

## **G.9 Assessment of the Present Condition and Confirmation of Key Issues**

### **G.9.1 Technical System**

#### **G.9.1.1 Municipal Solid Waste Management**

##### **a. Collection and Haulage System**

Ringling bell with curbside collection would be effective to inform people of a collection vehicle coming. Curbside collection and container collection should not be mixed in one collection route, as the container collection generally requires cleansing activity around containers and it needs for a quite time. Then, the curbside collection becomes inefficient.

Some municipalities practice 6 days a week collection frequency. Such high level of service would raise the operation costs. In some municipalities two or three patterns of collection frequency are introduced, and this may cause drivers and workers confusion.

Length of collection route per collection area is various depending on municipalities. Most of municipalities do not know how much of waste is collected from a collection area. Therefore, it is necessary to know collection amount from a collection area in order to set an optimum collection area.

11yd<sup>3</sup>, 16yd<sup>3</sup> and 18yd<sup>3</sup> compactor trucks are the major collection vehicles in the Study Area. However, the 16yd<sup>3</sup> compactor is showing the low working rate and the low productivity due to its old age.

Haulage to Nejapa/Mariona or Espiga requires a long distances and duration. This cause large fuel consumption, shorter time for collection.

Maintenance of vehicle is not in good conditions in the most municipalities. It is difficult for small municipalities to have a workshop with appropriate tools, spare parts and personnel, as such a workshop needs a large investment and operation costs.

Consequently, the collection and haulage in AMSS are working fairly well. This would be because that the municipalities have enough experience of operating it and the personnel concerned have been get used to it. However, problems actually exist in the collection and haulage. Those are;

- the working rate and productivity decline of the 16yd<sup>3</sup> compactor,
- the haulage occupying the considerable portion (time and distance) in a trip, and
- the poor maintenance (in the most municipalities).

##### **b. Final Disposal System**

###### **b.1 Landfilling Operation**

It is appreciated but is also as a matter of course that the MIDES site has stationed heavy equipment for waste accumulation/compaction and applies daily soil coverage practices because the site receives as much as about 1000ton/day. In other words, if

such appropriate practices are not enforced, environmental problems by 1000ton/day would be huge.

Meanwhile, as for ESPIGA site which receives receiving about 70ton/day, it is awaited that daily waste accumulation/compaction and soil coverage should be practiced.

As for San Martin and Tonacatepeque open dumping sites, it would be very appreciated that if they are improved to apply once- or twice- a week of soil coverage. However in practice, it would be very difficult to cover soil over the disposed waste since the waste is dumped down in a ravine slope in these sites.

## **b.2 Landfill Structure**

The landfill structure designed for the MIDES Nejapa site is good enough to protect the environment. The problem with MIDES landfill is that some of the measures proposed such as evaporation lagoons and biogas removal are not constructed yet.

Although the other three sites are already in use since a few years before, it is impossible today to add bottom impermeable liner or leachate collection/treatment system. A possible additional improvement measure for the 3 sites, regarding the structure, is biogas removal system. Another structural recommendation could be to employ final soil cover with enough thickness for reducing the long term environmental contamination when the 3 sites are closed.

## **b.3 Landfill Management**

### **b.3.1 Hygiene and Scavenger Control**

While MIDES site has sufficient control over hygiene and scavenging, the other 3 sites need to be improved in this context.

### **b.3.2 Surface Water Management**

In the rainy season in 1999, mismanagement of surface water in MIDES site resulted in a huge generation of leachate and its discharge to the surrounding environment.

As for San Martin open dumping site, a vertical shaft (pozo) was constructed to connect to the storm sewer below buried waste with an aim of reducing leachate generation and its contamination. However, maybe because it is the dry season today, surface water control ditches are not yet constructed to connect to the vertical shaft. It is awaited that before the rainy season comes the surface runoff of rain water should be well controlled to direct to the vertical shaft.

## **G.9.1.2 Medical Waste Management**

### **a. Medical Centers with Medical Waste Management System**

- There are deficiencies in the labeling of wastes; it is not standardized and does not allow the identification of the generation source within the facilities.
- Central warehouses do not have all the drainage, hydraulic installations and finish conditions and restricted access only takes place in 50% of establishments. There are no appropriate facilities to disinfect the containers utilized for the storage and haulage of wastes.
- The use of nuclear medicine and the generation of radioactive waste concentrates

in three hospital centers: Rosales from MSPAS, Medico Quirúrgico and Oncológico from ISSS.

- However, 13 additional medical centers that reported radioactive waste were discovered in the study, which came essentially from the X-ray system. Actually, this does not generate radioactive waste but the exposure risk is present if radiological protection lacks or checkup by the corresponding teams.
- From the three hospital centers that deal with nuclear medicine, the best equipped facility for this is the Oncológico hospital; therefore, a greater support on these activities in the remaining centers should be provided.

**b. Medical Centers that Do Not Have a Hospital Solid Waste Management System**

- The majority of these hospitals report that they separate polluted from common waste; however, this separation is not reliable since no color code, tagging or standardized containers are used. They do not have written instructions or the willingness from the general management to implement them.

## **G.9.2 Institutional System**

### **G.9.2.1 Field of Competency and Institutional Coordination**

- Coordination of MSPAS with most of AMSS municipalities is acceptable. The support being provided by the former relies mainly on hygienic education, personnel training and occupational health for the cleansing staff; however, this is conducted in a limited manner. It should be taken into consideration that there is only one person in a central level in charge of the solid waste management program within the MSPAS' Department of Environmental Health. On the other hand, regarding the issue of hospital solid waste management that is controlled by MSPAS, coordination with most of the municipalities is quite weak or even non-existent with some of them.
- The Ministry of Environment and Natural Resources (MARN), created in 1998, replaced the "Secretary of Environment (SEMA)". Its organizational chart is still being prepared and coordination with some municipalities of AMSS has just started. Besides, the Environmental Law has not been regulated yet to allow MARN to exercise its corresponding actions. Therefore, Article 52, which states that MARN and MSPAS should be coordinated with municipalities to promote reduction, recovery and recycling of solid wastes, is not fully complied with.
- Coordination among municipalities is quite acceptable. A key element within this coordination is COAMSS, which has had an active participation in recent years. Regarding SWM, COAMSS has promoted and conducted MIDES project. Nevertheless, 4 municipalities out of the 14 belonging to AMSS do not take part in this MIDES project. In any case, the strengthening of COAMSS and OPAMSS is vital to improve SWM in AMSS.
- Cooperation among the neighboring municipalities in AMSS and with San Salvador municipality is good, especially when equipment is lent when emergency situations arise.

