3 Current Situation of Solid Waste Management

3.1 Field Survey

Field surveys are crucial to analyze the current situation of the municipal SWM in the Study Area. The data obtained in the surveys become basic information to formulate the M/P. This chapter presents objectives, methods, results and findings of the field surveys conducted in the Study Area in January and February 2000. Those are;

- Waste Amount and Composition Survey (WACS),
- Public Opinion Survey (POS),
- Time and Motion Survey (T&M),
- Recycle Market Survey, and
- Medical Waste Survey.

3.2 Service Projected Population

As for the present population of the Study Area, appropriate data does not exist. An estimated population by the Statistic and Census Department, Ministry of Economy ("Proyección de la Población de El Salvador") is one of reliable data as same as the estimated population in the country.

The population in the columns of "urban" in the table is defined as "service projected population".

Table 3-1: Estimated Population in the Study Area in 1998 and 1999

No.	Municipality	1998			1999		
		Urban	Rural	Total	Urban	Rural	Total
1	San Salvador	467,006	0	467,006	473,374	0	473,374
2	Mejicanos	180,775	0	180,775	185,204	0	185,204
3	Ciudad Delgado	145,189	0	145,189	149,394	0	149,394
4	Cuscatancingo	85,825	0	85,825	90,079	0	90,079
5	Ayutuxtepeque	26,216	10,028	36,244	28,000	10,158	38,158
6	San Marcos	68,685	0	68,685	69,660	0	69,660
7	Nueva San Salvador	133,461	13,820	147,281	138,723	14,000	152,723
8	Antiguo Cuscatlán	40,515	0	40,515	42,773	0	42,773
9	Soyapango	282,066	0	282,066	283,598	0	283,598
10	Ilopango	122,309	0	122,309	127,434	0	127,434
11	San Martín	66,861	27,726	94,587	73,000	28,086	101,086
12	Apopa	155,588	0	155,588	163,974	0	163,974
13	Nejapa	14,464	16,255	30,719	15,000	16,466	31,466
14	Tonacatepeque	27,640	10,731	38,371	29,000	10,871	39,871
Total population		1,816,600	78,560	1,895,160	1,869,213	79,581	1,948,794

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

3.3 History of Solid Waste Management

San Salvador Metropolitan Area has had an intensive activity regarding solid waste management, and because of their background deriving from the Spanish colonization, the cities preserve their customs. Therefore, it can be said that the responsibility of cleansing duties has belonged to the municipalities since the colonial age. In recent years, the cleansing service has been operated both by private entities and the municipality, with good experiences that unfortunately have not been taken advantage of.

In 1989 the Japanese government donated 56, 16yd^3 compactor trucks and 8 container lifter trucks, 94 7yd^3 containers and 6 D6H Carterpillar tractors with special blades for sanitary landfills, which were evenly distributed among 12 municipalities in the metropolitan area.

Table 3-2: Collection Coverage in the Urban Area in 1992 and 1996

Municipality	Municipal service 1998[1] %	Private service 1998[1] %	Total 1998 %
San Salvador	80.57	0.57	81.14
Mejicanos	65.63	19.27	84.90
Delgado	71.00	4.00	75.00
Cuscatancingo	70.97	0.54	71.51
Ayutuxtepeque	66.67	0.00	66.67
San Marcos	63.69	1.12	64.81
Nueva San Salvador	67.06	26.47	93.53
Antiguo Cuscatlán	92.11	0.00	92.11
Soyapango	82.11	12.63	94.74
Ilopango	40.12	9.88	50.00
San Martín	52.63	12.72	65.35
Apopa	72.73	0.00	72.73
Nejapa	52.66	0.00	52.66
Tonacatepeque	NA	NA	NA
Total	67.09	6.75	73.84

Source: [1] DIGESTYC, *Encuesta de hogares de propósitos Múltiples 1998.*
NA: Not available

In 1993 the Executive Secretariat of Environment (which would eventually become MARN in 1998), with the collaboration of the municipality of San Salvador and the Ministry of Health made a request to the Japanese government for the donation of collection trucks, which was accepted by the government of Japan. Therefore, in 1996 the Japanese government donated: three (3) 25yd^3 compactor trucks; 60Nos 18yd^3 compactor trucks; 21Nos 11yd^3 compactor trucks; and 189Nos 2.0m^3 containers.

The 14 municipalities belonging to COAMSS begin a search of final disposal alternatives, as the Mariona site was about to be closed. Different alternatives were received, of which two were chosen and eventually the environmental-friendly choice

that was closer to the integral management was selected[3]. From that moment, due to political and economic reasons, four municipalities did not longer continue with the project, reason why only 10 Mayors of COAMSS signed in November 1997 the agreement of concession of haulage and final disposal of wastes with the Canadian company CINTEC INC, which offered financing. Therefore, the 10 municipalities and the company formed a mixed enterprise known as *Sociedades de Economía Mixta* and called MIDES SEM de CV, in which 10% of the shares were owned by the municipalities and the rest to CINTEC INC. Within the agreement reached there was the construction of a modern sanitary landfill that meet the highest technical specifications such as geomembranes, leachate treatment and not receiving medical or industrial waste, as well as the construction of a transfer station furnished or not with a separation facility; all the aforementioned should be ready in no more than a 5-year period.

On May 3rd, 1999 the sanitary landfill was opened, which was located north of the municipality of Nejapa. The cost per ton received was US$18.00 + 13% V.A.T. The enterprise has also acquired a land in the municipality of Apopa, 5 km to the south of the former Mariona dumping site to build the transfer station.

[3] Integral management should be understood as that integrating all the stages in the management and the financial-economic part.

3.4 Waste Stream

The waste stream was formulated on municipal SW and medical waste.

3.4.1 Municipal Solid Waste

Figure 3-1 shows the present waste stream in the Study Area, and details are tabulated in Table 3-3.

The present waste stream was obtained from "Waste Amount and Composition Survey (See Table 3-4)," "Interview Survey at Generation Sources" and "Analysis of existing disposal amount data (weighing data at Mariona disposal site) (See Table 3-5) ."

