	46,139	47,192	48,193	49,122	50,005	50,868	51,733
	U	29,000	30,265	31,444	32,558	33,607	34,589	35,503	36,399	37,222	37,998	38,753	39,509
	R	10,871	11,012	11,144	11,278	11,413	11,550	11,689	11,794	11,900	12,007	12,115	12,224
Total	T	1,948,794	2,000,313	2,049,854	2,098,037	2,144,645	2,189,472	2,232,311	2,272,415	2,310,014	2,346,013	2,381,325	2,416,868
	U	1,869,213	1,919,698	1,968,273	2,015,476	2,061,094	2,104,919	2,146,743	2,186,078	2,222,900	2,258,115	2,292,636	2,327,381
	R	79,581	80,615	81,581	82,561	83,551	84,553	85,568	86,337	87,114	87,898	88,689	89,487

Note: T: total, U: urban, and R: rural
Source: arranged by the Study Team on the basis of information from the municipalities and Dirección General de Estadística y Censos, Ministerio de Economíca, 1995, "Proyección de la Población de El Salvador," El Salvador

M.2.1.2 Waste Amount

a. Municipal Solid Waste

Table M-15 summarizes waste generation amount in 2010.

Table M-15: Waste Generation Amount in 2010

Unit : ton/day

	Household	Restaurant	Other than restaurant	Institutional	Market	Road sweeping	Total
San Salvador	257.6	9.4	24.7	18.3	39.2	64.4	413.6
Mejicanos	101.0	4.8	10.9	8.5	2.8	5.8	133.8
Delgado	79.8	4.2	10.6	4.6	0.9	3.0	103.1
Cuscatancingo	54.6	4.1	6.0	3.0	0.0	1.8	69.5
Ayutuxtepeque	21.2	0.6	1.8	2.1	0.5	0.5	26.7
San Marcos	34.5	1.8	2.7	1.3	0.9	1.4	42.6
Nueva San Salvador	106.8	3.3	8.2	8.1	5.5	8.5	140.4
Antiguo Cuscatlan	41.2	1.1	3.6	4.6	1.2	10.2	61.9
Soyapango	136.4	11.2	13.4	8.9	6.2	2.5	178.6
Ilopango	75.4	3.9	5.9	3.4	0.9	0.3	89.8
San Martin	57.5	6.0	6.7	2.9	7.8	0.3	81.2
Apopa	100.4	9.3	8.9	3.2	11.3	1.1	134.2
Nejapa	8.9	0.7	1.3	0.4	0.2	0.1	11.6
Tonacatepeque	19.0	0.8	2.7	3.4	0.3	0.6	26.8
Total	1,094.3	61.2	107.4	72.7	77.7	100.5	1,513.8

b. Medical Waste

Table M-16 summarizes medical waste generation amount in 1999 to 2010.

Table M-16: Forecast of Future Medical Waste Generation Amount

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Increase Rate*	1.000	1.027	1.053	1.078	1.103	1.126	1.148	1.170	1.189	1.208	1.227	1.245
Amount (ton/day)	3.20	3.29	3.37	3.45	3.53	3.60	3.67	3.74	3.80	3.87	3.93	3.98

Note: * Increase rate having the amount in year 1999 as the base.

M.2.2 Technical System

M.2.2.1 Municipal Solid Waste Management

SWM activities in 14 municipalities of AMSS mainly consist of collection, street sweeping, transport and final disposal activities. Separate discharge and collection is not practiced in reality. As for intermediate treatment activities in SWM, only small-scale composting activities using market wastes are carried out.

"Special Regulation on Integral Solid Waste Management" was published on June 1st 2000. Accordingly, in future planning of municipal SWM, it is necessary to follow and comply with this national environmental regulation. The regulation specifies final disposal requirements of: sanitary landfill; impermeable structure; and leachate drainage and treatment.

In its consequence, among all the final disposal sites in El Salvador, the MIDES Nejapa S/L seems to be the only final disposal site that complied with the recently published national regulation on SWM. Therefore, all municipalities other than the MIDES Nejapa users turn out to be violators of the said national regulation.

As a matter of course, the above national regulation should be observed by all municipalities with respect to the environmental viewpoint. However, if an immediate compliance with this regulation is demanded, it will require a substantial increase of financial burdens by municipalities and which may consequently affect the whole municipal finance to a great length.

The principal SWM mission for COAMSS/OPAMSS and 14 municipalities is to implement sustainable municipal SWM services for all citizens reminding the environmental conservation and targeting the service coverage expansion and service quality improvement. Whereas the grade of collection services, organizational integrity of the cleansing offices, its budget and resources in hand are diversely different among those municipalities. In view of that, the M/P categorizes the SWM issues in AMSS into what requires regional focus and solutions by OPAMSS/COAMSS and what requires individual focus and solutions by respective municipalities. The M/P outlines the action plans respectively for the metropolitan focuses and individual municipal focuses.

a. Discharge and Storage System

Waste is generated on a somewhat continuous basis. However, collection occurs intermittently, a few times a week or perhaps daily, depending on the quantity generated at a specific location and climatic conditions. Therefore, it is necessary to provide proper storage of waste at home until it is collected. Storage is quite important because it can have a significant effect on:

- Public health and aesthetic conditions
- Subsequent functional elements such as collection
- Material recovery (recycling)

The effects on these aspects vary depending on the generation source, i.e., detached houses, apartments, shops, office buildings, etc.

As the POS shows that the use of the plastic sack is widely accepted in the Study Area, this is favorable in view of sanitation and handling. The problem is that it is vulnerable to animal infestation. Therefore, the best recommendable storage method is combination use of the plastic bag and the plastic dustbin.

b. Collection and Transport System

b.1 Collection System

In order to achieve the essential objective of waste collection, i.e., to eliminate waste from living environment before the waste becomes hindrance to keep the sanitary environment, twice or three times a week of collection frequency should be applied. On the other hand, every day waste collection is not recommendable as it results in considerably high collection cost.

Almost of the municipalities in the Study Area still need to raise collection coverage. Therefore, mixed collection is recommendable over the Study Area in principal. There are, however, some municipalities that have achieved high collection coverage such as Nueva San Salvador and Antiguo Cuscatlan. In high-income areas of such municipalities, introduction of separate collection in the near future is recommendable.

In the Study Area many communities that is inaccessible for the collection vehicle exist. For such communities, point collection (container collection or station collection) or house to house collection by community-based collection or micro-enterprises depending on conditions of a target community would be applicable. For the accessible area to collection vehicle, continuation of the present collection method, i.e., curbside collection with ringing bell, is recommendable.

The 18 yd^3 compactor truck would be the best suitable for the Study Area especially in view of its efficiency, i.e., fewer collection cost per ton of waste. The 11 yd^3 compactor truck and the dump truck would also be used depending on town structure, road condition, type of waste, etc. It should be kept in mind, however, the collection costs of those vehicles are high. Especially, one of the dump truck is enormous.

When expansion of collection service is required, making plural shifts is recommendable rather than purchasing other vehicles. This results in fewer collection cost per ton of waste. Also it would be a way to rent collection vehicles to the private sector for the second or third shift.

b.2 Transport System

Whether the transfer transport should be employed or not is depending on the size of T/Ss that are used. Small T/Ss' unit costs tend to be expensive, contrarily large T/Ss' ones are likely to be inexpensive due to economy of scale. In the examination of breakeven distance and travel time to Nejapa Disposal Site, 100ton/day transfer transport system never became beneficial to the Study Area, 300ton/day or over transfer transport system were advantageous compared with the direct transport.

In consequence of the examination of T/S case studies, installing two numbers of T/S (a 350ton/day T/S in the western part, and a 900ton/day T/S in the eastern part) used by 8 municipalities becomes an optimum proposal of the transfer stations and transport (T/S&T) system in the M/P. The respective users for the two T/Ss are listed below.

Table M-17: Major Users of Transfer Stations

Name of T/S	Major User (name of municipality)
West T/S (350 ton/day)	San Salvador, Nueva San Salvador, Antigo Cuscatlan
East T/S (900 ton/day)	San Salvador, Mejicanos, Cuscatancingo, San Marcos, Soyapango, Ilopango

On the other hand, the examination verified that maintaining the current transport system (i.e., direct transport by collection vehicles) stands as the optimum choice for the remaining 6 municipalities.

As for type of T/S, direct-load type is recommendable due to its fewer cost and smaller environmental impacts on and around the site. Although the direct-load type

is less reliable than the storage-load type for maintaining the collection system, this would not be a serious problem because waste collection works can temporarily return to the direct transport system that is presently practiced.

20 ton or over tractor-trailers are recommendable as transport vehicles. Smaller capacity vehicles than those are not recommendable because use of a small vehicle for transfer transport raises transport cost.

c. Intermediate Processing System

Under the circumstances, it is judged that the necessity for introducing intermediate processing system in AMSS for municipal SWM is fairly small. Team's observation is summarized as follows.

- As for compost, its market size is currently small and a market demand for compost products only exists in relatively short periods. Therefore, it is anticipated that if compost is produced substantially more than what is produced today, its limited marketability may result in price drop and surplus of compost product and further financial burdens for municipalities.
- There might be a justifiable reason to introduce a MIDES S/P for creating job opportunities for waste pickers. However, material recovery from mixed discharged waste has large limitation for resource conservation purposes. It is also doubtful whether S/P that recovers materials from mixed discharged waste has financial feasibility in maintaining the operation. Whereas if a S/P is fed with source separated recyclable materials, its efficiency will be much higher. Therefore, S/P that recovers materials from mixed discharged waste is not recommended.
- Incineration facilities are very expensive and also require technical capability for their operation and maintenance. It is judged that introduction of such intermediate processing system for present AMSS should be too early, in view of economical dimensions that municipalities has.

Hence, it is proposed in this M/P that a S/P should start its operation when 14 municipalities deploy the separate collection of recyclable materials. As for incineration, the M/P recommends that an examination whether incineration system is necessary or not should take place around year 2009 to 2010.

d. Final Disposal System

d.1 Appropriate Number of Final Disposal Sites

Currently, 10 out of 14 municipalities in AMSS dispose their municipal waste at MIDES Nejapa landfill. As for remaining 4 municipalities, 2 municipalities use ESPIGA controlled dumping site and the other 2 municipalities dispose of at open dumping site within their jurisdiction.

It should be a matter of course that the selection of a final disposal alternative lies on discretion of respective autonomous municipalities. Meanwhile, "Special Regulation on Integral Solid Waste Management (Reglamento Especial sobre el Manejo Integral de los Desechos Sólidos)" was published on 1st June 2000. Out of present final disposal sites that 14 municipalities use, a final disposal site that complies with this requirement is only MIDES Nejapa sanitary landfill that 10 municipalities use. Therefore, other 4 municipalities will be required to implement satisfactory final

disposal of their municipal waste in order to comply with such environmental legislative requirements.

However, viewing financial capabilities of respective municipalities, the US$18/ton tipping fee of MIDES should be very expensive. Which consequently would impose a significant financial burden on municipal finances that may possibly lead to municipal financial crisis. This implies serious questions that whether or not a "sustainable SWM" that being the goal of the Master Plan could be realized by respective 14 municipalities, from municipal financial aspects.