- Municipalities are the fundamental piece in SMW of AMSS; however, since law states that municipalities are autonomous and due to political differences, metropolitan technical solutions for the urban cleansing service are sometimes difficult to achieve.
- Inspection and auditing by the *Ministerio Público* (Public Surveillance Office) regarding SWM is still quite limited.
- OPAMSS has a primordial function in the supervision of MIDES project, such function is being carried out since September 1999.
- Besides, it is estimated that the supervising and controlling function by municipal cleansing services on the contracts and concessions signed by the municipalities is very weak.

### **G.9.2.2 Legislation and Regulatory Framework**

- National legislation on municipal solid waste is quite limited.
- The Basel Convention is just being enforced.
- The scarce provisions in the Health Code regarding municipal solid wastes have not been practically enforced. In fact, there are discrepancies between Article 56 of the Health Code and Article 4 No. 19 of the Municipal Code with respect to the jurisdiction on urban solid waste management.
- Enforcement of the provisions of the Environmental Law, whose regulation has not been approved yet, is still incipient.
- There exist no municipal ordinances that regulate SWM in the municipalities of AMSS, with the exception of San Salvador, Antiguo Cuscatlan, Soyapango and Apopa. The aforementioned suggests that some municipalities collect even hazardous wastes, since there is no provision that prohibits such collection.
- Sanctions from the Health Code, Environmental Law, Municipal Code and the regulating municipal ordinances are not really enforced on those who violate SWM. In some cases fines do not even compensate the means to collect such fine. San Salvador's regulatory municipal ordinance is being updated and should be approved soon.

### **G.9.2.3 Other Bodies Participating**

- International bodies such as IDB and PAHO provide technical support for SWM in AMSS. It is necessary to continue with this type of cooperation, especially for the organizational development of cleansing services and staff training.
- No Salvadoran enterprises are interested in the contracting-out or concession of the different stages of SWM. The financial risk in the case of concessions restrains the participation of large and medium size companies. An exception is CINTEC, a contractor of MIDES project, which is constructing Nejapa sanitary landfill.
- Regarding hospital wastes, CINTEC is a contractor for the treatment of pathological hospital wastes, as well as the company "Transporte Guadalupe" that collects such wastes.

- Participation by formal/informal micro-enterprises and cooperatives is increasing. Most of the personnel working in this field comes from former scavengers of “Mariona” dumping site. There exist 45 formal and informal micro-enterprises where more than 300 people work in collection and sweeping activities and some of the micro-enterprises have been supported by NGOs. While the demand for cleansing services by the population of several municipalities in AMSS is not satisfied, increase of micro-enterprises mainly in collection can be expected. This is a positive aspect because this could provide employment to some of the scavengers that were displaced from dumping sites.
- Universities and professional groups such as AIDIS have cooperated in the development of cleansing services in AMSS; and it is advisable that they keep on supporting such.
- The same can be said about ISDEM and COMURES, whose assistance in institutional development of municipalities is essential. It is also advisable that this cooperation reach municipal cleansing departments or units in AMSS.
- Regarding NGOs, there are two groups: the first one consists of those NGOs that support and promote the creation of cooperatives and micro-enterprises, environmental education activities and such related to SWM, which are deemed as necessary and should continue. The second group belongs to smaller and weaker organizations with financial problems and they lack qualified human resources for SWM, whose participation is not necessary.

#### **G.9.2.4 Information System**

- Operative cleansing services in most municipalities do not have information or data at all or handle them insufficiently. This situation does not allow a correct decision-making process if the efficiency and quality of services and the reduction of operation costs is pursued.
- MIDES obtains the weight of the collection truck that arrive to Nejapa sanitary landfill and “Mariona’s temporary transfer station” by means of weighbridges installed at both sites. This information is and will be useful for collection planning of the diverse municipalities. Completion of the information with the weighing of the recyclable materials separated everyday in “Mariona” should be done as an additional data for SWM planning, and is not being carried out.
- Lack of information is even more critical with respect to budgetary and cost data, as cleansing services are totally unaware of such information.

#### **G.9.2.5 Social and Community Aspects**

- Scavengers: They are also known as “*pepenadores*” in San Salvador. Men, women and children that separate reusable or recyclable materials during the different stages of SWM to trade them later. The whole process is informal.

The main scavenger groups that currently operate are distributed as follows:

- Peddling purchasers of paper, bottles and others that pay certain money to the citizens to acquire such materials.
- “Pre-scavenging” is carried out before collection at points where solid wastes are discharged, which will be picked by collection trucks. This is conducted mostly at

high-income residential zones.

- During the collection by the crew of municipal collection trucks, who separate those items with a greater commercial value.
  - At “Mariona temporary transfer station” where around 300 scavengers separate the discharged material from collection trucks and after separating the materials, wastes are loaded again in the truck and taken to Nejapa sanitary landfill. This staff will keep on working until the selection plant for recycling is built.
  - In “La Chuca (Espiga)” dumping site, where around 20 scavengers select the wastes coming from the municipalities of Antiguo Cuscatlán and Cuscatancingo.
  - “San Martín #1” dumping site, where solid wastes from San Martín are disposed of, and “Cantón El Rosario” dumping site where wastes from the municipality of Tonacatepeque are discharged, with around 20 scavengers.
  - A total of not less than 600 persons, without including the municipal collection personnel, separate solid wastes. The solution of this social problem, especially that of the scavengers from the “temporary transfer station” and other dumping sites will have to be dealt with in the short term.
- Unions: The staff of 7 municipalities, including the cleansing personnel are associated with at least 4 associations -ASTRAM, ATRAM, CGTM and ATMES. In the remaining 7 municipalities -Delgado, Cuscatancingo, Ayutuxtepeque, Antiguo Cuscatlán, San Martín, Nejapa and Tonacatepeque, the cleansing staff is not associated. Salvadoran legislation prohibits governmental workers –including those of municipalities- to belong to a union. Therefore, these groups belong to what they call “Association”, which in fact performs as a union that defends the interests of the associates. In 1999, 3 short strikes and two stoppages took place in 4 municipalities. Since there is not a single union, the solution of contingent conflicts and negotiations during discussions is feasible. However, it is possible in the future that efficiency of services will improve, and consequently the proposals to rationalize staff will require of further negotiations to reach a consensus with such associations.
- Community participation: Yet it is true that each generator has the right to a clean and healthy environment, he/she is also responsible for participating in the different stages of solid waste management. Such participation stands for to minimize generation; to help recovery, reuse and recycling of solid wastes; to achieve self-sustainability of the service through paying fees that cover their real costs and to inspect whether regulations on the service are being enforced, over those who render the service and those who use the service. As a consequence, a sensitization, communication and educational program for the population is important. Achievements will be obtained in the long term, not in short-term “campaigns” because it is all about behavioral changes in the civil society and such change by adults may be difficult to achieve. Therefore, fundamental concepts of SWM will have to be included in the educational plans and programs for elementary 6 years in an articulated and continuous manner, so that student can clearly understand them and become customs during their childhood and later on a natural behavior when they are grown up.