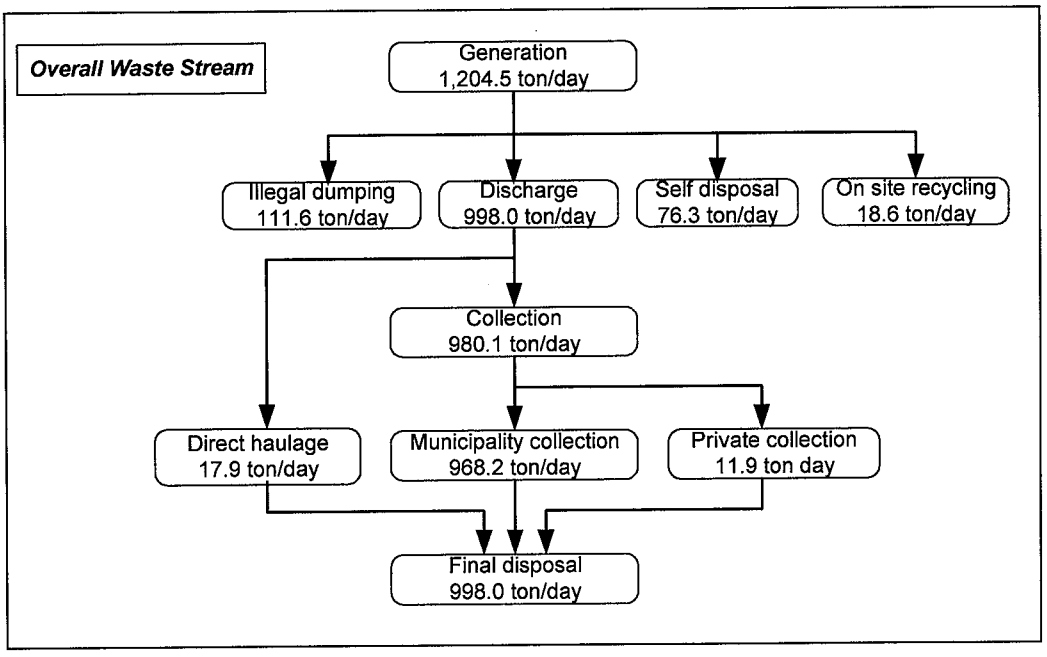


Figure 3-1: Overall Waste Stream in 1998

Table 3-3: Waste Stream in 1998

	Generation	Collection			Direct haulage	Final disposal	Final disposal ratio (%)	Without collection			
		Municipality	Private	total				Total	Illegal dumping	Self disposal	On-site recycle
Unit : ton/year											
San Salvador	206,391	162,907	38	162,945	1,826	164,771	79.8	41,619	22,474	15,399	3,746
Mejicanos	28,119	24,216		24,216	247	24,463	87.0	3,656	1,974	1,353	329
Delgado	12,101	10,576		10,576	0	10,576	87.4	1,525	824	564	137
Cuscatancingo	10,292	8,996		8,996	0	8,996	87.4	1,296	700	480	116
Ayutuxtepeque	4,040	3,532		3,532	0	3,532	87.4	508	275	188	45
San Marcos	12,376	10,813		10,813	4	10,817	87.4	1,559	842	577	140
Nueva San Salvador	34,011	26,670	2,987	29,657	32	29,689	87.3	4,322	2,334	1,599	389
Antiguo Cuscatlan	18,300	14,471		14,471	698	15,169	82.9	3,131	1,691	1,159	281
Soyapango	58,627	43,234	1,299	44,533	3,406	47,938	81.8	10,689	5,772	3,955	962
Ilopango	17,368	14,853		14,853	299	15,151	87.2	2,217	1,197	820	200
San Martin	9,605	8,395		8,395	0	8,395	87.4	1,210	653	448	109
Apopa	18,145	15,831		15,831	26	15,857	87.4	2,288	1,236	847	205
Nejapa	1,903	1,653		1,653	0	1,653	86.9	250	135	93	22
Tonacatepeque	8,352	7,300		7,300	0	7,300	87.4	1,052	568	389	95
Total	**439,630**	**353,447**	**4,324**	**357,771**	**6,536**	**364,306**	**82.9**	**75,323**	**40,675**	**27,871**	**6,777**
Unit : ton/day											
San Salvador	565.5	446.3	0.1	446.4	5.0	451.4	79.8	114.1	61.6	42.2	10.3
Mejicanos	77.0	66.3	0.0	66.3	0.7	67.0	87.0	10.0	5.4	3.7	0.9
Delgado	33.2	29.0	0.0	29.0	0.0	29.0	87.4	4.2	2.3	1.6	0.3
Cuscatancingo	28.2	24.6	0.0	24.6	0.0	24.6	87.4	3.6	1.9	1.3	0.4
Ayutuxtepeque	11.1	9.7	0.0	9.7	0.0	9.7	87.4	1.4	0.8	0.5	0.1
San Marcos	33.9	29.6	0.0	29.6	0.0	29.6	87.4	4.3	2.3	1.6	0.4
Nueva San Salvador	93.2	73.1	8.2	81.3	0.0	81.3	87.3	11.9	6.4	4.4	1.1
Antiguo Cuscatlan	50.1	39.6	0.0	39.6	2.0	41.6	82.9	8.5	4.6	3.1	0.8
Soyapango	160.6	118.4	3.6	122.0	9.3	131.3	81.8	29.3	15.8	10.8	2.7
Ilopango	47.6	40.7	0.0	40.7	0.8	41.5	87.2	6.1	3.3	2.3	0.5
San Martin	26.3	23.0	0.0	23.0	0.0	23.0	87.4	3.3	1.8	1.2	0.3
Apopa	49.7	43.4	0.0	43.4	0.1	43.5	87.4	6.2	3.4	2.2	0.6
Nejapa	5.2	4.5	0.0	4.5	0.0	4.5	86.9	0.7	0.4	0.3	0.0
Tonacatepeque	22.9	20.0	0.0	20.0	0.0	20.0	87.4	2.9	1.6	1.1	0.2
Total	**1,204.5**	**968.2**	**11.9**	**980.1**	**17.9**	**998.0**	**82.9**	**206.5**	**111.6**	**76.3**	**18.6**

Table 3-4: Waste Generation Ratio

Source		unit	Generation ratio
Household waste	High income	g/person/day	600
	Middle income		540
	Low income		420
Commercial waste	Restaurant	g/seat/day	466
	Others	g/employee/day	482
Institutional waste		g/employee/day	196
Market waste		g/stall/day	1,674
Street sweeping waste		g/m/day	198

Table 3-5: Weighing Data at Mariona Final Disposal Site (1998)

