

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NO. 22

THE GOVERNMENT OF THE FEDERAL DISTRICT
THE UNITED MEXICAN STATES

社会開発調査部報告書

**THE STUDY
ON
SOLID WASTE MANAGEMENT
FOR
MEXICO CITY
IN
THE UNITED MEXICAN STATES**

**FINAL REPORT
VOLUME I**

EXECUTIVE SUMMARY

JICA LIBRARY



J 1151136 (7)

MAY 1999

KOKUSAI KOGYO CO., LTD.

SSS

JR

99-082

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE GOVERNMENT OF THE FEDERAL DISTRICT
THE UNITED MEXICAN STATES

**THE STUDY
ON
SOLID WASTE MANAGEMENT
FOR
MEXICO CITY
IN
THE UNITED MEXICAN STATES**

**FINAL REPORT
VOLUME I**

EXECUTIVE SUMMARY

MAY 1999

KOKUSAI KOGYO CO., LTD.



1151136 [7]

PREFACE

In response to a request from the Government of the United Mexican States, the Government of Japan decided to conduct a development Study on Solid Waste Management for Mexico City in the United Mexican States and entrusted the study to the Japan International Cooperation Agency (JICA).


JICA selected and dispatched a study team headed by Mr. Hiroshi Kato, Kokusai Kogyo CO., LTD. to Mexico, three times between June 1998 to May 1999. In addition, JICA set up an advisory committee headed by Dr. Kunitoshi Sakurai, International Environmental Planning Institute between June 1998 to May 1999.

The team held discussions with the officials concerned of the Government of Mexico, and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Mexico for their close cooperation extended to the Team.

May 1999



Kimio Fujita

President

Japan International Cooperation Agency



May 1999

Mr. Kimio Fujita
President
Japan International Cooperation Agency

Letter of Transmittal

Dear Mr. Fujita,

We are pleased to submit the report on the Study on Solid Waste Management for Mexico City in the United Mexican States.

This report consists of three components: a study on the present practices of waste management in Mexico City; the formulation of the solid waste management master plan until the year 2010; and a feasibility study on the priority projects drawn from the master plan.

In the study on the present practices, six types of field investigations were conducted and existing data and information of various sources were collected and examined. By doing so, the current status of solid waste management in Mexico City was thoroughly understood and the issues to be considered were identified.

The master plan was formulated aiming to overcome these issues, with ultimate goals of the promotion of citizens' welfare, implementation of sustainable solid waste management, and contribution to environmental conservation. In the master plan, we proposed a planning framework which shows stepwise implementation and strategies towards the goals. We also suggested technical and institutional improvement plans, a public education program, and financing options.

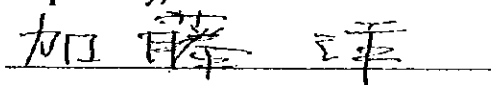
The feasibility study was carried out on three priority projects which should be commenced during the years from 1999 to 2001: introduction of a new composting plant, vertical expansion of an existing final disposal site, and construction of a new final disposal site. From the technical, financial, economical, institutional, social and environmental assessment of these projects, we concluded that they would be viable and sound in every aspect.

During the study, we held two seminars on technology transfer with as much as 200 participants in each. The seminars were reported on newspapers and attracted much attention from the general public.

We would like to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Health and Welfare of Japan. We would also like to extend our deep appreciation to the Government of the Federal District, the Embassy of Japan and the JICA office in Mexico for their vital cooperation during the implementation of our study in the United Mexican States.

Last but not least, we hope that the output of our study presented here will contribute to the improvement of solid waste management and citizens' welfare in Mexico City.

Respectfully,



Hiroshi Kato

Team Leader

The Study on Solid Waste Management for
Mexico City in the United Mexican States

8

8

8

1 Objectives of the Study

The study covers the Federal District (DF) as its subject and aims to achieve the following objectives.

- Formulate an SWM master plan for the target year 2010.
- Carry out the feasibility study of the priority project(s).
- Pursue technology transfer regarding SWM to the counterpart personnel.

2 Study Area

This study covers the area under the jurisdiction of the Government of the Federal District of the United Mexican States.

3 Solid Waste to be Covered Under the Study

The following six "solid waste" types are covered during the study.

- 1) Domestic waste.
- 2) Commercial waste.
- 3) Institutional waste.
- 4) Market waste.
- 5) Street sweepings waste.
- 6) Medical waste.