### **G.9.3 Organizational System**

Table G-92 summarizes the key issues that have been confirmed.

#### **G.9.3.1 Organization**

- Cleansing services in all municipalities except San Salvador are arranged in a traditional manner according to the operative function: collection; sweeping; and equipment maintenance. As for San Salvador, whose Environmental Sanitation Management Office has a complex organization and that is even being restructured.
- Hierarchy of the cleansing service is quite low (4<sup>th</sup> or 5<sup>th</sup> within municipal organization), regardless of being the most important service rendered by the municipality, employing up to 40% of municipality's workers and using almost 50% of the budget in some municipalities.
- Regulatory ordinances of the cleansing service: Only 4 municipalities have such. Without these ordinances, it cannot be expected that generators and the community observe regulations that do not even exist.
- Function handbook: Only 4 municipalities have such function handbook, which includes the cleansing service. Obviously, the staff cannot be demanded to perform something that they do not even know if they do not have such manuals.
- San Salvador's Environmental Sanitation Management Office has a more complex organization, since it has a collection department, a mechanical sweeping unit, a workshop department and an environmental education unit. Besides, the municipality is divided into 6 districts in order to render the manual sweeping service and exercise vectors control.

#### **G.9.3.2 Planning**

- Although Departments of Public Services or Cleansing units are in charge of planning, preparation of regulation and such as route design in most of the municipalities, only some of them have qualified human resources to perform such functions and perhaps could make erroneous empirical decisions.
- On the other hand, the main project in mind are related to equipment replacement, management modernization, improvement of commercial system; in a nutshell, sustainability of the cleansing service.

#### **G.9.3.3 Operation**

- It is estimated that 60% to 95% of urban population in the 14 municipalities of AMSS are rendered municipal and private collection service. This suggests that there still are suburban, marginal or difficult access zones that the service is not rendered, or provided occasionally or irregularly.
- Collection service is rendered mostly by the municipalities. However, contractors and/or concessionaires such as micro-enterprises, cooperatives and even small family or single-person organizations, most of them are informal, also provide this service in some residential areas and for the collection of special wastes in all municipalities. In these contracts the municipality pays the contractor per ton

collected, whereas in concessions the payment for the service is made directly by users to the concessionaire.

- The workshops and maintenance units in most municipalities face organizational and supply problems and lack preventive maintenance. Technical and economic feasibility to contract out maintenance duties with private workshops should be studied and suggested in some municipalities.
- The sweeping service is limited to the municipalities' downtown and markets, almost all of it is rendered directly by the municipality.
- There are more than 200 containers for public use in AMSS that are directly operated by cleansing services. An important number of the containers are being used as illegal dumping sites because of the inefficient community education or by the irregular collection of containers. Therefore, some municipalities are thinking about getting rid of such containers.

#### **G.9.3.4 Commercial**

- The collection of cleansing fees by means of CAESS' and DELSUR's electric consumption bills is very important and perhaps is the most effective method. If such are not paid after bills are issued, the electric service is cut off.
- However, since CAESS and DELSUR do not bill for the unpaid cleansing fees in the next month bill, it allows those users that have not paid yet to pay for the electric consumption every two months. This situation would eventually lead to the fact that such users annually pay only half of the billing. The municipalities are negotiating this commercial restriction with CAESS and DELSUR.
- Updating and upgrading of the tax payer cadastre could help solving the aforementioned restriction, as San Salvador is currently doing such.
- The fee for MIDES sanitary landfill for the residential sector is charged according to ranges and based on the electric consumption average. Some of the population refuses to pay such, which in turn becomes an additional restriction for commercialization.
- Another key issue perceived is the collection of the waste fee and/or of the sanitary landfill fee from those that are not rendered the collection service. Updating and upgrading of the municipal tax payer cadastre and the commercial system of fee collection is urgent and that are insisted by most of the officials visited.
- Finally, payment for the wastes discharged in MIDES sanitary landfill by contractors/concessionaires is done by the municipalities, instead of users (which are normally large waste generators), which means they are being subsidized.

#### **G.9.3.5 Financial**

- No municipality has an accounting system for the costs of the cleansing service, which turns decision-making management level difficult.
- Treasury works with only one and whole accounting for the entire municipality.



Table G-92: Organizational Systems in SWM. Confirmation of Key Issues

Items	Key issues
Organization	<ul style="list-style-type: none"> <li>- Organization chart: With the exception of San Salvador, the other cleansing services are organized by operations in collection, sweeping and maintenance.</li> <li>- Hierarchy of the cleansing service: very low; 4<sup>th</sup> level.</li> <li>- Regulatory ordinance of the cleansing service: only in 4 municipalities.</li> <li>- Function handbook of cleansing service: only in 4 municipalities.</li> <li>- San Salvador has a more complex organization.</li> </ul>
Planning	<ul style="list-style-type: none"> <li>- Human resources in cleansing services in several municipalities are not qualified.</li> <li>- The main plans and projects for SWM in mind by municipalities should meet the sustainability of the services.</li> </ul>
Operation	<ul style="list-style-type: none"> <li>- Collection coverage: 60% to 95% of urban population in the different municipalities. Most of these cleansing services are rendered by the corresponding municipality, but private contractors/concessionaires also provide such.</li> <li>- Most of the municipalities face preventive maintenance, spare parts supplying and equipment repair problems.</li> <li>- Manual and mechanic sweeping is provided directly by municipal cleansing services.</li> <li>- Some municipalities are thinking about getting rid of containers. (There are more than 200 in AMSS).</li> </ul>
Commercial	<ul style="list-style-type: none"> <li>- Fee collection efficiency along with electricity billing by CAESS and DELSUR is high.</li> <li>- With the exception of San Salvador, when fees not paid for the waste service in the bill of the following month is not recovered, it could allow user to pay for the waste fees only 6 months/year.</li> <li>- Modernization and updating of the tax payers' registry is required.</li> <li>- The community refuses to pay for a high sanitary landfill fee.</li> <li>- The collection of the waste fee from those that are not rendered the service is unfair.</li> <li>- Great generators of wastes should not be subsidized either for the sanitary landfill fee.</li> </ul>
Financial	<ul style="list-style-type: none"> <li>- Revenue/expenditure ratio of cleansing service has a deficit in almost all the municipalities.</li> <li>- No municipality has a cost accounting of the services.</li> <li>- Treasury works with only one and whole accounting for the entire municipality.</li> </ul>
Administrative	<ul style="list-style-type: none"> <li>- The important difference of workers per 1000 people (a range from 0.3 to 2.4 workers/1000 inhab.) should be studied and analyzed regarding the efficiency of the service rendered.</li> <li>- Formal and informal participation by private sector is important, and its participation in SWM will keep on increasing.</li> <li>- It will be necessary to re-examine the contract-out and concession processes to achieve a total transparency of both, competition among enterprises and cost reduction. On the other hand, Technical Supervision Units in municipalities should be duly organized.</li> <li>- Management of pathological hospital wastes by MSPAS, that began in January 2000, should improve day by day in close cooperation with AMSS municipalities.</li> </ul>