Unit: ton/year

Collector	City	Market	Household	Commercial
Municipality collection	01SS	18,014.2	139,399.3	5,493.8
	02MJ	227.4	23,988.8	0.0
	03CD	15.0	10,560.8	0.0
	04CT	0.0	8,995.9	0.0
	05AY	0.0	3,531.6	0.0
	06SM	5.8	10,807.6	0.0
	07ST	197.6	26,469.6	3.1
	08AC	0.0	14,471.3	0.0
	09SY	0.0	43,231.1	2.4
	10IL	0.0	14,852.8	0.0
	11SMT	0.0	8,395.0*	0.0
	12AP	15.8	15,814.9	0.0
	13NJ	0.0	1,648.2	4.7
	14TN	0.0	7,300.0*	0.0
	total	18,475.8	329,466.9	5,504.0
Direct haulage	01SS	16.4	1,011.5	798.0
	02MJ	24.5	179.7	42.3
	03CD	0.0	0.0	0.0
	06SM	0.0	3.6	0.0
	07ST	0.0	24.4	7.2
	08AC	13.6	321.2	362.8
	09SY	20.7	1,935.1	1,450.0
	10IL	2.2	283.9	12.4
	11SMT	0.0	0.0	0.0
	12AP	0.0	25.8	0.5
	13NJ	0.0	0.0	0.0
	14TN	0.0	0.0	0.0
	total	77.40	3,785.20	2,673.20
Private Contractor	01SS	0.0	37.9	0.0
	07ST	0.0	2,986.7	0.0
	09SY	0.0	1,299.0	0.0
	total	0.00	4,323.60	0.00
Total (ton/year)		18,553.20	337,575.70	8,177.20

Note: * data from hearing survey, sources: San Salvador Municipality

3.4.2 Medical Waste

Figure 3-2 shows the present medical waste stream in the Study Area. was formulated based on the following surveys and analysis:

Results obtained from Medical Waste Survey were shown in Table 3-6, Table 3-7 and Table 3-8. Besides the results, taking into account the weighing data at Mariona disposal site, medical waste generation amount in the Study Area was estimated to range from 2.9 to 3.4 ton/day. This study employs the mean value 3.2ton/day for estimating the medical waste stream in AMSS.

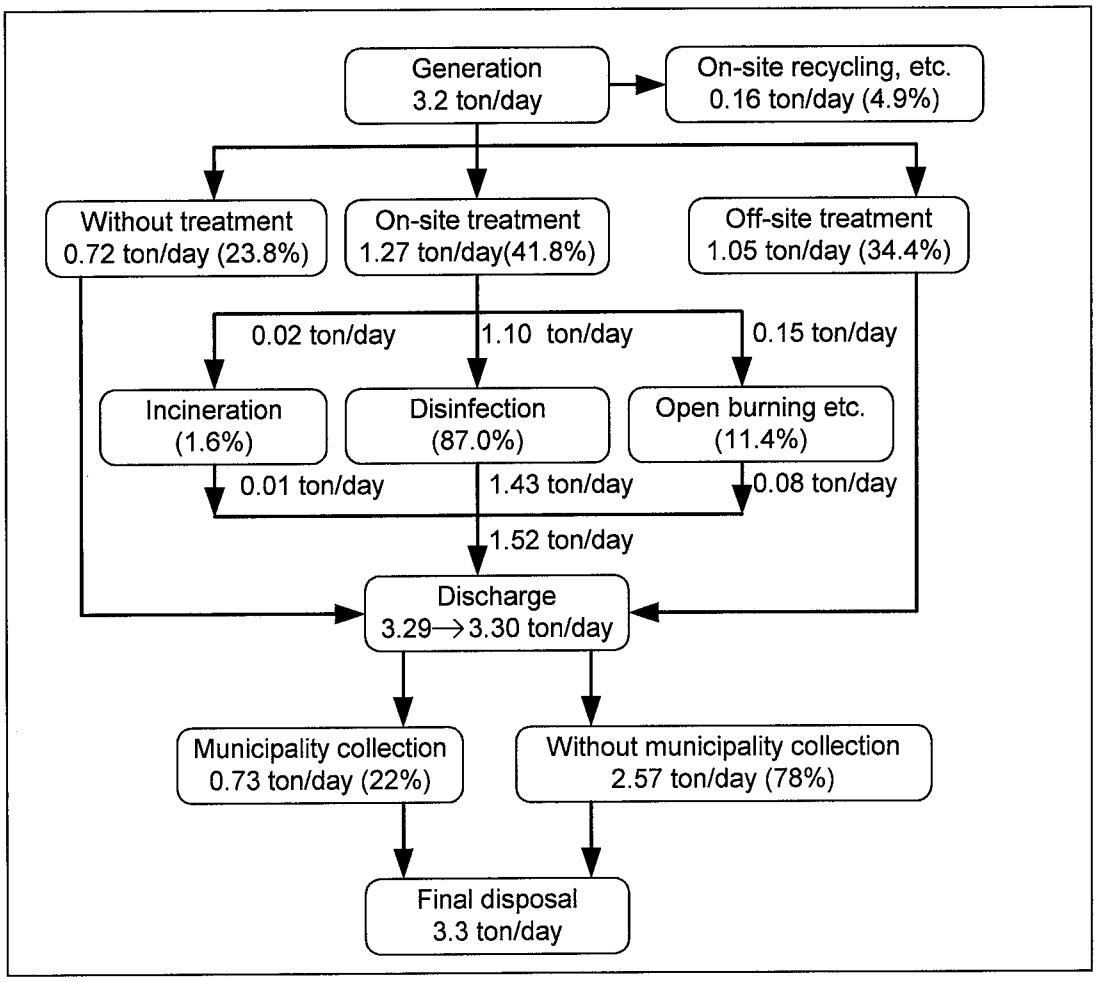


Figure 3-2: Present Medical Waste Stream

Table 3-6: Waste Generation Ratio

Category	Item	MSPAS 1999	JICA Study (MWS)
I (more than 200 beds)	Waste generation ratio (kg/bed/day)	0.652	0.553
II (50 to 200 beds)	Waste generation ratio (kg/bed/day)	0.699	0.675
III (less than 50 beds)	Waste generation ratio (kg/bed/day)	0.465	0.329

Table 3-7: Number of Bed

Category	Private	Public	Total
I	-	3,690	3,690
II	485	538	1,023
III	277	465	742
Total	762	4,693	5,455