4 Target Year

The target year of the Master Plan is 2010 and that of the Feasibility Study on the priority projects, which was selected during the Phase II of the study, is 2004.

5 The Master Plan

5.1 Scope of the Master Plan

The major study scope field of the M/P is defined as shown in Figure 1.

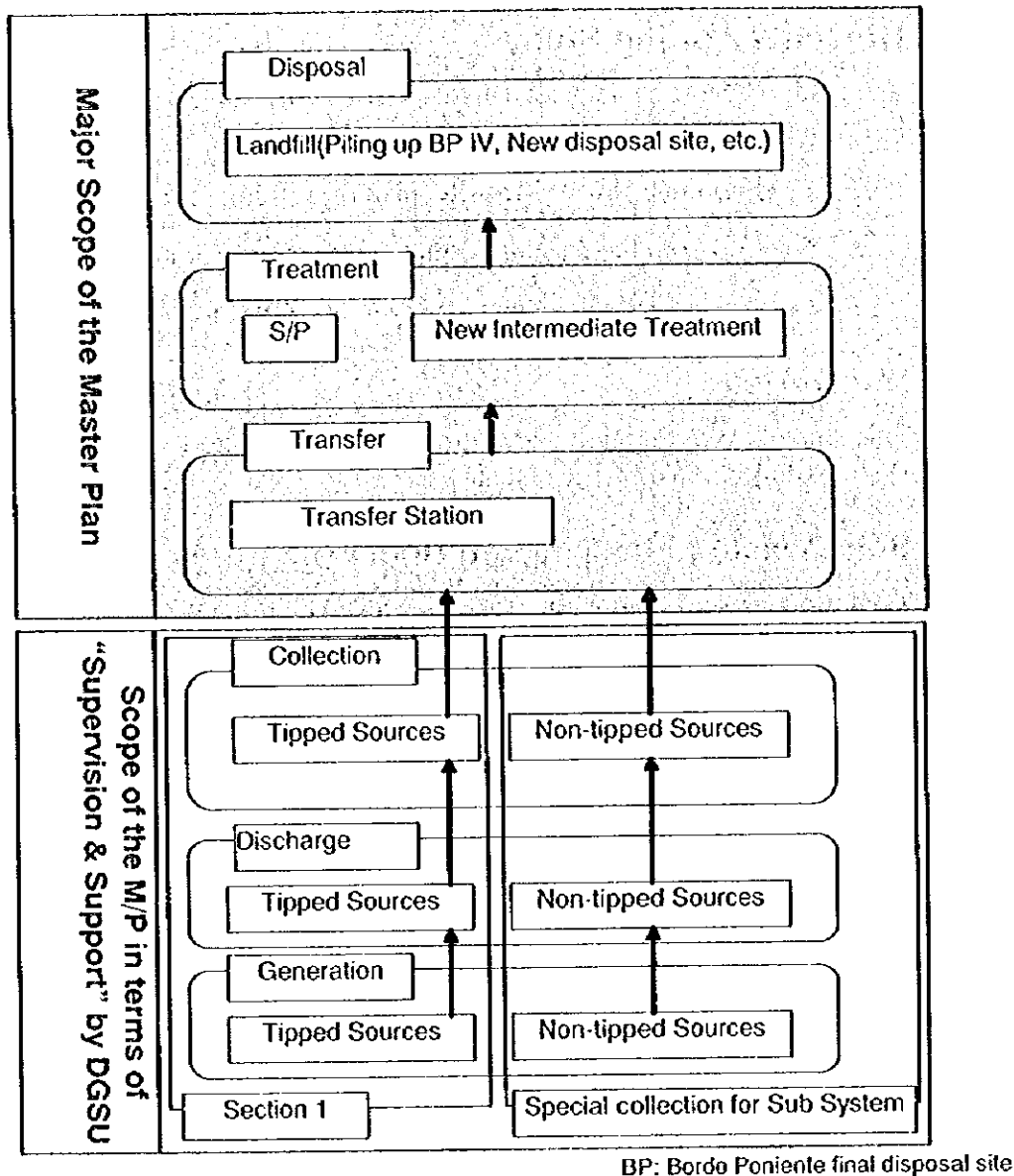


Figure 1: Scope of the M/P

5.2 Goals

The principal goal of the Master Plan is to establish a sound Solid Waste Management System by the target year 2010 in Mexico City, where the population and major economic activities of the country are centered.