Meanwhile, municipalities that currently use ESPIGA site consider to participate in the New ESPIGA S/L that is supposed to be managed by a private sector and of course is supposed to comply with the regulation mentioned above. Therefore, measures to comply with the regulation are needed for the two (2) municipalities that currently have open dumping practices, i.e., Tonacatepeque and San Martin municipalities. Consequently, this M/P recommends constructing another regional sanitary landfill that said two municipalities are going to use.

Currently there is only one regional S/L (MIDES Nejapa) that complies with the national regulation of SWM. When the New ESPIGA S/L and another S/L for the Tonacatepeque and San Martin municipalities are constructed, AMSS in total will have 3 regional S/Ls. It consequently will raise the safety factor of final disposal management in AMSS that can fully cope with the emergency and accident occasions.

d.2 Tipping Fee

d.2.1 Tipping Fee of MIDES Nejapa S/L

10 municipalities currently make payment of US$18.0/ton to MIDES for its waste treatment/disposal services. The services in consideration for the price consist of what listed in the table below, and it is informed that MIDES recently presented the price breakdown as shown in the table.

However to date, the service provided by MIDES is only the waste disposal in the sanitary landfill and the whole price of the US$18/ton is being paid. Under such circumstances, a set of incertitude e.g., interpretation of the contractual context remains unsolved.

Table M-18: Breakdown of MIDES Project

Item	Cost (U$/ton)
Sanitary Landfill (Nejapa landfill site)	**12.80**
Composting Plant	0.25
Transfer Station and Selection Plant	3.90
Environmental Education	0.40
Waste Picker Welfare	0.15
Closure of Ex-dumping sites	0.50
Total	18.00

Source: verbal information from a C/P

d.2.2 Tipping Fee of Tonacatepeque S/L

On the other hand, in the case that a new S/L (total site area 20ha and total disposal capacity 433,000ton assumed) is constructed in Tonacatepeque municipality in compliance with the regulation, the total cost is estimated to be about U$5,900,000. That entails land acquisition costs assumed to be 12,000colon/ha, construction costs, O&M costs till the end of its service life, etc.

Table M-19: Outline of Tonacatepeque Landfill Site

Type of landfill	Sanitary landfill with leachate treatment
Site area	approximate 20 ha
Landfill capacity	approximate 433,000 ton (exc. cover soil)
Type of liner	HDPE liner
Leachate treatment method	Aerated lagoon and oxidation pond
Equipment	Bulldozer, Dump truck, Waste truck, etc.
Initial investment cost	approximate U$ 3,000,000

The table below summarizes the cases of the Tonacatepeque S/L tipping fee (US$/ton disposed) depending upon the alternatives of project execution modality (e.g., public direct management, private administration) with respective financial conditions as presented in the table.

Table M-20: Tipping Fee of Tonacatepeque S/L

		Base (net cost)	OPAMSS/COAMSS		Private company
			Direct management	Public company	
Tipping fee	**inc. VAT**	**-**	**-**	**18.8 (U$/ton)**	**31.0 (U$/ton)**
	exc. VAT	**13.7 (U$/ton)**	**20.4 (U$/ton)**	**16.6 (U$/ton)**	**27.4 (U$/ton)**
Conditions					
Security	(%)	-	0	25	15.5
Interest ratio	(%)	-	8.1 (libor+1%)	1.7*	10.75
Corporation tax	(%)	-	0	25	25
VAT	(%)	13	13	13	13
Capital	(%)	-	0	20 % of initial investment	20 % of initial investment
Evaluation period		-	2001 to 2022	2001 to 2022	2001 to 2022
Evaluation index		-	FIRR>8%	Profit rate>5%	Return on own capital >13.75%

Note: * loan rate for environmental improvement project, (repayment period 25 years, deferment 7 years) Japan Bank of International Cooperation

On the other hand, as distances from Tonacatepeque and San Martin municipalities to Tonacatepeque S/L or MIDES Nejapa S/L are different, respective costs are different. The table below summarizes collection and transport costs for both municipalities with respective cases.

Table M-21: Collection and Transport Cost

Municipality / Destination	San Martin	Tonacatepeque
Tonacatepeque S/L	16.2 (U$/ton)	12.8 (U$/ton)
MIDES Nejapa S/L	22.3 (U$/ton)	17.7 (U$/ton)

Summary of outcome listed in Table M-20 and Table M-21 is presented below.

Table M-22: Comparison of Collection/Haulage and Landfill Cost

		Tonacatepeque S/L			MIDES Nejapa S/L	
		Direct	Public company	Private company		
SMT	Tipping fee	20.4	16.6	27.4	18.0	12.8
	Collection & haulage	16.2	16.2	16.2	22.3	22.3
	Total	**36.6**	**32.8**	**43.6**	**40.3**	**35.1**
TN	Tipping fee	20.4	16.6	27.4	18.0	12.8
	Collection & haulage	12.8	12.8	12.8	17.7	17.7
	Total	**33.2**	**29.4**	**40.2**	**35.7**	**30.5**

The above table compares alternative choices of final disposal for municipalities of Tonacatepeque and San Martin.

If the tipping fee of the MIDES Nejapa S/L remains US$18.0/ton, it will be cheaper for both municipalities of Tonacatepeque and San Martin to use the Tonacatepeque S/L when it is operated by the following modalities:

- direct operation by OPAMSS/COAMSS; or
- operation by a public company using an international loan of low interest rate (e.g., JBIC loan for environment projects)

If the tipping fee of the MIDES Nejapa S/L is resolved as US$12.8/ton, it will be cheaper for both municipalities of Tonacatepeque and San Martin to use the Tonacatepeque S/L when it is operated by the following modality:

- operation by a public company using an international loan of low interest rate (e.g., JBIC loan for environment projects).

In any cases, total cost burden of SWM will be substantially increased in order to comply with the newly published environmental legislation for all municipalities other than the municipalities currently utilizing MIDES Nejapa S/L that have already been bearing such environmental costs since May 1999.

d.2.3 Tipping Fee of New Espiga Landfill Site

The new ESPIGA S/L is planned to be constructed and operated to receive municipal waste from municipalities of Cuscatancingo, Antigo Cuscatlan etc. As a matter of course, it should be structured and operated to satisfy the environmental requirements of the newly published legislation. Its engineering specifications and project execution modality should be devised to reduce the additional burden of final disposal cost as small as possible. On the other hand, in view of economy of scale that the new ESPIGA S/L is expected to have, compared with the case of Tonacatepeque S/L, it will have to be devised that the tipping fee should become in

the order of less than US$12.8/ton. This is essential in order to have competitiveness against MIDES tipping fee, since the transport distance from municipalities of Cuscatancingo and Antigo Cuscatlan are in the same order either to the New ESPIGA S/L or to the MIDES Nejapa S/L.

e. Waste Stream

Waste streams in years of 2003, 2006, 2010, which are respective phase ends, are shown below.