Table 3-8: Waste Generation Amount

	Category	Generation ratio (kg/bed/day)	Generation amount (ton/day)
JICA study	I	0.553	2.0
	II	0.675	0.7
	III	0.329	0.2
	Total	-	**2.9**
MSPAS 1999	I	0.652	2.4
	II	0.699	0.7
	III	0.465	0.3
	Total	-	**3.4**

3.5 Technical System

3.5.1 Storage and Discharge System

a. Households

According to the results of POS, 89.0% out of 420 houses are using plastic bag as a recipient of waste, 20.7% uses metal/plastic/wood container, a small population uses paper bag (1.0%) and carton box (1.4%), and 3.1% answered that they use other containers.

b. Institutions (Commercial entities and institutions)

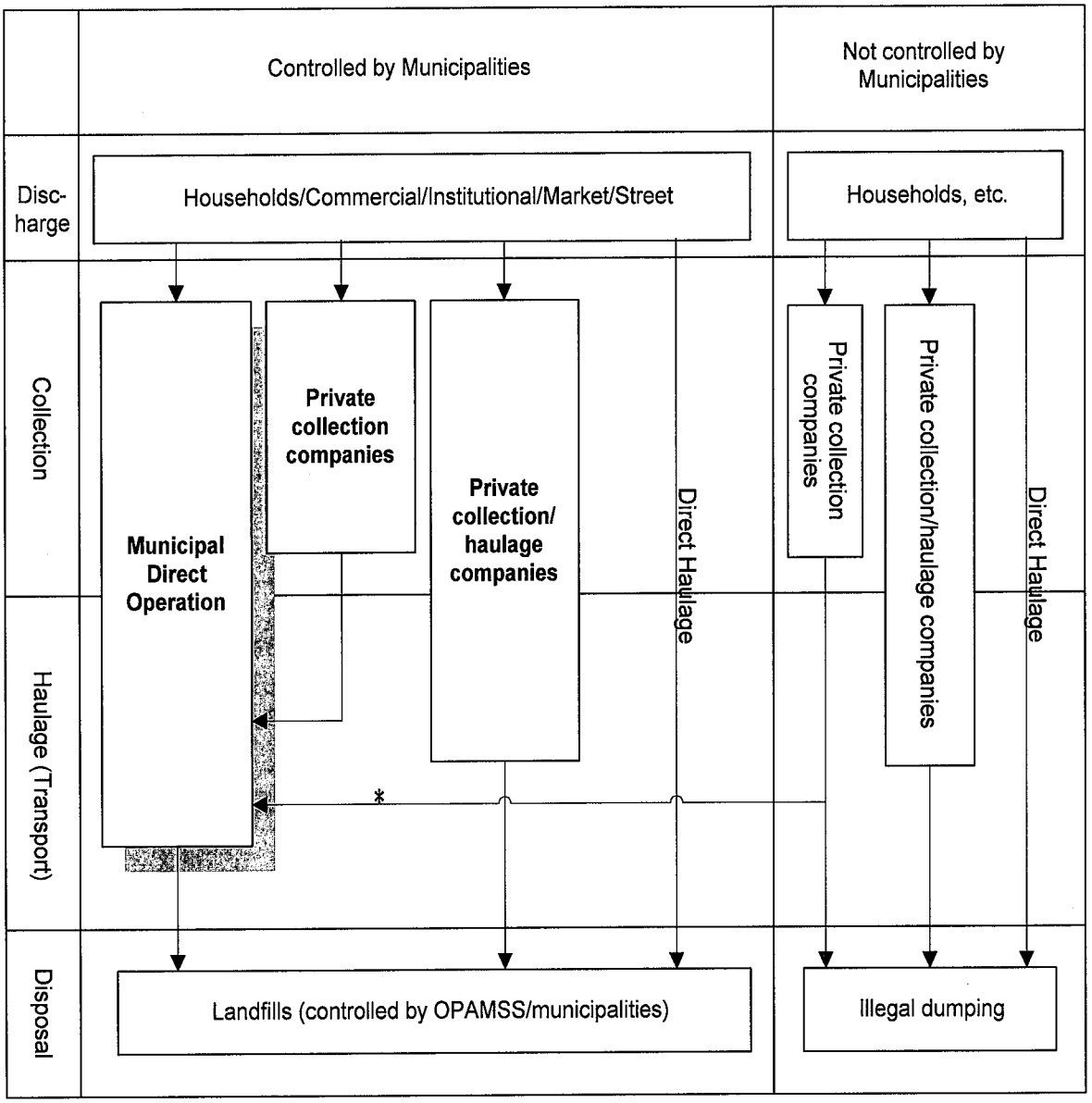
According to the results of POS (total interviewee is 52 institutions), a major part of institutions, 28, uses plastic bag as recipient of waste, 19 metal container and 11 carton box. Most of the institutions, 42, stores waste within their premises.

c. Market

Containers mainly found in markets are concrete container, metal container ($2m^3$), and drum. Most of containers are placed in certain places under control of personnel of markets to avoid scavenging by waste pickers and animals.

3.5.2 Collection and Haulage System

Figure 3-3 schematically shows collection and haulage system in AMSS, which can be divided into two areas; with municipalities' control (municipal direct operation and private companies' operation with contract or authorization by municipalities) and without control (operation without contract or authorization by municipalities).



* Waste is placed at municipalities' containers but not controlled by municipalities.

Figure 3-3: Collection and Haulage System in AMSS

a. Municipal Direct Collection

Curb side and bell collection is a popular **collection method** in the Study Area. Waste is put on the curb side in front of the house and the collection vehicle picks up it. Also the collection vehicle inform of the arrival in the collection area with ringing a bell. Use of containers is also a widespread method. A major number of containers used in the Study Area are $2m^3$ metal containers that are compatible with $18yd^3$ and $25yd^3$ compactor trucks having a winch for lifting the container. However, some municipalities make use of concrete containers. Also, some "botadero," which is a place where waste is piled up, are considered collection points like containers in some municipalities.