Items	Key issues
Social	<ul style="list-style-type: none"> <li>- Present and future activity by micro-enterprises should be promoted, consulted, trained and formalized.</li> <li>- Formalization of more than 300 scavengers that are working at Mariona and 3 other dumping sites.</li> <li>- A study to create collection micro-enterprises, formed by municipal workers themselves as an alternative option.</li> <li>- Weak community participation should change through sensitization, informational, communication and educational programs focused on elementary education.</li> </ul>

### G.9.3.6 Administrative

- The 1.1 cleansing workers ratio per 1000 inhabitants in AMSS is comparable with that of other Latin American cities. However, differences among municipalities are important: San Salvador and Antigua Cuscatlán have 2.3 workers/1000 inhabitants, whereas Mejicanos, Ayutuxtepeque, Soyapango, San Martín and Apopa have less than 0.5. This could suggest that some of the municipalities might have more workers than required and others might be short of them or that the capacity to expand the service without losing quality might be sufficient.
- Formal or informal participation by private sector (enterprises, micro-enterprises, cooperatives and others) is active by means of contracts and/or concessions. Calculations show that up to 25% collection might be being executed by the private sector, whereas in final disposal activities such rate could reach almost 90% through the sanitary landfill managed by CINTEC. The aforementioned means that programs and regulations regarding private participation should be reviewed in order to make contracting-out and concessions more transparent, fostering competition among enterprises, cost reduction and better quality of the services rendered. Besides, Municipal Supervising Units regarding contracts and concessions should be strengthened.
- Administration of the cleansing personnel is managed by sections not related to the service itself, and the formalities to purchase and obtain supplies is tedious and bureaucratic.
- Management of hospital solid wastes is carried out by the same generators of pathological wastes: MSPAS, ISSS, private hospitals and clinics. The collection of these pathological wastes is conducted directly by MSPAS at their hospitals, and the collection of pathological wastes in ISSS' and private hospitals is conducted by means of a private contractor. Autoclave treatment for pathological wastes is contracted out to the private company CINTEC.

### G.9.3.7 Social

- An important number of informal micro-enterprises, cooperatives and family groups are working in the collection of solid wastes. Most of them cannot have capacity to transport waste to the Nejapa sanitary landfill or even pay US \$ 18/Ton of wastes discharged; therefore, they dump those wastes anywhere and thus increasing the number of illegal dumping sites. Promotion, training and

formalization of such small organizations by municipalities should not be delayed at all.

- Formalization of more than 300 scavengers that are currently selecting solid wastes at “Mariona’s temporary transfer station” and dumping sites of “La Chuca (Espiga)”, “San Martín #1” and “Cantón El Rosario” should be faced in the short term. A possibility is to create micro-enterprises or cooperatives for the selection of materials for recycling.
- The creation of collection micro-enterprises with municipality workers is another option that should be analyzed.
- Community participation in SWM is still weak. People are still unaware of the purposes of the reduction, reuse and recycling of solid wastes. Most of the population is ignorant of the negative effect on health and environment by an inappropriate SWM. They pay for the cleansing services as an obligation instead of being convinced about it. A program that sensitizes and educates the community; that fosters the environmental education program in schools; that permanently informs the population on the functions and operations by the cleansing services; and that trains the municipal working staff, as well as that of micro-enterprises and cooperatives that work in SMW will have to be developed.

## **G.9.4 Financial System**

### **G.9.4.1 Examination on Current Balance of SWM**

In order to realize a sound and sustainable municipal SWM, it is necessary to establish a system to assure the revenue (i.e., the service fee collection) to cover not only the direct cost but also the indirect cost of municipal SWM. However in the present situation, only a few municipalities out of 14 municipalities have just enough revenue (SWM fees) to cover the direct cost of the municipal SWM. In other words, most municipalities presently can not collect SWM fees even to cover the recurrent direct cost of municipal SWM. Therefore it is strongly anticipated that the indirect cost of SWM and a capital expenditure when necessary (e.g., replacement of collection vehicle in the near future) need to be covered by some other financial sources of the municipality or that SWM fees should be collected more. However, these must be another difficult task for those municipalities.

For some municipalities such as Mejicanos, Ayutuxtepeque and San Marcos, their direct SWM expenditure account for as high as more than 80% of total municipal income (local tax and all municipal fees). It clearly shows that such municipalities are now facing the hardship of covering the SWM costs.

If a large portion of the whole municipal budget is appropriated for one municipal administration issue (i.e., SWM), it could easily result that other municipal management issues are made light of or ignored of. In other words, an unbalanced appropriation of municipal resources will not last long and may induce miserable consequences for the municipality’s administration and consequently it may demand a tall order for citizen that might be far beyond the ability-to-pay of the citizen.

Table G-93: Examination of Current Balance of SWM

	SWM cost (direct only)	SWM Fees collected	Balance	Municipal (Tax+Non-tax) Income total	Share of SWM cost to Tax+Non-tax	Municipal budget total: Central subsidy & (Tax+Non-tax)	Share of SWM cost to total revenue
	A	B	B-A	C	A/C	D	A/D
	(c/person <sup>1</sup> )	(c/person <sup>2</sup> )		(c/person*2)	%	(c/person*2)	%
San Salvador	154.7	204.6		492.2	31.4	681.4	22.7
Mejicanos	41.5	38.6	red	50.3	82.5	82.2	50.5
Delgado	25.2	26.1		76.9	32.8	121.7	20.8
Cuscatancingo	20.3	23.3		55.1	36.9	144.5	14.0
Ayutuxtepeque	52.0	34.6	red	45.6	114.1	226.7	22.9
San Marcos	43.9	34.4	red	66.4	66.2	153.1	28.7
N. San Salvador	101.3	105.5		271.0	37.4	371.8	27.3
Antiguo Cuscatlan	176.5	74.6	red	367.4	48.0	497.2	35.5
Soyapango	51.5	46.5	red	69.1	74.5	142.2	36.2
Ilopango	39.7	42.0		57.1	69.6	101.8	39.0
San Martin	17.3	15.4	red	44.9	38.7	136.9	26.0
Apopa	31.1	24.3	red	51.3	60.6	85.3	36.5
Nejapa	18.1	7.9	red	40.2	45.0	271.8	6.7
Tonacatepeque	18.4	6.9	red	44.8	41.2	150.1	12.3

Note: <sup>1</sup> Service Projected Population, <sup>2</sup> Census Population

In view of negative indicators shaded in the cells of the above table, Mejicanos, Ayutuxtepeque, San Marcos, and Soyapango must be facing the hardship in recovering the municipal SWM costs.