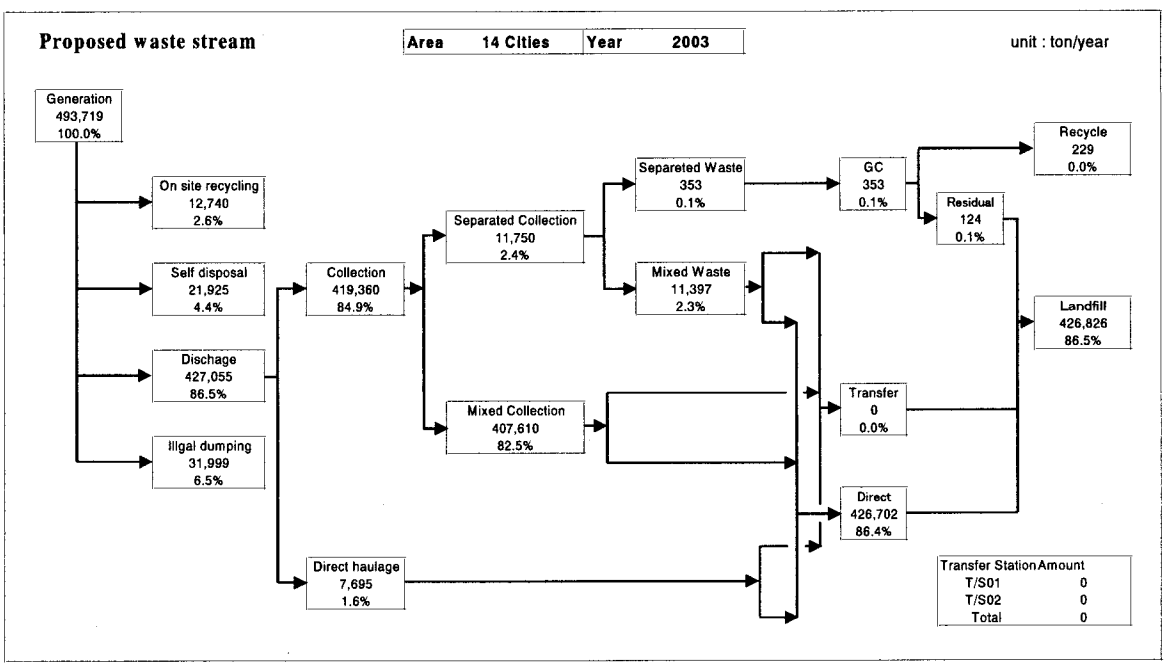

Figure M-6: Waste Stream in 2003

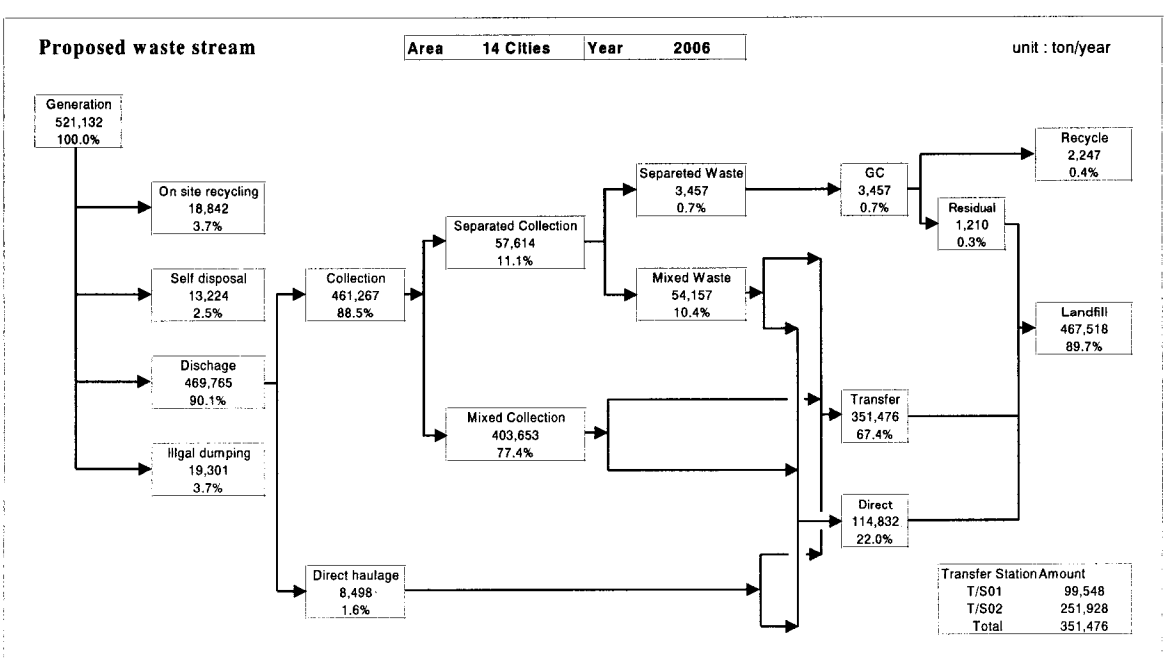

Figure M-7: Waste Stream in 2006

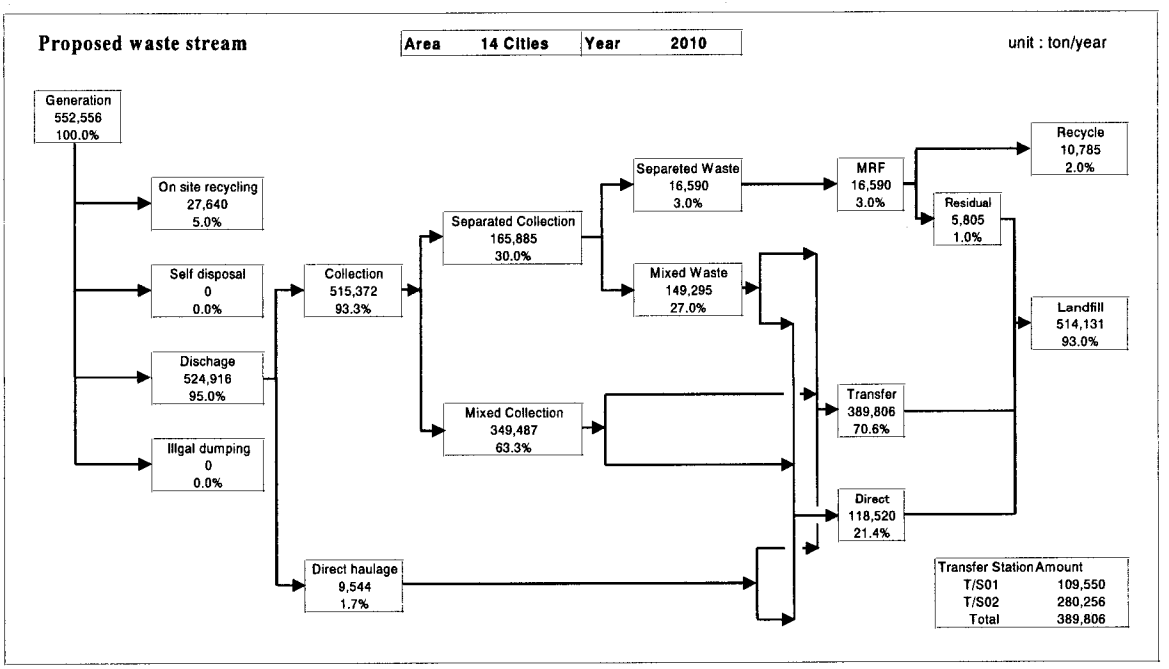

Figure M-8: Waste Stream in 2010

Table M-23: Waste Stream in 2003

	Generation	Collection	Direct haulage	Recyclable		Transfer station	Landfill	Recycling	Without collection		
				GC	MRF				Illegal dumping	Self disposal	On-site recycle
Unit : ton/year											
San Salvador	231,945	193,552	2,169	0	0	0	195,721	0	17,685	12,117	6,422
SS-01	62,361	52,040	583	0	0	0	52,623	0	4,754	3,258	1,726
SS-02	53,658	44,776	502	0	0	0	45,278	0	4,092	2,803	1,485
SS-03	26,108	21,786	244	0	0	0	22,030	0	1,991	1,364	723
SS-04	22,267	18,581	209	0	0	0	18,790	0	1,698	1,163	616
SS-05	67,551	56,369	631	0	0	0	57,000	0	5,150	3,529	1,872
Mejicanos	31,550	27,923	284	42	0	0	28,180	27	1,551	1,063	729
Delgado	13,577	12,175	0	0	0	0	12,175	0	646	443	313
Cuscatancingo	11,547	10,355	0	0	0	0	10,355	0	550	377	265
Ayutuxtepeque	4,533	4,066	0	0	0	0	4,066	0	216	148	103
San Marcos	13,885	12,448	4	0	0	0	12,452	0	661	453	319
Nueva San Salvador	38,158	34,151	37	102	0	0	34,122	66	1,833	1,256	881
Antiguo Cuscatlan	20,550	16,956	817	51	0	0	17,740	33	1,333	913	531
Soyapango	65,850	52,426	4,010	158	0	0	56,333	103	4,549	3,116	1,749
Ilopango	19,485	17,108	344	0	0	0	17,452	0	940	644	449
San Martin	10,776	9,664	0	0	0	0	9,664	0	513	351	248
Apopa	20,357	18,225	30	0	0	0	18,255	0	970	665	467
Nejapa	2,136	1,907	0	0	0	0	1,907	0	106	73	50
Tonacatepeque	9,370	8,404	0	0	0	0	8,404	0	446	306	214
Total	**493,719**	**419,360**	**7,695**	**353**	**0**	**0**	**426,826**	**229**	**31,999**	**21,925**	**12,740**
Unit : ton/day											
San Salvador	635.5	530.3	6.0	0.0	0.0	0.0	536.3	0.0	48.5	33.2	17.5
SS-01	170.9	142.6	1.6	0.0	0.0	0.0	144.2	0.0	13.0	8.9	4.8
SS-02	147.0	122.6	1.4	0.0	0.0	0.0	124.0	0.0	11.2	7.7	4.1
SS-03	71.5	59.7	0.7	0.0	0.0	0.0	60.4	0.0	5.5	3.7	1.9
SS-04	61.0	50.9	0.6	0.0	0.0	0.0	51.5	0.0	4.7	3.2	1.6
SS-05	185.1	154.5	1.7	0.0	0.0	0.0	156.2	0.0	14.1	9.7	5.1
Mejicanos	86.4	76.5	0.8	0.1	0.0	0.0	77.2	0.1	4.2	2.9	2.0
Delgado	37.2	33.4	0.0	0.0	0.0	0.0	33.4	0.0	1.8	1.2	0.8
Cuscatancingo	31.6	28.4	0.0	0.0	0.0	0.0	28.4	0.0	1.5	1.0	0.7
Ayutuxtepeque	12.4	11.1	0.0	0.0	0.0	0.0	11.1	0.0	0.6	0.4	0.3
San Marcos	38.0	34.1	0.0	0.0	0.0	0.0	34.1	0.0	1.8	1.2	0.9
Nueva San Salvador	104.5	93.6	0.1	0.3	0.0	0.0	93.5	0.2	5.0	3.4	2.4
Antiguo Cuscatlan	56.3	46.5	2.2	0.1	0.0	0.0	48.6	0.1	3.7	2.5	1.4
Soyapango	180.4	143.6	11.0	0.4	0.0	0.0	154.3	0.3	12.5	8.5	4.8
Ilopango	53.4	46.9	0.9	0.0	0.0	0.0	47.8	0.0	2.6	1.8	1.2
San Martin	29.5	26.5	0.0	0.0	0.0	0.0	26.5	0.0	1.4	1.0	0.6
Apopa	55.8	49.9	0.1	0.0	0.0	0.0	50.0	0.0	2.7	1.8	1.3
Nejapa	5.9	5.2	0.0	0.0	0.0	0.0	5.2	0.0	0.3	0.2	0.2
Tonacatepeque	25.7	23.0	0.0	0.0	0.0	0.0	23.0	0.0	1.2	0.8	0.7
Total	**1,352.6**	**1,149.0**	**21.1**	**0.9**	**0.0**	**0.0**	**1,169.4**	**0.7**	**87.8**	**59.9**	**34.8**

Table M-24: Waste Stream in 2006

	Generation	Collection	Direct haulage	Recyclable		Transfer station	Landfill	Recycling	Without collection		
				GC	MRF				Illegal dumping	Self disposal	On-site recycle
unit : ton/year											
San Salvador	244,801	215,304	2,413	1,292	0	165,166	216,877	840	10,666	7,308	9,110
SS-01	65,817	57,885	649	347	0	57,754	58,308	226	2,868	1,965	2,450
SS-02	56,632	49,808	558	299	0	0	50,172	194	2,468	1,691	2,107
SS-03	27,555	24,237	271	145	0	24,207	24,414	94	1,200	822	1,025
SS-04	23,501	20,669	231	124	0	20,643	20,819	81	1,024	702	875
SS-05	71,296	62,705	704	377	0	62,562	63,164	245	3,106	2,128	2,653
Mejicanos	33,303	30,268	308	363	0	30,008	30,340	236	935	641	1,151
Delgado	14,331	13,177	0	40	0	0	13,151	26	390	267	497
Cuscatancingo	12,189	11,210	0	0	0	11,210	11,210	0	332	227	420
Ayutuxtepeque	4,785	4,402	0	0	0	0	4,402	0	130	89	164
San Marcos	14,657	13,476	4	0	0	13,477	13,480	0	399	273	505
Nueva San Salvador	40,278	36,977	39	555	0	35,939	36,655	361	1,106	758	1,398
Antiguo Cuscatlan	21,694	18,653	899	280	0	18,759	19,370	182	804	551	787
Soyapango	69,517	57,914	4,430	868	0	58,262	61,780	564	2,744	1,880	2,549
Ilopango	20,569	18,531	372	0	0	18,655	18,903	0	567	389	710
San Martin	11,375	10,461	0	0	0	0	10,461	0	310	212	392
Apopa	21,488	19,727	33	59	0	0	19,722	38	585	401	742
Nejapa	2,254	2,069	0	0	0	0	2,069	0	64	44	77
Tonacatepeque	9,891	9,098	0	0	0	0	9,098	0	269	184	340
Total	521,132	461,267	8,498	3,457	0	351,476	467,518	2,247	19,301	13,224	18,842
unit : ton/day											
San Salvador	670.7	590.0	6.5	3.5	0.0	452.5	594.2	2.3	29.3	20.0	24.9
SS-01	180.3	158.6	1.8	1.0	0.0	158.2	159.8	0.6	7.9	5.4	6.6
SS-02	155.2	136.5	1.5	0.8	0.0	0.0	137.5	0.5	6.8	4.6	5.8
SS-03	75.5	66.4	0.7	0.4	0.0	66.3	66.8	0.3	3.3	2.3	2.8
SS-04	64.4	56.7	0.6	0.3	0.0	56.6	57.1	0.2	2.8	1.9	2.4
SS-05	195.3	171.8	1.9	1.0	0.0	171.4	173.0	0.7	8.5	5.8	7.3
Mejicanos	91.2	83.0	0.8	1.0	0.0	82.2	83.2	0.6	2.6	1.8	3.0
Delgado	39.3	36.1	0.0	0.1	0.0	0.0	36.0	0.1	1.1	0.7	1.4
Cuscatancingo	33.4	30.7	0.0	0.0	0.0	30.7	30.7	0.0	0.9	0.6	1.2
Ayutuxtepeque	13.1	12.1	0.0	0.0	0.0	0.0	12.1	0.0	0.4	0.2	0.4
San Marcos	40.2	36.9	0.0	0.0	0.0	36.9	36.9	0.0	1.1	0.7	1.5
Nueva San Salvador	110.4	101.3	0.1	1.5	0.0	98.5	100.4	1.0	3.0	2.1	3.9
Antiguo Cuscatlan	59.4	51.1	2.5	0.8	0.0	51.4	53.1	0.5	2.2	1.5	2.1
Soyapango	190.5	158.7	12.1	2.4	0.0	159.6	169.3	1.5	7.5	5.2	7.0
Ilopango	56.4	50.8	1.0	0.0	0.0	51.1	51.8	0.0	1.6	1.1	1.9
San Martin	31.2	28.7	0.0	0.0	0.0	0.0	28.7	0.0	0.8	0.6	1.1
Apopa	58.9	54.0	0.1	0.2	0.0	0.0	54.0	0.1	1.6	1.1	2.1
Nejapa	6.2	5.7	0.0	0.0	0.0	0.0	5.7	0.0	0.2	0.1	0.2
Tonacatepeque	27.1	24.9	0.0	0.0	0.0	0.0	24.9	0.0	0.7	0.5	1.0
Total	1,428.0	1,264.0	23.1	9.5	0.0	962.9	1,281.0	6.1	53.0	36.2	51.7