Table 3-9: Collection Method

Municipality	Collection method	Nos. of containers	Collection frequency (times/week)		Shift (times/day)
SS	• curbside and bell • container	92 metal, 31 concrete	3		3[1]
MJ	• curbside and bell • container	8	2 and 3	Certain areas 3; others 2	2
CD	• curbside and bell • container	7	3 and 6	Basically 6	1
CT	• curbside and bell • container	6	3 and 6	Basically 3; downtown 6	1
AY	• curbside and bell • container	8	3 and 6		1
SM	• curbside and bell • container	6 metal, 9 concrete	3		1
ST	• curbside and bell • container	28	3 and 7	Basically 3; downtown 7.	3[2]
AC	• curbside and bell • container	2	6	7 days/week for market	1
SY	• curbside and bell • container	29	3		1
IL	• curbside and bell • container	6 metal, 5 concrete	2, 3 and 7		2[3]
SMT	• curb side	0	6		1[4]
AP	• curbside and bell • container	19	2		1
NJ	• curbside	0	3 and 6		1
TN	• curbside and bell • container	concrete	6		1[4]

Note:
[1] 1. 6:30-13:00; 2. 12:00-19:30; 3. 18:00-0:30.
[2] 1. 7:30-13:00; 2. 13:00-18:00; 3. 18:00-24:00.
[3] 1. 6:00-13:00, 2. 13:00-19:00, 3. 19:00-24:00, 1 and 2 are basic operation, 3 is a special operation when it is needed.
[4] 6:00-14:00.

b. Collection Area and Route

Collection areas and routes are empirically set in the most municipalities, however, San Salvador municipality has set their collection areas according to criteria; collection amount of one collection area should be less than 15,000 pounds (6,800kg) and collection work should complete within 6 hours.

Table 3-10: Present Collection Areas and Routes

Municipality	Nos. of collection area	Collection area (km^2)		Collection route (km)	
		Total	Average	Total	Average
SS	*50	40.37	0.81	644.12	12.88
MJ	25	8.72	0.35	111.82	4.47
CD	5	6.35	1.27	54.91	10.98
CT	9	4.18	0.46	43.15	4.79
AY	2	1.07	0.54	17.26	8.63
SM	7	3.59	0.51	50.44	7.21
ST	13	6.12	0.47	112.67	8.67
AC	10	6.48	0.65	90.46	9.05
SY	17	10.83	0.64	118.02	6.94
IL	10	3.91	0.39	38.72	3.87
SMT	5	1.26	0.25	38.41	7.68
AP	7	4.87	0.70	55.39	7.91
NJ	2	1.28	0.64	25.38	12.69
TN	2	1.75	0.88	34.53	17.27
Total/average	164	100.78	0.61	1435.28	8.79

Note: * San Salvador has other 20 routes for containers besides the 50 routes.

c. Collection Vehicles

Inventory

Currently, 155 collection vehicles are working in the Study Area (See Table 3-11). 134 Compactor trucks occupy the most of them (86.5%) and are used in 13 municipalities.

Table 3-11: Collection Vehicles Currently Owned by Municipalities

Municipality	Compactor	Dump truck	Flat truck	Total
San Salvador	49	5	-	54
Mejicanos	9	-	1	10
Ciudad Delgado	7	-	-	7
Cuscatancingo	6	1	-	7
Ayutuxtepeque	2	-	-	2
San Marcos	7	1	-	8
Nueva San Salvador	11	4	-	15
Antiguo Cuscatlán	5	6	-	11
Soyapango	16	-	-	16
Ilopango	9	-	-	9
San Martín	4	-	1	5
Apopa	7	-	-	7
Nejapa	2	-	-	2
Tonacatepeque	-	2	-	2
Total	134	19	2	155

Table 3-12: Types of Compactor Trucks Used in the Study Area

Municipality	8m³ (11yd³)	12m³ (16yd³)	14m³ (18yd³)	15m³ (20yd³)	19m³ (25yd³)	Total
San Salvador	5	8	34	-	2	49
Mejicanos	2	2	5	-	-	9
Ciudad Delgado	2	-	5	-	-	7
Cuscatancingo	1	2	3	-	-	6
Ayutuxtepeque	-	1	1	-	-	2
San Marcos	1	4	2	-	-	7
Nueva San Salvador	1	5	4	1	-	11
Antiguo Cuscatlán	1	3	1	-	-	5
Soyapango	3	3	9	-	1	16
Ilopango	1	4	4	-	-	9
San Martín	1	-	3	-	-	4
Apopa	1	2	4	-	-	7
Nejapa	1	-	1	-	-	2
Tonacatepeque	-	-	-	-	-	-
Total	20	34	76	1	3	134

Conditions

One third of the vehicles (48; 31.0%) have been used more than 10 years. The rest of the vehicles (107; 69.0%) have been operated less than 5 years. The operation time clearly reflects the conditions of the vehicles.

Table 3-13: Conditions of Collection Vehicles

Year	Bad (Nos. of vehicle)	Regular (Nos. of vehicle)	Good (Nos. of vehicle)	Total (Nos. of vehicle)
1975-1989	6	34	8	48
1995-1999	2	17	88	107
Total	8	51	96	155

Table 3-14: Working Rate of Vehicle according to Manufacture Year

Item	1975-1989	1995-1996	Total/average
Vehicle working days [a)]	8,515	20,884	29,399
Nos. of vehicles [b)]	46	89	135
Possible vehicle working days [c)]	14,391	27,844	42,235
Working rate [d)]	59.2%	75.0%	69.6%

Note: a) Number of days on which the vehicles worked in 1998.
b) Number of vehicles in 1998.
c) b) x 365 days x 6/7 (taking Sunday into account).
d) a)/c) in percent.

Table 3-15: Productivity of Compactor Truck

Type of compactor		Ton/year	Nos. of vehicle	ton/year /vehicle	ton/year/m^3
yd^3	m^3				
11	8	32,521	19	1712	214
16	12	53,477	37	1445	120
18	14	171,273	61	2808	201
total/average		257,271	117	1988	178

d. Haulage

Haulage, transport from a collection area to a landfill and vice versa, is conducted by the collection vehicles.

Currently, 10 municipalities haul their waste to Mariona transfer site or directly Nejapa landfill. Other municipalities haul their waste to Espiga disposal site or disposal sites in their own municipalities. Table 3-16 shows average distance from each municipality to a disposal site.