The Master Plan aims to:

- ◆ promote the citizens' well-being.
- ◆ implement sustainable SWM.
- ◆ contribute to environmental conservation.

Table 1: Outline of the Master Plan

	Data of 1997	Phase 1 (1999 - 2001)	Phase 2 (2002 - 2004)	Phase 3 (2005 - 2010)
Population	8,610,000	8,654,000-8,747,000	8,796,000-8,896,000	8,946,000-9,206,000
Waste generation amount (ton/year)				
Household	1,926,000	1,946,000-1,965,000	1,976,000-1,998,000	2,009,000-2,072,000
Commercial	1,210,000	1,217,000-1,223,000	1,229,000-1,236,000	1,244,000-1,267,000
Service	636,000	642,000-649,000	652,000-657,000	659,000-669,000
Special	130,000	131,000-134,000	134,000-136,000	136,000-140,000
Others	267,000	268,000-270,000	271,000-275,000	276,000-282,000
Total	4,169,000	4,204,000-4,241,000	4,262,000-4,302,000	4,324,000-4,430,000
Discharge/Storage				
	Sub System	-	Introduction of source separation	Introduction of source separation
	Delegation	Mixed	Mixed	Introduction of source separation
Collection				
Amount (ton/year)	Sub System	-	853,000-858,000	861,000-867,000
	Delegation	4,169,000	3,293,000-3,325,000	3,342,000-3,376,000
Method	Sub System	-	Introduction of separate collection	Introduction of separate collection
	Delegation	Mixed	Mixed	Introduction of separate collection
Transfer Station and Transport				
Transfer Station and Transport			<ul style="list-style-type: none"> Installation of weighbridges for every station. Utilization of a single common format for data compilation 	<ul style="list-style-type: none"> Utilization of the transport monitoring and control system (for 5 flows¹) based on the accurate incoming/outgoing weight measuring Efficient transport allocation by the monitoring and control system
Transfer amount (ton/year)		3,123,000	3,725,000-3,757,000	3,776,000-3,812,000
O&M cost(US\$/year)		43,547,000	51,941,000-52,387,000	52,652,000-53,154,000
Intermediate Treatment				
Selection plant			<ul style="list-style-type: none"> Experiment of operation modification to incorporate an objective of quantity oriented picking. Experiment of "storage system" for recovered materials to cope with market prices fluctuation. 	<ul style="list-style-type: none"> Implementation of operation control with 2 objectives of: <ul style="list-style-type: none"> - revenue oriented picking; - quantitative picking. Establishment of "storage system" for recovered materials to cope with market prices fluctuation, in view of experiment results.
Input amount (ton/year)	Mixed	1,794,000	1,650,000-1,516,000	1,288,000- 725,000
	Recyclable	-	0 - 98,000	210,000-438,000
Recycle amount(t/y)		182,000	166,000-224,000	277,000-380,000
Recovery rate (%)		10.0	10.0-13.6	18.5-32.7
O&M cost (US\$ 1,000)		11,232	10,565 - 10,537	9,857 - 8,296
Composting plant			Design and construction	Starting operation
Input amount (ton/year)		-	-	253,000 - 424,000
				425,000 - 431,000

¹ 5 flows refer to current waste flows (from the transfer stations to the S/Ps, from the transfer stations to the final disposal sites, and from the S/Ps to the final disposal site) and additional flows from the transfer stations to the NIT and the NIT to the final disposal site.

		Data of 1997	Phase 1 (1999 - 2001)	Phase 2 (2002 - 2004)	Phase 3 (2005 - 2010)
	Compost production amount (ton/year)	-	-	34,000 - 57,000	57,000 - 58,000
	Investment (USD)	-	3,959,000	1,345,000	1,334,000
	O&M cost(US\$/year)	-	0 - 33,000	1,185,000 - 1,343,000	1,343,000 - 1,343,000
Final Disposal					
Final Disposal Site		BP "Etapas IV" Santa Catarina	BP "Etapas IV" vertical expansion Design & construction of BP "Etapas V"	Operation of BP "Etapas V"	Operation of BP "Etapas IV" & "Etapas V"
Disposal amount (ton/year)	GDF	3,489,000	3,619,000 - 3,592,000	3,325,000 - 3,101,000	3,089,000 - 2,994,000
	State of Mexico	262,000	284,000	284,000	284,000
	Total	3,751,000	3,903,000-3,876,000	3,609,000-3,385,000	3,373,000-3,278,000
Investment (US\$)		-	12,708,000	-	-
O&M cost (US\$/year)	Bordo Poniente	9,925,694	8,570,000 (2001)	9,400,000 (2003)	4,072,000 (2005)
	Santa Catarina	?	-	-	-
Others					
Street sweeping	Length (km/day)	1,273.4	1,285-1,296	1,303-1,316	1,323-1,357
	O&M cost (US\$/y)	3,293,000	3,323,000-3,352,000	3,369,000-3,403,000	3,421,000-3,509,000