Table M-25: Waste Stream in 2010

	Generation	Collection	Direct haulage	Recyclable		Transfer station	Landfill	Recycling	Without collection		
				GC	MRF				Illegal dumping	Self disposal	On-site recycle
unit : ton/year											
San Salvador	259,510	243,820	2,732	0	7315	183,892	241,797	4,755	0	0	12,958
SS-01	69,772	65,553	735	0	1967	64,321	65,009	1,279	0	0	3,484
SS-02	60,035	56,405	632	0	1692	0	55,937	1,100	0	0	2,998
SS-03	29,210	27,444	308	0	823	26,929	27,217	535	0	0	1,458
SS-04	24,913	23,407	263	0	702	22,968	23,214	456	0	0	1,243
SS-05	75,580	71,011	794	0	2131	69,674	70,420	1,385	0	0	3,775
Mejicanos	35,310	33,217	338	0	1329	32,226	32,691	864	0	0	1,755
Delgado	15,195	14,430	0	0	361	0	14,195	235	0	0	765
Cuscatancingo	12,924	12,277	0	0	246	12,031	12,117	160	0	0	647
Ayutuxtepeque	5,074	4,819	0	0	96	0	4,757	62	0	0	255
San Marcos	15,541	14,762	5	0	295	14,472	14,575	192	0	0	774
Nueva San Salvador	42,706	40,516	43	0	1824	38,735	39,373	1,186	0	0	2,147
Antiguo Cuscatlan	23,013	20,851	1,005	0	938	20,918	21,246	610	0	0	1,157
Soyapango	73,750	65,070	4,977	0	2928	67,119	68,144	1,903	0	0	3,703
Ilopango	21,810	20,310	408	0	305	20,413	20,520	198	0	0	1,092
San Martin	12,061	11,458	0	0	229	0	11,309	149	0	0	603
Apopa	22,784	21,608	36	0	540	0	21,293	351	0	0	1,140
Nejapa	2,390	2,270	0	0	34	0	2,248	22	0	0	120
Tonacatepeque	10,488	9,964	0	0	150	0	9,866	98	0	0	524
Total	552,556	515,372	9,544	0	16590	389,806	514,131	10,785	0	0	27,640
unit : ton/day											
San Salvador	711.1	668.0	7.4	0.0	20.0	503.8	662.4	13.0	0.0	0.0	35.7
SS-01	191.2	179.6	2.0	0.0	5.4	176.2	178.1	3.5	0.0	0.0	9.6
SS-02	164.5	154.6	1.7	0.0	4.6	0.0	153.3	3.0	0.0	0.0	8.2
SS-03	80.0	75.2	0.8	0.0	2.3	73.8	74.5	1.5	0.0	0.0	4.0
SS-04	68.3	64.1	0.7	0.0	1.9	62.9	63.6	1.2	0.0	0.0	3.5
SS-05	207.1	194.5	2.2	0.0	5.8	190.9	192.9	3.8	0.0	0.0	10.4
Mejicanos	96.7	91.0	0.9	0.0	3.6	88.3	89.5	2.4	0.0	0.0	4.8
Delgado	41.6	39.5	0.0	0.0	1.0	0.0	38.9	0.6	0.0	0.0	2.1
Cuscatancingo	35.4	33.6	0.0	0.0	0.7	33.0	33.3	0.4	0.0	0.0	1.8
Ayutuxtepeque	13.9	13.2	0.0	0.0	0.3	0.0	13.0	0.2	0.0	0.0	0.7
San Marcos	42.6	40.5	0.0	0.0	0.8	39.6	40.0	0.5	0.0	0.0	2.1
Nueva San Salvador	117.0	111.0	0.1	0.0	5.0	106.1	107.9	3.2	0.0	0.0	5.9
Antiguo Cuscatlan	63.0	57.1	2.8	0.0	2.6	57.3	58.2	1.7	0.0	0.0	3.1
Soyapango	202.1	178.3	13.6	0.0	8.0	183.9	186.7	5.2	0.0	0.0	10.2
Ilopango	59.8	55.7	1.1	0.0	0.8	55.9	56.3	0.5	0.0	0.0	3.0
San Martin	33.0	31.4	0.0	0.0	0.6	0.0	31.0	0.4	0.0	0.0	1.6
Apopa	62.4	59.2	0.1	0.0	1.5	0.0	58.3	1.0	0.0	0.0	3.1
Nejapa	6.5	6.2	0.0	0.0	0.1	0.0	6.1	0.1	0.0	0.0	0.3
Tonacatepeque	28.7	27.3	0.0	0.0	0.4	0.0	27.0	0.3	0.0	0.0	1.4
Total	1,513.8	1,412.0	26.0	0.0	45.4	1,068.0	1,408.6	29.5	0.0	0.0	75.8

M.2.2.2 Medial Waste Management

a. Intra-hospital Management

a.1 Entire Inspection and Instruction

The Study Team carried out the field investigation for the 40 larger medical institutions out of the total 70 medical institutions in AMSS. It is recommended that the authorities carry out the same sort of field investigation for the remaining 30 small medical institutions in order to find out the actual practices of intra-hospital management of them and to give appropriate instructions for their separate discharge.

a.2 Instruction and Training on Separate Discharge

Instruction for separate discharge should be strictly given to such small medical institutions that have not practiced intra-hospital separate discharge yet. Furthermore, training should be offered by authorities for them to promote their cooperation and participation.

a.3 Medical Waste Classification for Separate Discharge

Medical institutions that have already been practicing separate discharge should maintain the same. Medical institutions that have not started separate discharge practices should start it with the following waste classification.

Medical wastes and common wastes should be separately managed. Medical wastes should be classified into the following 4 categories and managed respectively:

- Sharps;
- Infectious and Pathological waste;
- Radioactive waste; and
- Other medical waste (than the above categories).

b. Appropriate Collection System

b.1 Collection Agents

It is expected that all medical institutions practice the separate discharge in the near future. Therefore, the medical waste collection system should also be improved to cope with all medical institutions.

As for the Japanese experiences as outlined below, a collection agent normally has more than 100 clients (i.e., medical institutions) in order to have appropriate business efficiency in medical waste collection works. Therefore it might suggest that one or two agents to serve for all medical institutions in AMSS would have a better efficiency in view of economy of scale.

Therefore, it will be necessary to have a contract mechanism in AMSS that, even only one or two contractors are working, a competitive price is offered and accepted through an open tender prepared by the competent authority.

b.2 Collection Frequency

Since there are few medical institutions in AMSS that have cool storage facilities, it is not appropriate to store medical wastes at hospitals for a longer time. The collection

should be frequent enough for example at least once a week. It would be preferable to have the collection plan of twice a week.

b.3 Collection Vehicle

It is a minimum requirement to maintain the current system of collection vehicles that vehicles are exclusively assigned for the medical waste collection. In case that a new vehicle is to be procured for this, the vehicle should satisfy the following requirements:

- It should be a cool storage vehicle of a box type or a wagon type;
- It should be equipped with provisions that can cope with its traffic accident and a vehicle breakdown; and
- The warning sign of "biohazard" should be clearly indicated on the vehicle.

b.4 Containers

Although recipients and/or containers for medical waste collection should preferably be disposable types with respect to workers health risk and environmental consideration, it is anticipated that costs burden of container purchase impinges prevalence of such practices in AMSS. Hence, it is foreseen that waste cardboard boxes and/or waste plastic recipients are utilized for intra-hospital separate collection and are stored in the designated red-color plastic containers. It is observed that those designated red-color plastic containers are reused. In case of such reuses of containers, they should be carefully and thoroughly disinfected each time.

b.5 Transfer Stations for Medical Waste

Transport using transfer stations is currently practiced in AMSS in order to make gain the efficiency of collection and transport works. It is foreseen that future increase of medical institutions that practice the separate discharge will require some new transfer stations of medical wastes.

Transfer station should satisfy the following requirements:

- Medical waste storage periods therein should be as short as possible;
- Fencing all around the site should be made in order to prohibit unauthorized access; and
- Storage works should take places only for the transfer purpose.

Large and clear sign of "infectious waste" should be indicated that all people concerned with the site could notice it. Handling procedures and precautions should also be indicated.

Storage places in the transfer station should have such structure that medical wastes stored do not scatter or spill, the floor should be waterproof to prevent infiltration to ground.

c. Appropriate Treatment System

c.1 Principles

The M/P recommends establish the medical waste incineration system as the action plan for the medical waste management. Its objective is to ensure the reliable

treatment for all medical waste generated in AMSS at all time. The medical waste incinerator will enable the reliable treatment that is continuously given to the all amount of the future increased medical waste. Meanwhile, on occasions of the MIDES autoclave breakdown, appropriate treatment of medical waste can be maintained.

The plan proposes 24 hours continuous operation for the medical incinerator to be capable of treating all generated amount of medical waste. When the incinerator is halted for such as periodical inspections and maintenance, the autoclave facility should substitute the medical waste treatment.

In future, it is expected that the present autoclave facility and the proposed incinerator should complement each other for the regional medical waste treatment.

c.2 Medical Waste Incineration Facilities

Incineration systems are diverse such as: stoker firing system (fixed grate or travelling grate); rotary kiln system; destructive gasifying system; fluidized bed system; etc. Meanwhile, incinerator operation systems are basically classified into the batch feed system and the continuous feed system.

Rotary kiln system is proposed herewith for the medical waste incineration in AMSS, in view of its advantages of easier operation and combustible wastes purview being wider. 24 hours continuous operation is proposed in order to avoid pollution problems of such as dioxins.