#### G.9.4.2 Examination of Trends of SWM costs

One of the major critical problems is that the great majority of the 14 municipalities does not view or interpret the trends of annual expenditure for the municipal SWM.

In fact, not only the 10 municipalities that use the MIDES landfill but also other municipalities are now facing the considerable increase of final disposal cost as explained below.

##### a. Recent Cost Increase

##### a.1 1994 Cost Estimation

The 1995 Canadian studies<sup>14</sup>, which also constitute the “Documento Complementario No.1 del E.I.A.” of the MIDES project that was submitted to OPAMSS as a clarification document for requesting the construction permission of MIDES landfill, estimate the unit costs of SWM in AMSS in 1994 as follows.

<sup>14</sup> “Proyecto de Mejoramiento del Manejo de los Desechos Sólidos de la Región Metropolitana Fase 1 – Diagnóstico. (Mayo, 1995. CIDA Doble-G, Soprin ADS)” and “Proyecto de Mejoramiento del Manejo de los Desechos Sólidos de la Región Metropolitana Fase 2 – Programa de Ejecución. (Octubre, 1995. CIDA Doble-G, Soprin ADS)”

Table G-94: 1994 SWM Costs Estimated by the Canadian Study

	Collection (U\$/ton) <sup>1</sup>	Transport (U\$/ton) <sup>2</sup>	Disposal (U\$/ton) <sup>3</sup>	Overall (U\$/ton)
San Salvador	7.5	9.00	3.58 <sup>4</sup>	20.08
Mejicanos	5.0	6.76	0.0	11.76
Delgado	5.0	4.76	0.0	9.76
Cuscatancingo	5.0	6.75	0.0	11.75
Ayutuxtepeque	5.0	6.93	0.0	11.93
San Marcos	5.0	11.44	0.0	16.44
Nueva San Salvador	5.0	14.96	0.0	19.96
Antiguo Cuscatlan	5.0	13.06	0.0	18.06
Soyapango	5.0	7.50	0.0	12.50
Ilopango	5.0	1.48	1.5	7.98
San Martin	5.0	2.46	1.5	8.96
Apopa	5.0	1.49	0.0	6.49
Nejapa	5.0	0.90	0.0	5.90
Tonacatepeque	-	-	-	-

Note:

<sup>1</sup> It estimates the collection cost as 7.50US\$/ton for San Salvador and 5.00US\$/ton for other municipalities.

<sup>2</sup> It estimates the transport cost as 0.50US\$/ton/km for all municipalities.

<sup>3</sup> It estimated the final disposal cost as 1.50US\$/ton.

<sup>4</sup> It is re-calculated in a manner that all the final disposal cost incurred by the San Salvador municipality for disposing all the waste including from other municipalities at Mariona site is divided by the disposal quantity of San Salvador municipality only.

It estimated that the SWM cost in 1994 was in the range of US\$6.0 to 12.5/ton for 9municipalities and US\$16.5 to 20.0/ton for 4 municipalities in AMSS.

## a.2 1999 Present Cost

The JICA Team estimated the 1999 present SWM cost as shown in the table below based on the data of present expenditure of municipal SWM given by the C/P members.

Table G-95: 1999 Present SWM Cost based on the Team's Survey

City	Item	Service projected population (1998)	Colons				US \$			
			Per person	Per ton			Per person	Per ton		
				Overall cost (c/person)	Collection and transport (c/ton)	Disposal (c/ton)		Overall cost (c/ton)	Overall cost (U\$/person)	Collection and transport (U\$/ton)
San Salvador		467,006	154.7	87.7	147.7	443.4	17.7	10.0	16.9	50.7
Mejicanos		180,775	41.5	97.1	169.0	309.8	4.7	11.1	19.3	35.4
Delgado		145,189	25.2	100.1	202.1	346.6	2.9	11.4	23.1	39.6
Cuscatancingo		85,825	20.3	144.1	?	193.6	2.3	16.5	?	22.1
Ayutuxtepeque		26,216	52.0	142.4	214.9	386.1	5.9	16.3	24.6	44.1
San Marcos		68,685	43.9	120.0	140.4	279.1	5.0	13.7	16.0	31.9
Nueva San Salvador		133,461	101.3	265.0	188.6	507.1	11.6	30.3	21.6	58.0
Antiguo Cuscatlan		40,515	176.5	337.5	25.3	494.1	20.2	38.6	2.9	56.5
Soyapango		282,066	51.5	96.2	192.1	335.7	5.9	11.0	22.0	38.4
Ilopango		122,309	39.7	132.5	180.2	327.2	4.5	15.1	20.6	37.4
San Martin		66,861	17.3	121.3	?	138.1	2.0	13.9	?	15.8

City	Item	Service projected population (1998)	Colons				US \$			
			Per person	Per ton			Per person	Per ton		
				Overall cost (c/person)	Collection and transport (c/ton)	Disposal (c/ton)		Overall cost (c/ton)	Overall cost (US\$/person)	Collection and transport (US\$/ton)
Apopa		155,588	31.1	76.4	206.2	305.8	3.6	8.7	23.6	35.0
Nejapa		14,464	18.1	135.5	?	158.5	2.1	15.5	?	18.1
Tonacatepeque		27,640	18.4	53.7	?	69.8	2.1	6.1	?	8.1
Total		1,816,600	75.1	128.0	?	385.8	8.6	13.5	?	44.1

On the other hand, based on the same assumptions made by the 1995 Canadian studies, present SWM cost for municipalities in AMSS are estimated as shown in the table below.