Table 3-16: Haulage Distance

Unit: km

Municipality	Distance		
	Nejapa	Mariona	Others
San Salvador	28.9	19.9	
Mejicanos	25.5	16.5	
Ciudad Delgado	22.2	13.2	
Cuscatancingo			35[1]
Ayutuxtepeque	24.5	15.5	
San Marcos	32.1	23.1	
Nueva San Salvador	37.8	37.2	
Antiguo Cuscatlán			35[1]
Soyapango	29.3	20.3	
Ilopango	33.9	24.9	
San Martín			2[2]
Apopa	14.0	5.0	
Nejapa	9.6	2.6	
Tonacatepeque			3[3]

Note: [1] Espiga disposal site
[2] a disposal site in San Martin municipality
[3] a disposal site in Tonacatepeque municipality

e. Maintenance of Vehicles

Present situation of vehicle maintenance is also various in municipalities. 5 municipalities do not own their workshops for maintenance of the collection vehicle. Even municipalities that have workshops are having problems, such as lack of tools and spare parts. In case of Mejicanos, the cleansing section has a difficulty to control the workshop as it belongs to another section.

Table 3-17: Workshops in AMSS

Municipality	Nos. of workshop	Remarks
San Salvador	2	1 is for corrective work and the other is for preventive work
Mejicanos	1	-
Ciudad Delgado	1	For daily inspection and small repair
Cuscatancingo	1	-
Ayutuxtepeque	none	-
San Marcos	none	When repair is necessary, a truck is brought to a private workshop.
Nueva San Salvador	1	The workshop mainly devotes the collection vehicles, but also deals with other vehicles.
Antiguo Cuscatlán	1	Beside the workshop, there is a garage where small maintenance work is available.
Soyapango	1	-
Ilopango	1	-
San Martín	none	When repair is necessary, a truck is brought to a private workshop.
Apopa	1	-
Nejapa	none	-
Tonacatepeque	none	-

f. Private Collection

In 1995 there were 20 micro-enterprises[4] located in six municipalities of AMSS. These enterprises collected, transported, recovered, separated and composted wastes.

Currently there are more of these enterprises that have expanded to 12 municipalities of the metropolitan area. According to the units in charge of sanitation services, 48 micro-enterprises devoted to the collection, haulage, recovery and composting service have been identified. Out of this total, 37 that account for 77.08% are devoted to housing collection, whereas the remaining service other sectors, Table 3-18 shows next.

[4] Meléndez, *Microempresas y Cooperativas en Gestión de residuos Sólidos en EL Salvador*, 1996

Table 3-18: Distribution of Registered Micro-enterprises in AMSS in 1999

Municipality serviced	Hospital	Housing	Industry	Bonding industry	Markets	Markets and housing	Rest.	Street sweeping	total	%
San Salvador	1	7	-	-	2	-	1	1	12	25.00
Mejicanos	-	5	-	-	1	-	-	-	6	12.50
Ciudad Delgado		1							1	2.08
Ayutuxtepeque		2							2	4.17
San Marcos		3		2					5	10.42
Nueva San Salvador		2							2	4.17
Antiguo Cuscatlán			1						1	2.08
Soyapango		5							5	10.42
Ilopango		6				1			7	14.58
San Martín		2							2	4.17
Apopa		1						1	2	4.17
Tonacatepeque		3							3	6.25
Total	**1**	**37**	**1**	**2**	**3**	**1**	**1**	**2**	**48**	
%	2.08	77.08	2.08	4.17	6.25	2.08	2.08	4.17		

Source: Prepared with the information provided by AMSS municipalities.

3.5.3 Processing, Treatment and Recycling System

Large-scale processing, treatment and recycling system has not yet been found in the Study Area. In some municipalities, composting plants are operated by municipality, private company and NGO.

A major activity regarding recycling in the informal sector is found in Mariona transfer site. There are about 300 waste pickers in the site, and they sort recyclable materials, such as aluminum cans, paper, iron and glass bottles.

3.5.4 Street Sweeping System

Manual sweeping method occupies the major part of the street sweeping in AMSS. Only San Salvador has five mechanical sweepers.

Table 3-19: Length of Manual Street Sweeping

Municipality	Length (m)	nos. of Sweeper	m/sweeper/day
SS	269,509	450	599
MJ	29,060	34	855
CD	15,036	9	1,671
CT	8,970	9	997
AY	2,660	2	1,330
SM	7,010	8	876
ST	43,080	66	653
AC	51,630	30	1,721
SY	12,618	12	1,052
IL	1,760	3	587
SMT	1,700	4	425
AP	5,615	10	562
NJ	668	4	167
TN	3,225	3	1,075
Total	452,541	644	703

Table 3-20: Length of Street Sweeping by Mechanical Sweeper

Length (m)	Mechanical sweeper	m/unit/day
55,260	5	11,052

3.5.5 Final Disposal System

3.5.5.1 Final Disposal Sites used in the Past and Today

Final disposal sites used in the past and today by the 14 municipalities are listed in the table below.

Table 3-21: Final Disposal Sites Used by the 14 Municipalities

	1995 [1]	1997 [2]	Present [3] (1999)
San Salvador	Mariona (19.9km)	Mariona (19.9km)	MIDES (28.9km)
Mejicanos	Mariona (16.5km)	Mariona (16.5km)	MIDES (25.5km)
Ciudad Delgado	Mariona (13.2km)	Mariona (13.2km)	MIDES (22.2km)
Cuscatancingo	Mariona (12.2km)	Mariona (12.2km)	ESPIGA (35km)
Ayutuxtepeque	Mariona (15.5km)	Mariona (15.5km)	MIDES (24.5km)
San Marcos	Mariona (23.1km)	Mariona (23.1km)	MIDES (32.1km)
N. San Salvador	Mariona (37.3 km)	Mariona (37.3 km)	MIDES (37.3km)
Antig. Cuscatlan	Mariona (42.2km)	Mariona (42.2km)	ESPIGA (35km)
Soyapango	Mariona (20.3km)	Mariona (20.3km)	MIDES (29.3km)
Ilopango	Botadero de Ilopango (3.0km)	Mariona (24.9km)	MIDES (33.9km)
San Martin	Botadero de Tonacatepeque (a few km)	Botadero de San Martin (a few km)	Botadero de San Martin (a few km)
Apopa	Mariona (5.0km)	Mariona (5.0km)	MIDES (14.0km)
Nejapa	Mariona (2.6km)	Mariona (2.6km)	MIDES (9.6km)
Tonacatepeque	Botadero de Tonacatepeque (a few km)	Botadero de Tonacatepeque (a few km)	Botadero de Tonacatepeque (a few km)

Note: [1] source: the Doble-G report (Proyecto de Mejoramiento del Manejo de los Desechos Sólidos de la Región Metropolitana Fase1 Diagnóstico Mayo, 1995).
[2] source: PAHO report (Análisis Sectorial de Residuos Sólidos El Salvador Agosto, 1998).
[3] source: surveyed by this study
Distance to final disposal sites: Departomento de Informática, OPAMSS.