Technical specifications that the incinerator should comply with are as follows:

- The facility should be a fire resisting structure for maintaining more than 800ºC temperature at the main combustion chamber exit;
- The facility should have an auxiliary combustion equipment in order to rapidly raise the temperature at the main combustion chamber exit at more than 800ºC, and to be capable to maintain that temperature; and
- The facility should have the control of air supply to combustion chamber.

d. Japanese Experiences in Medical Waste Management

d.1 Provisions of Medical Waste Handling

In order to prevent infection accidents for medical professionals, patients and workers, the following are provided as regulations for medical waste handling:

- Medical wastes that are distinguished from general waste, should be categorized into: (i) liquid or semi-liquid medical wastes; (ii) solid medical wastes; and (iii) sharps, and be separately discharged respectively.
- Containers for the separate discharge should be: (i) airtight; (ii) easy to store; and (iii) durable.
- When infectious waste is deposited in the container, it should be sealed afterward.
- Containers for medical wastes and/or receptacles storing such containers should have warning sign of "infectious medical waste" and handling precautions.

- In order to prevent contents in containers being scattered or spilled during the intra-hospital transport, container with sealing lid should be used and transported by stable carts.
- Exclusive storage place for medical waste should be designated in the premise of institutions. Storage period should be as short as possible. Off-limits and warning signs should be indicated.
- With regard to the intra-hospital treatment, requirements are stipulated in the regulation in detail respectively for such as incineration, autoclave, chemical disinfection etc.

d.2 Intra-hospital Intermediate Treatment

It is a principle of medical waste management that infectious waste should receive intra-hospital intermediate treatment in a shorter time after its generation. Accordingly incineration used to become major intra-hospital intermediate treatment in Japan. However, due to problems of dioxin generation from old conventional incinerators, majority of medical institutions now suspends such incinerators' operation and entrusts the medical waste incineration for specialized contractors.

d.3 Contract-out

Medical institutions, as generators, are liable for the medical waste until the moment of its safe treatment/disposal. Therefore, a law in Japan decides that, in the case that medical institutions require to entrust the treatment/disposal, medical institutions should enter contract in writing, respectively with a transport contractor and a treatment/disposal contractor based on the model contract provided by the legislation. It stipulates that medical institutions can not have one contract for a package of transport to disposal of medical waste.

"Manifest" document should be used for handing the medical waste from generator to transporter, transporter to treatment/disposal agent. The document should contain the medical waste data such as its classification, quantity, characteristic, handling precautions, etc. Each party should reserve one copy of the "manifest" document for their confirmation and record. The disposal agent should return one copy to the medical institution to inform that the waste is appropriately disposed of. Furthermore, both the medical institution (waste generator as the starting point) and disposal agent (its destination) should submit another copy to the inspecting authority. In so doing, it enables to identify, in case of violation, who is the violator the transport contractor or the treatment/disposal contractor. It avoids indetermination of the default liable party that should be sanctioned.

d.4 Contract Works

As the law requires, medical institutions make separate contracts one with transporter and another with treatment/disposal agent. Whereas, there are many agents that have both business of transportation and treatment/disposal.

Majority of medical waste transporters in Japan has more than 100 clients (medical institutions).

Specification of collection containers is agreed between the transporter and the client, and the transport fee is normally set up with the unit rate per container, not by the quantity that requires measurement and its supervision every time.

Cool storage vehicles are employed for the transport in most cases.

Incineration is the most popular medical waste treatment in Japan, as it is generally accepted as the most reliable treatment system.

The most common incinerator operation is 24 hours continuous operation system, not the batch feed system, in view of pollution (e.g., dioxins) prevention.

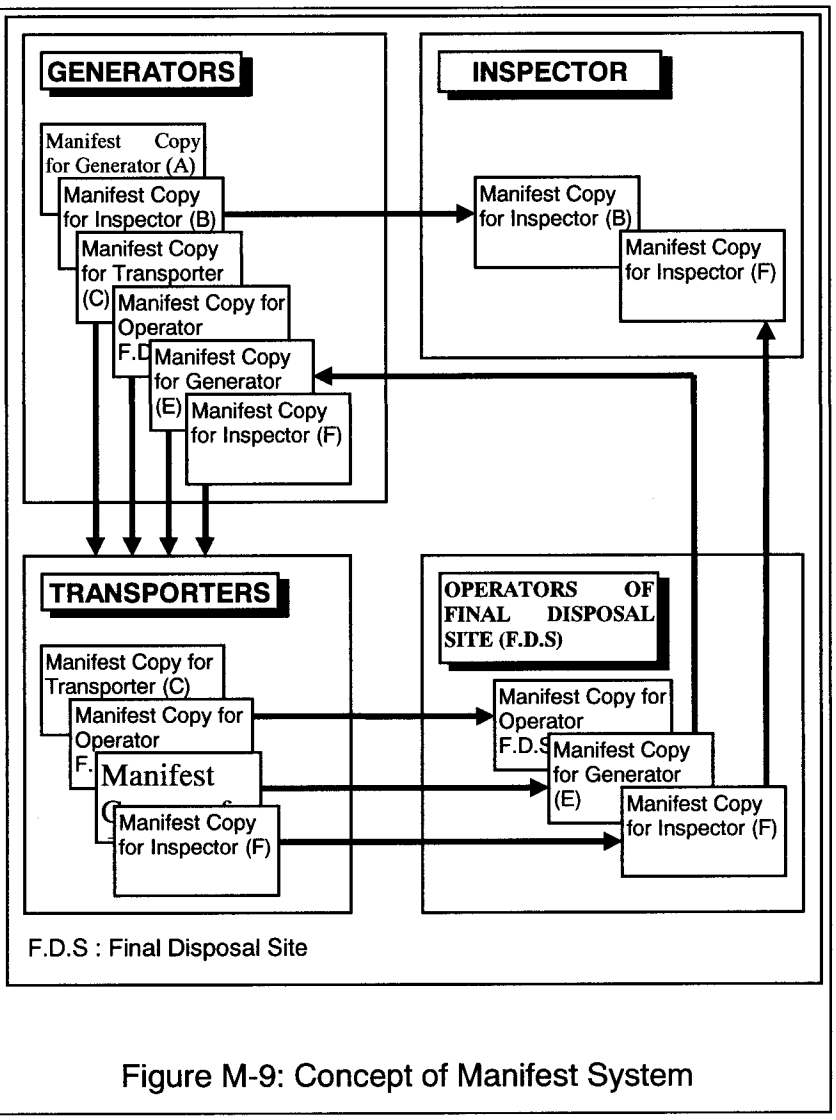

Figure M-9: Concept of Manifest System

Medical waste containers, without opening them, should be disposed in the incinerator in Japan, which consequently prevents the reuse of those medical waste containers.

e. Management of Hazardous Medical Solid Wastes

Intra-hospital management of hazardous solid wastes must be managed, operated and financed by each generation health establishment, be it from MSPAS, ISSS or the private sector.

As for collection, initial investment and operation can be conducted either by MSPAS or by a private specialized collection enterprise contracted. For both alternatives, financing of collection will be in charge of each health establishment from MSPAS, ISSS or the private sector.

For the incineration method proposed, initial investment and operation can be carried out by MSPAS or a private company contracted through a previous bid: For both alternatives, functioning of the incineration process will be in charge of each health establishment from MSPAS, ISSS or the private sector.

For each one of the above stages, supervision and control is in charge of MSPAS, as shown below.

Table M-26: Proposal of Hazardous Medical SWM

Component	Management
Intra-hospital management	Management, operation and financing: by each health establishment generator of such hazardous SW (health establishments of MSPAS, ISSS or private ones) Investment: by each health establishment generator Supervision and control: MSPAS
Collection	Management and operation: a) Directly by MSPAS b) Contract-out to specialized private company Financing of investment: a) By MSPAS b) By private collection company Financing of operation: by each health establishment generator Control and supervision: MSPAS
Incineration	Management and operation: a) Directly by MSPAS b) By private contracted-out enterprise Financing of investment: a) By MSPAS b) By private enterprise Financing of operation: by each health establishment generator, be it from MSPAS, ISSS or private Control and supervision: MSPAS

M.2.3 Institutional and Organizational System

M.2.3.1 Contract Administration[1]

a. Regulatory Base

The effectiveness in the administration of SWM services in AMSS, will depend on the compliance with current norms and the new regulatory and institutional framework proposed in the "Proposal of Law" (see Annex-O).

As a result of this new regulation, the responsibilities of the organizations that should take part in and the conditions for the participation by private sector are outlined, by means of appropriate and transparent procedures that ensure competition and attainment of economic prices.

The quality norms that should be observed and the incentives and sanctions to which the Contractor will be subject to according to its performance are proposed. Also, the information that the Contractor should submit and its submission period is also pointed out, with the purpose of maintaining a true symmetry in the information and avoiding information lag.

On these bases and competition rules previously established in the bid basis contained in the Contract, the required organization can be structured in order to follow up and control all the terms and scope of the subscribed contract.

[1] Details of this section (Contract Administration) are presented in Annex-N.

The contract administration unit should constantly and orderly manage the information that being produced, not only to control the Contractor's performance, but also to analyze the data obtained and be able to gain experience in productivity and costs and negotiate better conditions in the future.

b. Contracts, Effective Regulation and Role by the Organizations

The regulation economy suggests that specific details of each market (or regulation of the distinctive private markets) should be realized by means of the contract specifications.

Hence, with the purpose of improving efficiency and effectiveness in the service provision through the contract with a private sector, it is necessary to establish and adopt certain basic approaches:

- Well-defined performance measures
- obligatory sanctions for non-performance
- permanent monitoring
- costs control

Experience has demonstrated that PPS is successful only if the above basic conditions are complied with and the performance is compared with the productivity of a model company.

Table M-27: Recommendation for the Execution of the PPS Contracts

• Carry out a pre-qualification process to exclude the companies with no resources or experience • Increase the responsibility of districts and/or civil society organization in the supervision of contracts • Improve the quality of the contract documents, especially in the service quality norms, penalty clauses (fines) and amounts of SW handled • Establish the contract duration for 5-7 years for collection, and use new vehicles during that period. • Expand the contracts including all the SWM services (collection, manual and mechanical sweeping and ditch and gutter cleaning), in order to prevent any overlapping and potential responsibility conflicts with parallel municipal services being carried out. • Stress the fact that the Contractor maintains a good image and presence (e.g., obligatory use of uniforms, well-painted and clean vehicles) • Obligate the Contractor to have an office in the Service Area, so that the contact among the municipality, the service provider and the public improves.

The municipality must be able to efficiently design, negotiate and verify the contracts without having to impose unnecessary fines to the contractors, but generate confidence upon the private sector and attract the best companies.

The municipality should remind that PPS does not exempt them from having technical assistance for training and strengthening of its organization, but supporting them. Likewise, the municipality should develop coordination mechanisms with other actors that participate in the regulation of the service.

The function of the actors of this public service is properly defined in the Proposal of Law of **"Regulatory and Institutional Framework for Solid Waste Management"** that this Study recommends for the authorities' consideration.

This Proposal of Law establishes an effective regulation with the separation of functions among the Ministry of Public Health and Social Assistance (MSPAS), the Regulator (entity that is recommended to be created or render its regulation functions to SIGET) and the Service Provider, in this case the Municipality.

MSPAS will be in charge of the formulation and coordination of the sector policies and long-term planning; dictate the technical norms and regulations related to the provision of the service, protection of public health and environmental preservation.