Table G-96: 1999 Present SWM Cost based on the 1995 Canadian Estimation

	Present Cost Estimated				Cost Increased since 1994		
	Collection (US\$/ton) <sup>1</sup>	Transport (US\$/ton) <sup>2</sup>	Disposal (US\$/ton) <sup>3</sup>	Overall (US\$/ton)	Longer Transport Distance <sup>4</sup>	MIDES/ESPIGA Disposal Fee	Cost Increased Total
San Salvador	7.5	13.50	20.34	41.34	4.50	16.76	21.26
Mejicanos	5.0	11.26	20.34	36.60	4.50	20.34	24.84
Delgado	5.0	9.26	20.34	34.60	4.50	20.34	24.84
Cuscatancingo	5.0	18.25	5.00	28.25	11.50	5.00	16.50
Ayutuxtepeque	5.0	11.43	20.34	36.77	4.50	20.34	24.84
San Marcos	5.0	15.94	20.34	41.28	4.50	20.34	24.84
Nueva San Salvador	5.0	14.96	20.34	40.30	0.00	20.34	20.34
Antiguo Cuscatlan	5.0	9.56	5.00	19.56	-3.50	5.00	1.50
Soyapango	5.0	12.00	20.34	37.34	4.50	20.34	24.84
Ilopango	5.0	16.95	20.34	42.29	15.47	18.84	34.31
San Martin	5.0	2.46	1.5	8.96	-	-	0.00
Apopa	5.0	5.99	20.34	31.33	4.50	20.34	24.84
Nejapa	5.0	4.40	20.34	29.74	3.50	20.34	23.84
Tonacatepeque	-	-	-	-	-	-	0.00

Note:

- <sup>1</sup> It estimates the collection cost as 7.50US\$/ton for San Salvador and 5.00US\$/ton for other municipalities.
- <sup>2</sup> It estimates the transport cost as 0.50US\$/ton/km for all municipalities.
- <sup>3</sup> It calculates the final disposal cost as 20.34US\$/ton for MIDES fee (18.00US\$/ton+IVA) and 5.00US\$/ton as ESPIGA disposal fee.
- <sup>4</sup> Cuscatancingo has a 23km longer transport distance, Antiguo Cuscatlan has a 7km shorter transport distance, Ilopango has a 30.94km longer transport distance, Apopa has 7km longer and San Martin, Tonacatepeque and Nueva San Salvador have the same distance. The other 7 municipalities have 9km longer transport distance.

Two cost estimations, as shown in the above two tables, illustrate quite similar costs for respective municipalities.

- As for 7 municipalities of Mejicanos, Delgado, Ayutuxtepeque, Sam Marcos, Soyapango, Ilopango, and Apopa, which are with MIDES, the JICA study team's estimation ranges from US\$34.6 to 45.8/ton and the Canadian estimation ranges from US\$31.33 to 42.29/ton.
- As for San Salvador and Nueva San Salvador municipalities, which are with

MIDES: the JICA study team's estimation is slightly more than the Canadian estimation (i.e., about US\$9 to 12/ton higher).

- As for San Martin and Tonacatepeque, that dispose their waste at the open dumping sites of the same municipalities, the cost ranges from US\$10 to 20/ton.
- As for Nejapa, that currently does not pay the MIDES disposal fee, the cost also ranges from US\$10 to 20/ton.
- As for Cuscatancingo, two cost estimation give the cost of US\$22.1/ton and US\$ 28.25/ton.
- As for Antiguo Cuscatlan: Two estimation give the cost of US\$53.9/ton and US\$ 19.56/ton.

Therefore, it could be judged that 1999 present cost calculated above could be reliable figures in general.

It estimated the total direct cost of SWM in the range of **US\$30.0 to 50.0/ton** for municipalities with MIDES.

Cuscatancingo and Antiguo Cuscatlan municipalities, which are not with MIDES, also face the recent cost increase mainly due to the additional costs incurred by the longer transport distance to ESPIGA disposal site and disposal fees to the same site.

### a.3 Near Future Cost with MIDES Transfer Station

In order to receive a construction permission (i.e., OPAMSS resolution No. 0188-98 dated 23 March 1998) for the MIDES landfill, SINTEC submitted a document which explained that transfer station(s) be located very near to the waste generation center of AMSS.

Supposing that a MIDES transfer station be located near the waste generation center of AMSS in accordance with the "Escenario 2" of the 1994 Canadian study, SWM cost in the near future is estimated as shown in the table below.

Table G-97: Near Future SWM Cost with MIDES Transfer Stations based on the 1995 Canadian Estimation (Escenario 2)

	Present Cost Estimated				Cost Increase or Decrease Compared with 1994 Cost		
	Collection (U\$/ton)	Transport (U\$/ton) <sup>1</sup>	Disposal (U\$/ton)	Overall (U\$/ton)	Transport Distance Changed	MIDES/ESPIGA Disposal Fee	Cost Increased Total
10 municipalities currently with MIDES project							
4 municipalities that Escenario 2 proposes to transport to the Transfer Station.							
San Salvador	7.5	1.75	20.34	29.60	-7.25	16.76	9.51
San Marcos	5.0	5.50	20.34	30.84	-5.94	20.34	14.40
Nueva San Salvador	5.0	6.25	20.34	31.59	-8.71	20.34	11.63
Soyapango	5.0	3.25	20.34	28.59	-4.25	20.34	16.09
6 municipalities that Escenario 2 proposes to transport to the Landfill site.							
Mejicanos	5.0	8.75	20.34	34.09	1.99	20.34	22.33
Delgado	5.0	8.75	20.34	34.09	3.99	20.34	24.33
Ayutuxtepeque	5.0	8.25	20.34	33.59	1.32	20.34	21.66
Ilopango	5.0	9.00	20.34	34.34	-3.45	18.84	15.39
Apopa	5.0	3.50	20.34	28.84	2.01	20.34	22.35
Nejapa	5.0	6.50	20.34	31.84	5.60	20.34	25.94

	Present Cost Estimated				Cost Increase or Decrease Compared with 1994 Cost		
	Collection (U\$/ton)	Transport (U\$/ton) <sup>1</sup>	Disposal (U\$/ton)	Overall (U\$/ton)	Transport Distance Changed	MIDES/ESPIGA Disposal Fee	Cost Increased Total
2 municipalities currently with ESPIGA landfill.							
Cuscatancingo	5.0	18.25	5.00	28.25	11.50	5.00	16.50
Antiguo Cuscatlan	5.0	9.56	5.00	19.56	-3.50	5.00	1.50
2 municipalities currently dispose at open dumping sites within their municipalities.							
San Martin	5.0	2.46	1.5	8.96	-	-	0.00
Tonacatepeque	-	-	-	-	-	-	0.00

Note:

<sup>1</sup> "Escenario 2" in the "Proyecto de Mejoramiento del Manejo de los Desechos Sólidos de la Región Metropolitana Fase 2 – Programa de Ejecución. (Octubre, 1995. CIDA Doble-G, Soprin ADS)" estimates the distance to MIDES Transfer Station or Landfill as follows: San Salvador 3.5km, Mejicanos 17.5km, Delgado 17.5km, Ayutuxtepeque 16.5km, San Marcos 11km, Nueva San Salvador 12.5km, Soyapango 6.5km, Ilopango 18.0 km, Apopa 7km and Nejapa 13km.