Note: US\$ 1 = 9.1 pesos.

6 Feasibility Study for the Priority Projects

6.1 Outline of the Projects

6.1.1 Target

Final disposal sites are indispensable components of the solid waste management for the GDF to provide cleansing services for the citizens. However, urbanization in and around the DF makes it difficult year by year for GDF to secure lands for future final disposal sites. Furthermore, as an urgent and critical issue of the DF's SWM, the existing final disposal sites have a very limited remaining disposal capacity (i.e., the remaining service life is only up to the beginning of the year 2001.).

Therefore, actions for:

- minimization of final disposal amount; and
- establishment of a new final disposal site

are urgently required for the GDF to comply its mission of solid waste management. In order to facilitate the actions required for the "minimization of final disposal amount" and to solve the critical issue of "a new final disposal site establishment", priority projects are selected herewith, and their preliminary design, estimated cost, and feasibility are examined in its regard.

In practice, the priority projects comprise:

- a composting plant for processing organic wastes separately delivered from the sub-system, with a prime objective of prolongation of final disposal sites' service lives; and
- the vertical expansion of existing final disposal site (BP-IV) and the construction of a new final disposal site (BP-V).

6.1.2 Outline of the Projects

Table 2 shows outline of the projects.

Table 2: Outline of the Projects

	*Present	1999	2000	2001	2002	2003	2004
Population	8,610,000	8,654,000	8,698,000	8,747,000	8,796,000	8,846,000	8,896,000
Waste generation amount (ton/yr)							
Household	1,925,000	1,946,000	1,956,000	1,967,000	1,976,000	1,989,000	1,999,000
Commercial	1,210,000	1,217,000	1,221,000	1,225,000	1,230,000	1,234,000	1,238,000
Service	636,000	639,000	641,000	645,000	647,000	650,000	657,000
Special	133,000	135,000	135,000	135,000	137,000	137,000	137,000
Others	265,000	267,000	269,000	269,000	272,000	273,000	274,000
Total	4,169,000	4,204,000	4,222,000	4,241,000	4,262,000	4,283,000	4,302,000
Composting							
**Construction and Operation schedule	F/S	B/D,P/P(1)	P/P(2),D/D,S/V	CON(3/5)	OP(3/5) CON(1/5)	OP(4/5) CON(1/5)	OP(5/5)
Treatment capacity (t/d)	-	-	-	-	750	1,000	1,250
Treatment amount (t/y)	-	-	-	-	253,000	338,000	424,000
Final disposal							
**Construction and Operation schedule	BP-IV		B/D	D/D, CON	OP	-	-
	BP-V	F/S	B/D	D/D	CON	OP	OP
Site to be used	BP-IV	BP-IV	BP-IV	BP-IV	BP-V	BP-V	BP-V
Disposal amount (t/y)	3,751,000	3,903,000	3,889,000	3,876,000	3,609,000	3,493,000	3,385,000

* : 1997/1998 data

** F/S : feasibility study, B/D : basic design, D/D : detailed design, CON : construction, OP : operation, S/V : supervision,
P/P : Pilot Project