The Regulator will have the functions of regulation, control, supervision and inspection of the services provided; to dictate the regulations to formulate efficient investment programs for maintenance, rehabilitation and expansion of the services. The regulator will also: intervene as a superior administrative body when clients complain about the services rendered or due to a lack of attention to such claims; oversee that competition is promoted in awarding contracts; revise and approve the tariff studies.

The Service Provider, in this case the municipality, has the obligation to provide the services under conditions that ensure their quality, continuity, regularity and equality so that their efficient provision is guaranteed. In order to comply with this responsibility, the municipality can modify its organizational structure and achieve participation by private sector through competitive bids.

c. Quality Norms and Contract-out Process

c.1 Quality Norms and Procedures for PPS

The quality norms and the procedures for PPP have been established for the rendering of the following services:

- Sweeping (manual)
- Sweeping (mechanical)
- Primary and secondary collection
- Transfer
- Final disposal through a national regulation project
- Forms of PPS
- Fixation of costs and competitive prices
- Participation by customers
- Control procedures
- Delivery of information

c.2 Pre-qualification

Pre-qualification has an objective of selecting the most competent and experienced companies, according to financial and technical requirements of the service to be contracted. Detail of the services to be contracted, contract-out modality, duration of the contract, regulation norms and quality of the requested services, required guarantees and insurance, form of payment should also be established.

An evaluation and qualification commission formed specifically for that purpose will give its judgement on a date established in advance, and the list of the participants that were pre-qualified will be published and communicated.

c.3 Bid

The Instructions to the Bidders will be sent to the pre-qualified participants, which will include the required and enough information for the preparation of their technical and economic offer.

The technical and regulation norms that rule the contract should be clearly established, since the best understanding between the Municipality and the Contractor during contract validity period will depend on the specificity of such norms. The norms will facilitate follow-up and control of the service quality and the information submission.

The Contract Specifications should be delivered, which consist of: definitions; scope of the contract; service, operations and performance; compensations; insurance; guarantees; permissions, licenses and taxes; bases and methods of payment. **Model of Contract Document** for the Solid Wastes Collection is attached in the Section **N.5** of the **Annex-N.**

d. Monitoring and Administration of Contracts

The performance review by the monitoring is a key element in the process of providing services of a good quality and at economical prices.

It is the process by which the service efficiency is monitored and compared with the parameters of quality agreed on in the Contract.

Data gathered should be processed in order to transform it into useful information. It should be reminded that the information itself is valuable only when if it is managed and used for a specific purpose.

d.1 Strengthening the Monitoring Performance

The analysis of the service status should be carried out along with the data obtained in a formal way and in accordance with a certain procedure. The following can lead to lamentable errors: data obtained by visual observations, comments by workers and/or customer claims; when considered exclusively to raise an opinion about the service status and quality. The service monitoring performance has numerous goals, such as the following:

Table M-28: Monitoring Performance

• Closely observe the quality of the services provided in order to maintain or improve the service quality
• Encourage efficient use of available resources
• Relate the expenditures with revenues and eventually costs
• First of all, improve the service quality and its relative costs
• Encourage the responsibility of the service providers
• Cut the service provision costs
• Compare and evaluate the services provided against the goals stated in the Contract
• Provide information with which the administration can work out policies and make decisions about the service.
• Compare the services provided for two or more municipalities.
• Compare the service received in a municipality month by month.
• Monitor the services provided by the Contractor in general

d.2 Definitions of the Performance Indicators

In order to determine the performance of SWM services in general, as well as individual components of the services in particular, data and information so called "performance indicators" and "performance measures" are used.

The "performance indicators" are quantitative data related with the services, such as:

- Number of served ICIs
- Kilometers of streets swept
- Number of employees in the collection

The "performance measures" are the result of processing the indicators while relating them to time or cost, and they represent the main tools for evaluating the performance of the system being analyzed. These are:

- Cost per collected ton
- Time of collection per ton
- Sweeping performance per day

d.3 Performance Indicators

Details of performance indicators that are recommended to be utilized for evaluating the service are shown herewith in the Annex-Q.

M.2.3.2 SWM Execution Unit of OPAMSS (UE-OPAMSS)[2]

a. Main Objective

In order to reach these goals and objectives, it is necessary that the municipal authorities that conforms COAMSS, should make the political decision of establishing a **Regional Solid Waste Program for AMSS** whose serious objective would be the implementation of the Master Plan. The programming of this plan has duration of ten years (2000-2010).

The development of said Program requires having a formal and permanent structure that supports the municipalities so that they can make it effective.

For such a purpose, the creation of an **Execution Unit of Solid Waste Management of OPAMSS (UE-OPAMSS)** is proposed, and whose aims would be the following:

- To act as a specialized body for supporting the provision of the solid waste management service for AMSS
- To participate in the urban development planning of AMSS in its areas of jurisdiction
- To coordinate the activities of technical support and international financing
- To provide the necessary technical support to the municipalities of AMSS, so that the provision of solid waste management services can

[2] Details of UE-OPAMSS proposed are presented in Annex-P.

reach the goals and objectives established in the Master Plan.

- To promote the formation of Communal Associations for Cleansing in the neighborhoods of AMSS.
- To have consent among public and municipal interests, private activities and the communities in SW generation reduction programs and recycling
- To verify the compliance with the norms, ordinances, laws and regulatory framework.
- To advise the municipalities in the selection of the most convenient modality for the participation by private sector in the provision of services.

It should be noted that the Unit is not to deprive the municipalities of their works regarding SWM, but to support and help them.

b. Functional Structure

The functional structure proposed for the SWM Execution Unit of OPAMSS is as presented in the figure below.

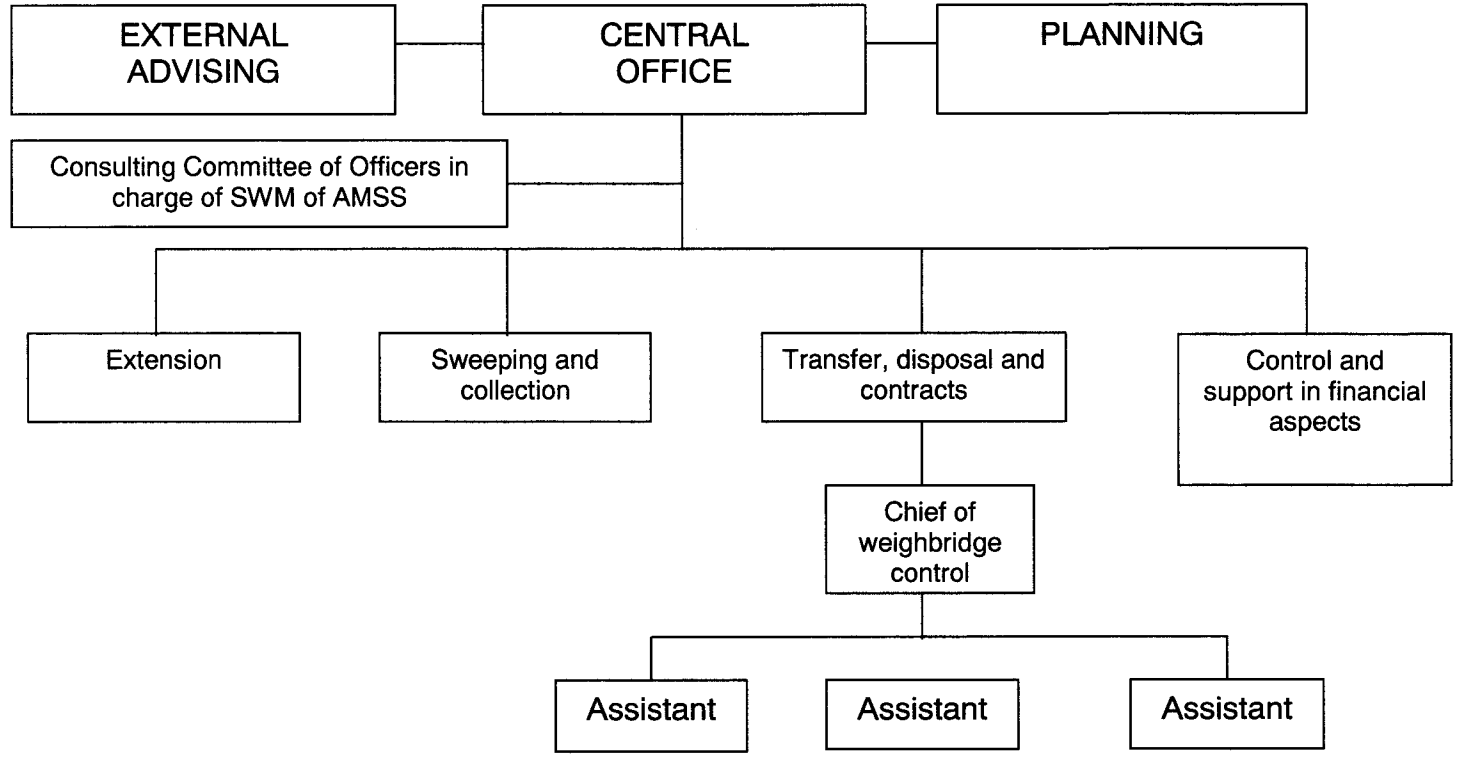

Figure M-10: Functional Structure of SWM Execution Unit of OPAMSS

c. Description of Functions

c.1 Central Office

It constitutes the executive body of the Execution Unit and will be in charge of a professional sanitary engineer or an administrator, with a minimum five-year experience in solid waste management. It will be the entity that responds on the conduction and steering of the Program and will also represent the Execution Unit. It will depend directly from OPAMSS Executive Direction.

c.2 Planning and Development

It generates the medium and long-term technical project of the Execution Unit and it designs their development. The Central Office will be in charge of it.

c.3 External Consulting

With the initial purpose of consolidating the Execution Unit and developing its human and technical resources, having an external consulting for a minimum of two years becomes necessary. The efforts devoted to improve the service on the basis of foreign help in terms of equipment and vehicles have shown limited results. This is mainly due to the lack of experienced and motivated human resources to assist the planning, operation and monitoring of the services activities, as well as the operation, maintenance and repair of damaged equipment for the collection and final disposal.

Hence, by considering the possibility of PPS in the rendering of collection, transfer and sweeping services, this does not mean that the public sector is exempted from its responsibility. On the contrary, having a professional and trained staff to plan, supervise and monitor the quality of the contracted service and achieve economical prices will be more necessary. A professional civil or sanitary engineer with a minimum international experience of fifteen years will be in charge of it.

c.4 Consulting Committee of Municipal Officers

The officers in charge of SWM services in the 14 municipalities of AMSS will create a consulting committee with the purpose of coordinating the activities they carry out in a regional manner.

c.5 Extension

It promotes, establishes and maintains the public participation and collaboration in the activities of the Execution Unit. Organized public participation is of vital importance in order to achieve the sustainable development of the service.

It is necessary to promote a prideful attitude and self-esteem in the entire population in general, but very especially among downtown pedestrians and in marginal, low-income urban areas. Little will be achieved with the application of the best engineering and administration practices if population does not participate nor collaborate by all means. 50% of the success depends on public participation. A health promoter with five-year experience will be in charge of it.

c.6 Collection and Sweeping

It has the mission of advising the municipalities in the management of the services they render, so that they meet the qualified and efficient conditions at economical and environmentally acceptable prices. It will coordinate and control the activities of

storage, collection, sweeping (manual and mechanical), haulage and maintenance and repair of equipment and vehicles. It will be under the conduction of a civil or sanitary engineer with at least five-year experience in solid waste management.