3.5.5.2 Transport Distance to Final Disposal Site

a. San Martin and Tonacatepeque

San Martin and Tonacatepeque municipalities dispose of their waste respectively at their own dumping site. In so doing, transport distance becomes significantly short, however, there remains problems of environmental contamination by disposed waste.

b. Municipalities that Use MIDES Nejapa Landfill Site Today

10 municipalities such as San Salvador, Mejicanos, Ciudad Delgado, Ayutuxtepeque, San Marcos, Nueva San Salvador, Soyapango, Apopa, Nejapa, and Ilopango (mentioned above) use MIDES Nejapa landfill site today.

c. Cuscatancingo and Antiguo Cuscatlán

Cuscatancingo and Antiguo Cuscatlán municipalities used to dispose of their waste at Mariona site, and their transport distances were about 12.2km and 42.2km respectively.

Today they bring their waste to ESPIGA site. The transport distance to the site from respective municipalities is about 35km. The transport distance to ESPIGA site for Antiguo Cuscatlán municipality becomes about **7km shorter** than to the formerly used Mariona site. On the other hand, as for Cuscatancingo municipality, it becomes about **23km longer**.

Formerly the two municipalities did not bear the disposal cost at Mariona site, however, today they pay the disposal fee to the owner of the ESPIGA site.

The figure below shows locations of final disposal sites currently used by the 14 municipalities of AMSS.

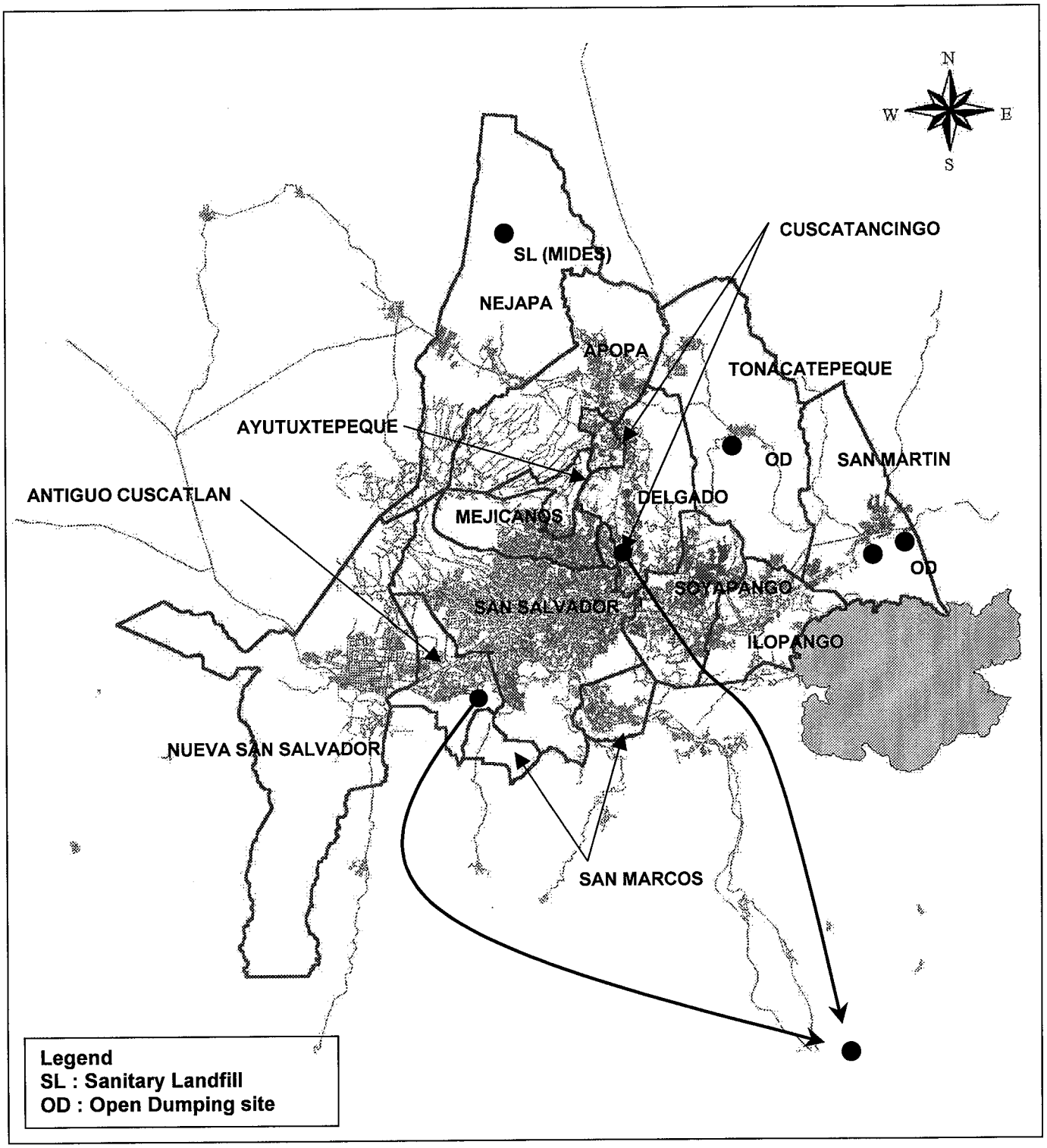


Figure 3-4: Locations of Existing Final Disposal Sites

3.5.5.3 Landfilling Operation

Important practices of landfilling operation comprise accumulation/compaction of waste disposed and the daily soil coverage over the waste. However, the intensity of those practices is very different among the 4 sites (see Table 3-22).

As for so-called open dumping sites of San Martin and Tonacatepeque, mechanical equipment for waste accumulation and/or compaction is not stationed at the sites. With a help of DUA, those sites arrange the soil cover over the disposed waste once in a while.