The above table illustrates that, if a MIDES transfer station is located as described in the "Escenario 2", some municipalities could save some amount of SWM cost (US\$ 4 to 9/ton) due to shorter transport distance.

The above table estimated the total direct cost of SWM in the range of **US\$29 to 34/ton** for 10 municipalities with MIDES with condition that a transfer station be located very close to the waste generation center of AMSS.

#### G.9.4.3 Examination on Municipalities' Ability-to-Pay (ATP) for Present SWM

##### a. Scale of Municipal Income

Taking a look at the scale of municipal income (impuestos y tasas municipales), San Salvador, Antiguo Cuscatlan and Nueva San Salvador might have higher possibility to reserve the appropriate ATP than other 11 municipalities in AMSS for maintaining the current SWM. This is because the 3 municipalities have the municipal revenue of US\$56.3/person/year, US\$42.0/person/year and US\$31.0/person/year respectively, however, that for other 11 municipalities ranges from US\$4.6/person/year to US\$8.8/person/year only. It suggests that even a slight increase of SWM cost (e.g., US\$1.0/person/year) brings a large hardship for such municipalities.

##### b. Current Balance (Revenue/Expenditure) of Municipal SWM

In view of "Current Balance of SWM" examined in the above section G.9.4.1, as most municipalities presently can not collect SWM fees sufficient enough to cover the recurrent direct cost of municipal SWM, most municipalities do not presently secure ATP for present SWM.

Furthermore, if additional expenditure such as capital expenditure to renew the waste collection vehicle become necessary in the near future, it is further anticipated that the municipalities' ATP for maintaining the present level of SWM becomes critical.

##### c. Municipal Cost Recovery for Cleansing Service

It becomes necessary for municipalities to increase the municipal revenue in order to maintain the municipalities' ATP for present SWM. One typical action to raise the



municipal revenue for covering the SWM service is to raise the fees for the same service that should be paid by the users of the service, namely the citizens.

In this context, it is necessary to examine the citizen's ATP for receiving cleansing services. This is examined in the section below.

#### G.9.4.4 Examination on Citizen's ATP for SWM

##### a. Present Burden on Citizen's Income (BCI)

In order to examine citizen's ability-to-pay (ATP) for SWM fees, Table G-98 shows relation between the "SWM cost per person per year" and average annual income of the citizen. The column D in the table shows the average annual income of citizen that ranges from 7,000 to 40,000 colons depending upon respective municipalities. The column E shows present SWM costs (**direct cost only**) for respective municipalities. Hence, column G shows average SWM cost burden for a citizen on their income.

Table G-98: SWM Cost and Burden on Citizen's Income (BCI)

A	B	C	D	E	F	G
	Annual Municipal SWM cost (colons)	Service projected population (1999)	Average annual income (colon/person)	Unit cost per person (colon/person/year)	Unit cost per person (US\$/person/year)	Unit cost per Annual income
San Salvador	72,241,000	467,006	17,650.7	154.7	17.7	0.88%
Mejicanos	7,501,702	180,775	15,488.6	41.5	4.7	0.27%
Delgado	3,665,464	145,189	12,029.8	25.2	2.9	0.21%
Cuscatancingo	1,741,541	85,825	11,481.6	20.3	2.3	0.18%
Ayutuxequpe	1,363,733	26,216	14,183.9	52.0	5.9	0.37%
San Marcos	3,017,786	68,685	10,813.6	43.9	5.0	0.41%
Nueva San Salvador	13,525,187	133,461	20,011.0	101.3	11.6	0.51%
Antiguo Cuscatlan	7,149,455	40,515	39,874.4	176.5	20.2	0.44%
Soyapango	14,515,509	282,066	13,801.2	51.5	5.9	0.37%
Ilopango	4,860,581	122,309	11,547.1	39.7	4.5	0.34%
San Martin	1,159,211	66,861	8,891.0	17.3	2.0	0.19%
Apopa	4,841,514	155,588	10,173.1	31.1	3.6	0.31%
Nejapa	261,952	14,464	7,321.6	18.1	2.1	0.25%
Tonacatepeque	509,705	27,640	7,321.6	18.4	2.1	0.25%
Total/average	137,827,505	1,816,600	14,327.8	75.1	8.6	0.52%

The SWM direct cost ranges from **0.19% to 0.88%** of the citizen's income in AMSS.

##### b. Ability-to-Pay (ATP)

The indicator of citizen's ATP for SWM fees (i.e., what percentage on income) varies depending on the economical situation of respective countries or cities. As a general reference for this examination, an example<sup>15</sup> of middle income countries with GDP per capita of about US\$1,950 is given in Table G-99.

<sup>15</sup> Conceptual Issues and Experiences in Developing Countries, December 1991, Sandora Cointreau-Levine

Table G-99: Representative Costs of Municipal SWM

SWM cost components	Percentage on Citizen's Income (%)
Collection	0.5 to 1.1
Public cleansing	0.1 to 0.2
Disposal	0.05 to 0.2
Transfer	0.1 to 0.2
Total	0.75 to 1.7

Meanwhile, Table G-99 indicates a reasonable range of citizen's burden for municipal SWM cost (which includes capital expenditure and indirect costs). The range from 0.75% to 1.7% of income is for bearing both current and capital expenditure of municipal SWM. Assuming representative proportions of 70% and 30% between current expenditure and capital expenditure on municipal SWM, it is suggested that a range from 0.53% to 1.19% of income is for bearing the current expenditure of municipal SWM. A mean value of 0.53% and 1.19% is calculated as **0.86%** herewith.

**c. Willingness-to-Pay (WTP)**

Table G-100 shows WTP for municipal SWM fees by citizens in AMSS that is induced from the public opinion survey (POS) of this study. It ranges from 33.3 to 65.0 colons/person/year being 0.17% to 0.65% of their annual income. Its mean value is 44 colon/person/year and 0.33% of the annual income of citizens.

Table G-100: Willingness to Pay for Municipal SWM Fees

	Willingness to pay (colon/person/year)	Willingness to pay per Annual income
San Salvador	50.7	0.29%
Mejicanos	47.7	0.31%
Delgado	35.7	0.30%
Cuscatancingo	40.5	0.35%
Ayutuxepeque	-	-
San Marcos	48.3	0.45%
Nueva San Salvador	33.5	0.17%
Antiguo Cuscatlan	65.0	0.16%
Soyapango	38.0	0.28%
Ilopango	33.3	0.29%
San Martin	57.7	0.65%
Apopa	35.4	0.35%
Nejapa	-	-
Tonacatepeque	-	-
Average	44.2	0.33%

Source: results of public opinion survey in this study

Figure G-26 illustrates relations among present citizen's burden, ATP and WTP.