It will also analyze the participation of micro-enterprises in the provision of services.

Micro-enterprises can cover the collection services in marginal, low-income areas where it is difficult to use collection vehicles due to urban layout and slopes reasons. These micro-enterprises should be organized with the participation of residents of the place where such service is provided. There are many successful experiences in Latin America (Peru, Bolivia and Colombia). The system uses non-conventional low-cost tools and vehicles. In general, they are in charge of the service by means of a regulated concession; i.e., a fee rate is established and the concessionaire charges it to the user directly.

The sweeping service can also be endowed to this modality of PPS. It is convenient that the micro-enterprises are formed with legal status in order to be subject to credit.

This section will be in charge of the promotion and relationships with the collection and sweeping micro-enterprises. The institution would place the necessary containers and be in charge of haulage and final disposal, as well as of the promotion, planning and technical assistance.

c.7 Transfer, Final Disposal and Contracts

To inspect and audit whether the operation of transfer station(s) (T/S) comply with the established service quality norms and with the management and environmental impact plan, as well as to keep the corresponding registrations.

To ensure that the disposal of municipal SW at the sanitary landfill in Nejapa and/or another sanitary landfill is environmentally acceptable by means of the correct operation of the service. It will be in charge of a civil or sanitary engineer with five-year experience.

The weights of the SW that enter Nejapa sanitary landfill will be controlled by full-time municipal officials.

Advising through the entire process for contract-out to the private sector and administration of the corresponding contracts.

c.8 Support in Financial Aspects

Advice for the control of the activities linked to the economy and finances of the SWM services; analysis and confirmation of the financial position.

Advice for the generation of municipal income through identification and classification of customers; calculation of the volume produced by ICI (Institutional, Commercial and Industrial) customers to achieve a fair and equitable allocation of service costs; billing and collection for the SWM services provided.

Advice and processing of whatever information is required which will be used to support and assist the municipalities in AMSS.

Table M-29: Required Personnel for the Execution Unit

Position	Qualification	Number
Central Office	Civil or sanitary engineer Seven (7) year experience in SWM	1
Planning and Development	In charge of the Central Office	---
External consulting	Civil or sanitary engineer Fifteen (15) year international experience in SWM	1
Extension	Public health promoter Five (5) year experience	1
Collection and sweeping	Civil or sanitary engineer Five (5) year experience in SWM Sweeping and collection	1
Transfer, final disposal and contracts	Civil or sanitary engineer Five (5) year experience in SWM Transfer, sanitary landfills and contracts	1
Administration and Finances	Administrator Seven (7) year experience	1
Weighbridge control	Administrative experience 1 chief and 3 assistants	4

M.2.3.3 San Salvador Municipal Public Company of Urban Cleansing (EMAUSS)[3]

a. Proposed New Administration and Organizational System

The proposed municipal public company will be entirely administratively and financially autonomous, and will have the purpose of achieving an integrated municipal solid waste management in the Municipality of San Salvador.

b. Proposed Organization for Implementing Waste Management

The administrative structure for the new proposed municipal company (EMAUSS) is shown in Figure M-11. It is very similar to a private company with the same degree of independence and autonomy; all its features are within the judicial framework established by the laws of the Republic of El Salvador for public companies.

[3] Details of EMAUSS proposed are presented in Annex-Q.

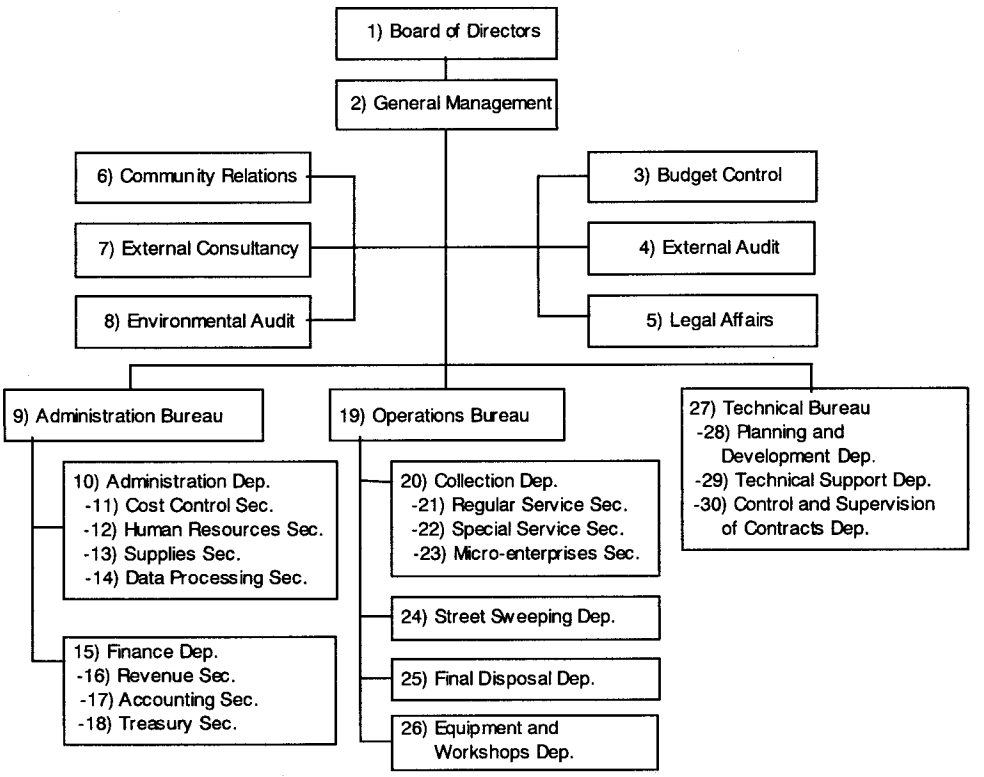

Figure M-11: Proposed Administrative Structure for the Municipal Company

c. Description of Roles and Functions

The structure proposed to manage the municipal company is designed to be in conformity to service needs. If all the operations are to be provided using its own equipment and personnel, enough human resources and materials should be provided; this will ensure duties are performed smoothly (see Table M-30). On the other hand, if services all or a part of are to be contracted to private sector there should be a proportional decrease in human resources and materials. In this sense, the Operations Bureau's operational level would be reduced to a minimum which would ensure services to a small sector and be free to counter emergency cases. On the other hand, the Department for Control and Supervision of Contracts would be strengthened.

In the Administration Board, all the sections' activities would be concentrated under the Department of Administration and Finances.

Table M-30: Personnel Table

Ref. No	Position	Qualification	Number
1)	Board of Directors	Representatives	7
2)	General Management	Civil or Sanitary Engineer (more than 10 years experience)	1
3)	Budget Control	Economist or Business Administrator	1
4)	External Audit	Contracted out	-
5)	Legal Affairs	Lawyer	1
6)	Community Relations	Public Relations Person to answer complains by phone	1 2
7)	External Consultant	Expert on International Cooperation	-
8)	Environmental Audit	Contracted out	-
9)	Administration Bureau	Chief Business Administrator	-
10)	Administration Department	Business Administrator	1
11)	Cost Control Section	Statistician	1*
12)	Human Resources Section	Sociologist	1*
13)	Supplies Section	Supplier	1*
14)	Data Processing Section	Programmer (System Engineer)	1*
15)	Finance Department	Public Accountant	
16)	Revenue Section	Public Accountant	1
17)	Accounting Section	Accountant I	1*
18)	Treasury Section	Accountant II	1*
19) 20) 21) 22)	Operations Bureau Collection Department Regular Service Section Special Services	Civil or Sanitary Engineer (5 years experience)	1
23)	Micro-enterprises Section	Social Promoter (PR Manager)	1
24)	Street Sweeping Department	Engineering Technician	1*
25)	Final Disposal Department	Civil or Sanitary Engineer	1*
26)	Equipment and Workshops Department	Mechanical Engineer	1*
27) 28)	Technical Bureau Planning and Development Department	Civil or Sanitary Engineer (5 years experience)	1
29) 30)	Technical Support Department Control and Supervision of Contracts	Civil or Sanitary Engineer (3 years experience)	1 (1)

Notes: * Personnel who will not be needed if most of the services are contracted out to the private sector. Their functions will be assigned to the respective director.
Control and Supervision of contracts would be strengthened with a professional with more experience.

d. Revenue Control System

The control of revenue is one of the most important functions to achieve the management of a financially sustainable EMAUSS.

Information Flow

Figure M-12 shows the information flow of routine work.

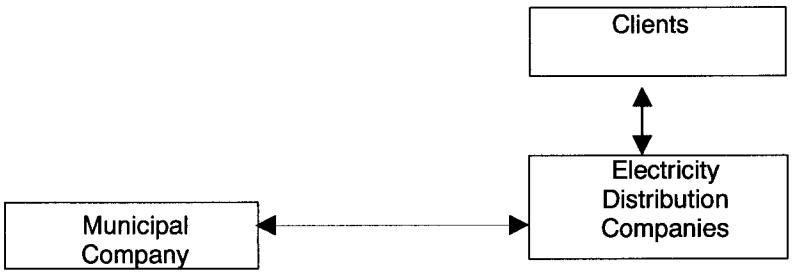

Figure M-12: Information Flow Diagram of Waste Fee Collection

Database

In order to control the revenue effectively, an information system based on following database should be developed.

- Household Customer Database
- ICI Customer Database
- Database of Large Dischargers and Those who Directly Transport

Reporting System

In order to act against non-payment of fees and to improve SWM services, the reporting system should be established.

e. Expenditure Control System

In order to have a financially sustainable management system, the overall service costs must correspond to the expected revenue. The Expenditure Control System should therefore consider the following functions:

- Prior approval for requests to acquire goods and services.
- Control the use of the budget.
- To achieve better conditions for acquisition.
- To record expenses in an organized manner in order to establish an effective control on costs per activity
- To control the quality and certify execution of contracted services; to authorize payments and to impose sanctions.

The Operation Department will assess the activities' efficiency by using Performance and Productivity indicators. Success will be measured by the amount of proposed technical goals reached in relation to the expenses spent.

Information Flow

The information flows are shown in the following figures: Figure M-13 "Acquisitions", Figure M-14 "Hiring Personnel", and Figure M-15 "Contracts to the Private Sector".