Table 3-22: Landfilling Operation of Respective FDS

Item	Nejapa MIDES	Chuca ESPIGA	San Martin open dumping site	Tonacatepeque open dumpig site
Working days	6 days a week (Mon. – Sat.)	6 days a week (Mon. – Sat.)	6 days a week (Mon. – Sat.)	6 days a week (Mon. – Sat.)
Working equipment	Constant arrangement of Bulldozer, Compactor, as well as Loader and dump trucks (for cover soil transport), and water tanker.	Occasional arrangement of Bulldozer, Compactor, and Motor-grader	Basically no.	Basically no.
Weigh-bridge control	Yes	No	No	No
Daily disposal amount	about 1000 ton	about 70 ton	about 30 ton	about 20 ton
Working cell size	Basically same as the daily disposal volume	Not managed	Not managed	Not managed
Daily soil coverage	Not daily but frequent	No (occasional)	No (once in one or two weeks)	No (once in one or two weeks)

3.5.5.4 Landfill Structure (Specification)

The table below summarizes the landfill structure of the MIDES sanitary landfill and other 3 disposal sites that are used by the municipalities in AMSS.

Table 3-23: Landfill Structure of Existing Disposal Sites

Item	MIDES Sanitary Landfill	Other 3 sites
Bottom Impermeable Liner	2 layers. (One High-Density Polyethylene (HDPE) geo-synthetic impermeable membrane of 1.5mm thick and placed over a geo-composed membrane (bentonite – geo-textile) and/or clay, compacted according to the form and nature of the soil at the site. *	No
Leachate collection system	A drainage layer with a minimum thickness of 450mm of granular material for drainage. A minimum slope of 1 to 2% to work as a gravity drainage. HDPE drilled pipeline.*1	No
Leachate treatment system	3 lagoons. The 1st lagoon is equipped with aerators. It is planned to construct and operate 3 Nos. of evaporation lagoons of 20,000m^2 on the 12m elevation of the filled cells. However, it is not practiced yet.	No
Biogas removal system	Although it is planned in the EIA report, not practiced yet to date. The report says "The system will be formed by removal shafts with a diameter of 600mm, drilled from the top part of the land up to a depth from 5 to 6m, ... A drilled polyvinyl chloride (PVC) piping will be installed within the shaft. The piping will be surrounded by pure rock."	No
Top liner	It is planned.	Not planned

Note. * Source: Estudio de Impacto Ambiental, Mejoramiento del Manejo de los Desechos de la Región Metropolitana de San Salvador, Enero 1998.

3.5.6 Other SWM Activities by NGOs

There are a number of NGOs which are active in providing some assistance for the improvement of environmental problems especially on waste in AMSS. Table 3-24 outlines the major activities and the background information on some of the active NGOs which have been carrying out campaigns or educational programs on solid waste issues.

Table 3-24: SWM Activities by NGOs

Name of NGOs	Year of Establishment	Number of Staff	Special Field of Work	Areas of Work	Experiences of Campaign or Environmental/ Sanitary Education on SWM	Sponsors
CESTA[1]	1987	55	Protection of environment	Urban and rural areas in Dept. of San Miguel, Santa Ana, Sonsonate, San Vicente, Cuscatlán, Morazán, La Libertad and Usulután	• Environmental education on waste in educational centers and municipalities • Promotion of reducing, reusing, and Recycling of waste • Planning and investigation for composting • Providing advice to municipalities and some groups for waste separation and composting	Hivos (Holland), MS (Denmark)
UNES[2]	1987	15	Environment	San Luis(La Paz), Quezaltepeque (La Libertad), Soyapango (San Salvador), Apopa (San Salvador)	• Education on solid waste problems • Education on waste separation for composting • Education on waste separation methods at schools	Novib (Holland), DANIDA (Denmark),Fundación Böll (Germany)
Procomes[3]	1988	30	Environment, credit	San Salvador, Apopa, Soyapango	• "Recycling Hopes" Project (1998-99)	Procomes e Intermon
Fundación Olof Palme[4]	1988	5	Protection of victimized children	Markets, parks, streets, disposal site(Nejapa)	• Helping children working and living on the streets and protecting their human rights • Joint work with Procomes for "Recycling Hopes" project	
Fundación ABA	1998	9	Solid waste (cooperatives)	San Salvador(#1,2,3,4,5), Mejicanos(Zacamil), Ilopango, Cojutepeque	• Capacity building on SWM • Capacity building on composting • Capacity building on solid waste legislation • Formation of ecology groups	MIDES, UNEX, Hivos (Holland)

Note:
[1] Fundación Centro Salvadoreño de Tecnología Apropiada
[2] Unidad Ecológica Salvadoreña
[3] Asociación de Proyectos Comunales de el Salvador
[4] Fundación Olof Palme

3.5.7 Medical Waste Management

In El Salvador, the Ministry of Health has been working with medical waste programs since 1993 because of the initiatives and technical assistance provided since 1989 by the Pan-American Health Organization. This entity formulated a project for all the capital cities in Central America in 1990, a program that was adopted by the

European Union in 1991 and commissioned in April 1994; such program was known as ALA 91/33 agreement whose purpose was to install a medical waste collection and treatment system in the six capital cities of Central America.

The final products of the program consist of four manuals for the following participants: health technicians and inspectors, medical and nursery staff, administrative and managerial personnel, as well as a popular version for the general services staff.

The ALA 91/33 program initiated a training and awareness process that cannot be overlooked, now that the diagnosis of medical waste management is being conducted.

Another remarkable point is that within the framework of the ALA 91/33 program the Ministry of Health installed a bio-infectious waste collection and final disposal system that is working since October 1st, 1997 for the 9 public hospitals in AMSS.

In the beginning hospital wastes were disposed of at ditch made with a machine in Apopa controlled dumping site that was operated by the municipality of San Salvador and provided the service for the entire AMSS. Later, from June to December 1999 a security cell in the current sanitary landfill of AMSS; such landfill is operated by the French-Canadian consortium CINTEC – TREDI as a mixed enterprise working for 10 municipalities and known as MIDES S.E.M de C.V. as of January 1st 2000, which has introduced the autoclave treatment system.

Most hospitals under MSPAS (Ministry of Public Health and Social Welfare) practice separate discharge for medical and common waste observing the manual[5] commonly used. Some of ISSS (Salvadorian Social Security Institute) hospitals also establish and practice a separate discharge system. However, many of other medical institutions lack an appropriate system for separate discharge. As for private hospitals and clinics, the great majority discharges the infectious medical waste mixed with common waste.

To cope with this situation, MSPAS (Ministry of Public Health and Social Welfare) presently plans to give such hospitals instructions to implement appropriate medical waste management (e.g., source separation, separate discharge and collection, contract for appropriate treatment/disposal).

[5] Manual para Personal Médico y de Enfermería, Gestión y Manejo de Desechos Sólidos Hospitalarios ALA91/33