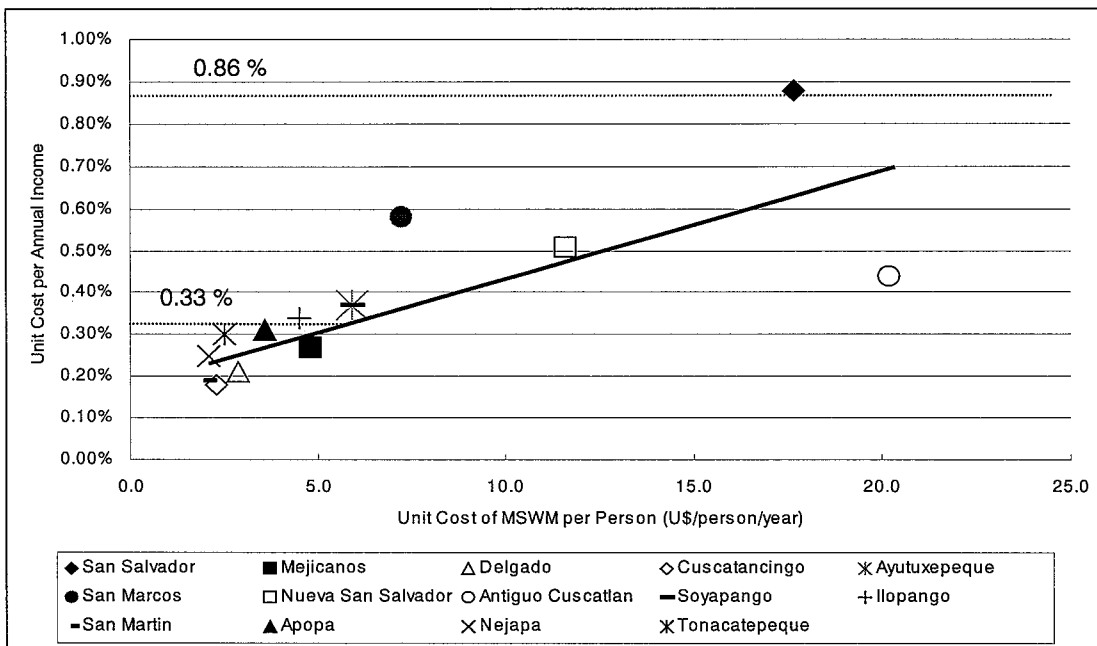


Figure G-26: Relation among BCI, ATP and WTP

**d. Examination of Appropriate Range of BCI**

As shown in Figure G-26, present “burden on citizen’s income (BCI)” for 7 municipalities of Mejicanos, Delgado, Cuscatancingo, San Martin, Apopa, Nejapa, Tonacatepeque are 0.27%, 0.21%, 0.18%, 0.19%, 0.31%, 0.25%, 0.30% respectively and they are below the mean value of WTP given by the POS. However, the mean value of BCI (i.e., 0.53%) for 14 municipalities exceeds the mean value of WTP (0.33%) given by the POS.

Present BCI of San Salvador municipality accounts for 0.88%, which exceeds the ATP value (0.86%) induced from Cointreau’s data.

If it is assumed that the appropriate BCI for AMSS is in the range of a mean value of the ATP above and the WTP from the POS, the present BCI of 14 municipalities on average falls on this mean value of ATP and WTP (about 0.6%). It consequently suggests that the **present BCI in AMSS reaches the upper limit of citizen’s ATP in general in AMSS.**

This shows that the direct cost of present municipal SWM is considerably expensive against general ATP of citizen in AMSS.

Meanwhile, the municipal SWM cost examined herewith is the direct cost of municipal SWM in AMSS, which does neither include the indirect cost nor capital expenditure. Therefore, actual citizen’s burden will be heavier than what was examined above.

**e. Future Cost Increase would be Intolerable**

The above examinations on ATP of both municipalities and citizens suggest that the present expenditure on municipal SWM could be a critical and upper-limit burden for both municipalities and citizens.

If further increase of SWM cost is anticipated in the future, well-considered plans and strategies should be formulated in advance for providing countermeasures to restrain the cost burden increase on municipalities and citizens and to establish and continue a sustainable SWM.

#### **G.9.4.5 Key Issues on Financial Aspects**

It should be a political decision of a mayor that what priority be given to the SWM issue among all the municipal administration issues. In so doing, it is essential that plans and strategies on municipal SWM with concrete ideas (i.e., concrete planning figures) should be formulated, practiced and monitored. In other words, it should be clarified what percentage of the whole municipal budget be appropriated for the SWM and how much should be proportioned for respective components of collection, street sweeping, final disposal, etc. from the whole SWM budget. And that should be an open information to the public in countries and/or cities where a democracy is further sought. However in practice, such information is not easily found in most of 14 municipalities for reviewing and analyzing the sustainability of municipal SWM.

##### **a. Key Issues**

In this context, examination of the following issues should be required for formulating the Master Plan.

1. A system to establish, realize and monitor the revenue/expenditure balance of municipal SWM (i.e., an independent cost accounting for SWM)
2. Establishment of component-wise cost accountability for SWM
3. Principles and strategies for fee collection (e.g., improvement of fee collection system)
4. Fee rates justification (examination of respective users' burden in view of ability-to-pay)

#### **G.9.5 Sanitary Education and Public Participation**

While the lack of waste collection generates high health risks and other problems, the accumulation of waste in "quebradas", rivers and illegal waste dumping also causes serious environmental problems including water pollution risks.

Inappropriate SWM can have serious consequences in the public health and a significant impact on the environment. Sound SWM is thus a crucial component of public health protection.

Sanitary and environmental degradation affects sustainable development. It has negative impacts on health and life expectancy, and consequently, reduces human capital investment and economic growth. Additionally, it reduces the quality of life, soil and labor productivity, and increases production costs.

According to surveys carried out by different organizations in other studies, the population has shown a lack of perception toward the solid waste problems when answering the questionnaire surveys carried out in the country:

- Sanitary education programs related to solid waste have been of little coverage.
- There is no unification of conceptual and/or operative approaches at an inter-

institutional level.

- The people do not perceive sanitary education as part of the problem related to solid waste. Also, institutions do very little in modifying the situation.
- Active community participation is rarely considered in the sanitary education programs.

Life and environmental quality may decrease if the potential and the existing impacts are not correctly assessed and necessary control measures are not adopted. The participation and own efforts made by the community to control the negative effects of the waste mismanagement will contribute positively to improve quality of life and the environment.

In AMSS there is no appropriate SWM at the citizen level, therefore, sanitary education and public awareness promotion are fundamental for the sustainability of the efforts made for appropriate SWM.