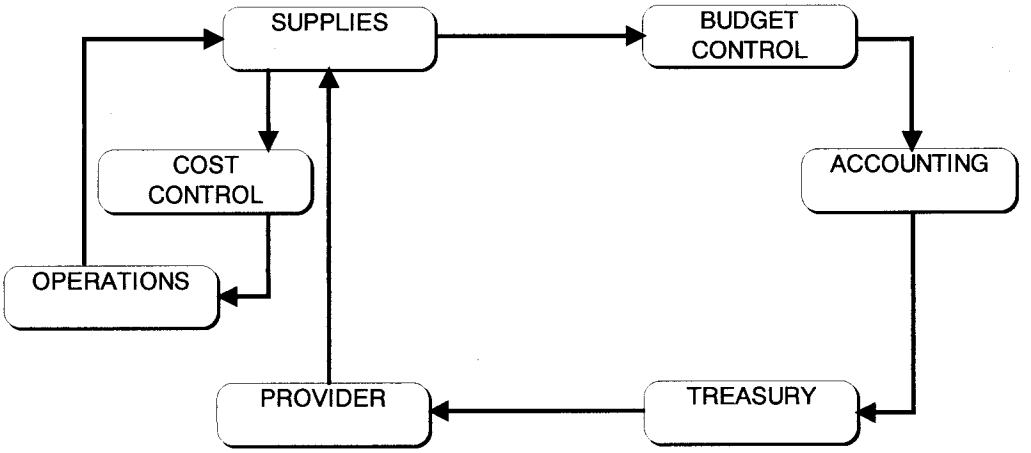

Figure M-13: Expenditure Control System; Information Flow for Making Acquisitions

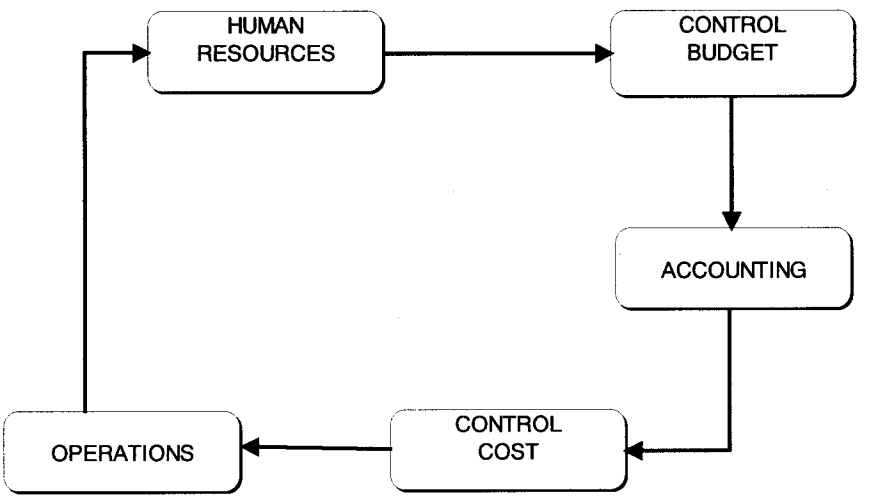

Figure M-14: Expenditure Control System; Information Flow to Hire Personnel

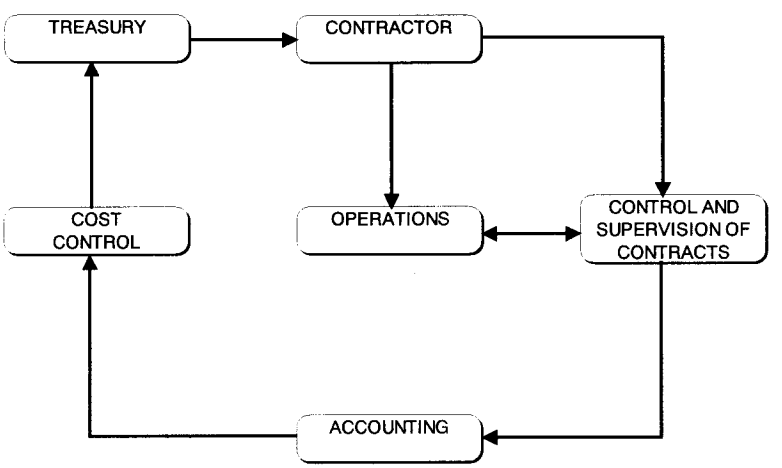

Figure M-15: Expenditure Control System; Information Flow to Control and Supervise Contracts

Recording Information

In order to effectively control expenditure, an information system should be developed which should include the following data base.

- Acquisitions
  - Capital Goods
  - Consumable Goods and Materials
- Personnel
- Services Contracted
- Reports

f. Contract Systems

f.1 Requirements for the Introduction of the Participation by Private Sector

Before the private sector can participate in the operation of solid waste services, the following conditions should also be satisfied.

- A collection and haulage system should be designed.
- A street sweeping system should be designed.
- Transfer station.
- Equipment and workshops should be strengthened.
- A system to control revenues should be established.
- A system for monitoring and supervision should be established.

Design for the Collection and Haulage System

- Urban area
- Marginal area

These designs should include the following:

- An even selection of routes, frequencies, and schedules.
- Define the number and type of vehicles, equipment, and containers.
- Determine the operational costs.
- Training for personnel involved in technical and operational aspects.

Design for the Street Sweeping System

This design should include:

- Street sweeping routes, frequencies, and schedules.
- Formation of crews.
- Location of sweeping offices (warehouses).
- Definition of operational costs.
- Promotion and establishment of small workers' organization (micro-enterprises) in order to provide the service by themselves.
- Training for micro-entrepreneurs.
- Training for technical personnel.

Equipment and Workshop Strengthening

It is necessary to integrally reorganize the Preventive and Corrective Maintenance System for equipment and machinery in the Cleansing Office.

Currently, there are neither maintenance programs nor indispensable spare parts in stock; acquisitions are made just when the equipment breaks down and then only following a long bureaucratic process (30 to 60 days).

Establishment of a System to Control Revenues

It is important that enough funds should be provided for municipal company's operation and contracted operation on a timely basis to ensure the success of this service.

Establishment of a System for Monitoring and Supervision

Permanent control and monitoring on service quality and performance will bring about public support and loyalty to the municipal company.

f.2 Guidelines and Specifications

In order to create the best conditions for contracts, it is necessary to pre-establish (in a transparent manner) bidding and contracting procedures that will be used. The following should be considered.

Open Competition

It is the most important factor and consists of cost reduction and introduction of the best technologies and procedures.

Precise Specifications

Technical specifications and legal requirements will be presented to the bidders in a very precise manner. An opportunity will be given to answer all questions. A draft contract will be attached.

Pre-qualification

It is advisable to set minimum requirements that bidders should satisfy such as experience in similar works, technical support, and financial capacity.

Scope of Works

Bidders should know the exact scope of works required and quality and level of service required for the contract.

f.3 Service Level and Quality

Bid base and, subsequently, the contract should establish the level and quality of service. Differences can be established based on the type of service, urbanization, and economic level.

Standards related to storage and discharge manner will be defined; these standards should be satisfied by all MSW generators. Standards related to collection, sweeping, transportation, and final disposal should also be respected by contractors.

g. Quality Control System

The information system to monitor and control is an important resource to verify and improve SWM tasks. Most of the services are repetitive, with small variations from time to time and with special services upon request. Planning and design for these

tasks and final evaluation of services make up the quality control system (Figure M-16).

First, guidelines and quality levels that need to be attained (parameters) should be defined; also, procedures to be followed and activities to be monitored should be determined. This information should be provided to the general public, municipal company's workers, and contractors.

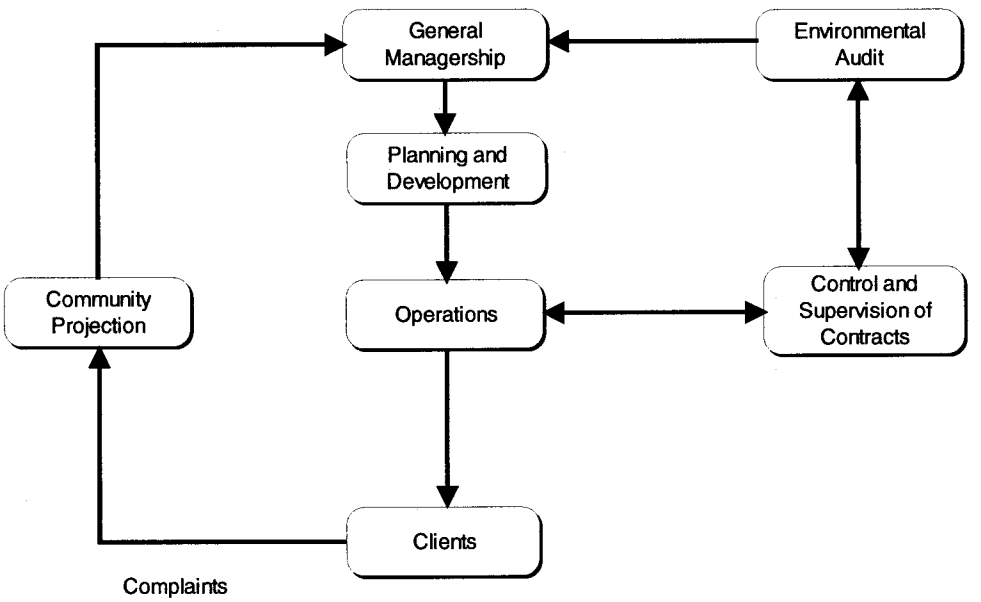

Figure M-16: Quality Control, Monitoring and Supervision System

h. Human Resources Development System

The improvement of public services requires the continuous development of strength and skills of the service providers. This basic concept shows two objectives on training human resources. The first is to instill a sense of pride in the public servants toward their work so that they develop a positive attitude and gain public trust for the municipal company. The second is to provide the public servants with necessary skills to improve their work and to ensure a cleaner environment which is comfortable for their citizens.

In order to attain those objectives, it is necessary that the municipality's legislative council approves a new institutional structure and selects appropriate personnel who will provide the services.

It consists of three training courses

- Public Affairs;
- Operations; and
- Support Services.

h.1 Public Affairs

Training on public affairs will help develop morale and good sense to help their community as a group. In this category, there are six classifications that are considered as groups.

Course for New Public Servants

It targets newcomers to the public company, such as administrators, engineers, operators, drivers, etc. They are instructed on institutional activities and indispensable issues about their duties with the objective that they can adapt quickly to their assignments.

Course for Heads of Departments and Sections

It targets directors and chief engineers. It provides them with knowledge and special skills to take care of administrative aspects of their assignments.

Course for Supervisors

This course is aimed at group leaders and sub-leaders directly in charge of supervision on field operations. It helps them to develop skills to face and solve situations and problems that may arise during operations under their supervision.

Course for Directors

This training will be for directors; the objective is to help them with their activities and help them to solve problems at the institutional and governmental level.

Public Relations

This course provides public servants with basic knowledge to help develop better manners that should be used to communicate with and to welcome all citizens. The public servants' behavior reflects the quality of the municipal company to the citizens.

Prevention of Criminal Acts

This course is directed to public servants to help them acknowledge the moral and ethical duties that they should undertake as public officials. This course will deal with the manners in which they should behave and how they should react when they encounter criminal and corrupt activities. Topics are such as alcoholism, non-work related personal activities during office hours, tardiness, unjustified absences, corrupt activities such as sale or unauthorized removal of goods and materials belonging to the institution (oil, tires, batteries, spare parts, use of vehicles), accepting bribery in exchange for leniency towards transgressors, giving favors in contracts or purchases, etc.

h.2 Operations

The specific objective is to provide the municipal company and the personnel with technical and operational skills to improve the SWM services in the following areas.

- Collection and haulage in urban and marginal areas
- Cleansing of roads and public areas
- Sanitary landfill operation
- Planning and development
- Control and monitoring
- Administration and finances
- Community relations
- Environmental education