t/d : ton/day

Table 3: Preliminary Cost Estimate of Composting Plant

Unit : US\$ 1,000

Item	Details	unit	Unit Cost US\$	Quantity	Cost US\$	Cost Pesos P9.1=51
SITE IMPROVEMENT						
earth works	spreading 1.0m layer of construction waste	m ²	1.04	370,000	385,000	3,504,000
	gravel for base, t=0.25m, A=33ha	m ³	4.2	91,000	382,000	3,476,000
	spreading sand surface, t=0.25m, A=33ha	m ³	5.35	94,000	503,000	4,577,000
	grading of surface for drainage	m ²	0.23	330,000	76,000	692,000
general improvements	embankment, exit track construction					
	drainage, fencing, connect electricity				599,000	5,451,000
	lighting, access improvement, fuel tank					
water tank, portable buildings						
Site improvement Total					1,945,000	17,700,000
Equipment						
truck scale	80 ton + foundations etc.	unit	60,000	1	60,000	546,000
wheel loader (A)	wheel loader with 5.4 m ³ refuse bucket	unit	125,400	3	376,000	3,422,000
wheel loader (B)	wheel loader with 4.0 m ³ refuse bucket	unit	100,320	2	201,000	1,829,000
compact loader	backhoe/loader, 2.36m ³ /0.84m ³ bucket	unit	34,320	1	34,000	309,000
dump truck	16 m ³ , 10 ton	unit	33,660	4	135,000	1,229,000
conventional farm tractor	60 hp (gross engine)	unit	33,000	3	99,000	901,000
water tanker	8,000 liters	unit	28,380	1	28,000	255,000
shredder	cap. 30 tons/hr, 175hp	unit	99,000	3	297,000	2,703,000
windrow turner	cap. 2500 tons/hr	unit	180,000	1	180,000	1,638,000
trommel	Screen 8 mm, & conveyors	unit	201,600	1	202,000	1,838,000
magnetic separator	permanent magnet + frame	unit	7,200	2	14,000	127,000
conveyors (separation)	w=600, side angle=25%	unit	15,000	3	45,000	410,000
pick up equipment	cap. 2 ton	unit	22,500	2	45,000	410,000
Equipment Total					1,716,000	15,617,000
sub-total (1)					3,661,000	33,317,000
miscellaneous 10%					367,000	3,332,000
Direct cost					4,028,000	36,649,000
general expenses/overhead 30%					1,209,000	10,995,000
total construction cost					5,237,000	47,644,000
physical contingency 10%					524,000	4,764,000
IVA 15%					785,000	7,147,000
Total Cost					6,546,000	59,555,000

6.1.3 Priority Project Cost

Table 4 and Table 5 shows costs for the composting project from 1999 to 2010 annually. Two cases shown below were set for the cost estimates.

- Case 1: Investment and operation by the DGSU
- Case 2: Investment by the DGSU and contracting out operation

Table 4: Cost of Priority Projects, Case of Direct Operation by DGSU (Case 1)

Unit : US\$ 1,000

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	
BP Etapa IV	B/D	33	0	0	0	0	0	0	0	0	0	0	0	33	
	D/D & S/V	0	298	0	0	0	0	0	0	0	0	0	0	298	
	Construction	0	7,902	2,164	0	0	0	1,883	1,874	0	0	1,773	1,528	17,124	
	Equipment	0	2,777	0	0	0	0	0	0	0	0	0	0	2,777	
	O & M	Contract out	0	0	0	0	0	0	0	0	0	0	0	0	0
		Direct	0	0	728	111	21	111	728	818	21	111	728	818	4,195
	Land fee	0	0	425	425	425	425	425	425	425	425	425	425	4,250	
	Total	33	10,977	3,317	536	446	536	3,036	3,117	446	536	2,926	2,771	28,677	
BP Etapa V	B/D	41	0	0	0	0	0	0	0	0	0	0	0	41	
	D/D & S/V	0	204	162	0	0	0	0	0	139	0	0	0	505	
	Construction	0	0	4,068	7,464	7,224	7,001	0	0	3,915	2,022	0	0	31,694	
	Equipment	0	0	0	0	0	0	0	0	2,777	0	0	0	2,777	
	O & M	Contract out	0	0	0	0	0	0	0	0	0	0	0	0	0
		Direct	0	0	0	707	707	801	13	70	720	777	13	70	3,878
	Land fee	0	0	231	231	231	231	231	231	231	231	231	231	2,310	
	Total	41	204	4,461	8,402	8,162	8,033	244	301	7,782	3,030	244	301	41,205	
Landfill Total		74	11,181	7,778	8,938	8,608	8,569	3,280	3,418	8,228	3,566	3,170	3,072	69,882	
Composting	B/D	50	0	0	0	0	0	0	0	0	0	0	0	50	
	P/P	10	10	0	0	0	0	0	0	0	0	0	0	20	
	D/D & S/V	0	164	99	33	33	0	0	0	13	2	0	0	344	
	Construction	0	0	2,376	551	551	0	0	0	0	0	0	0	3,478	
	Equipment	0	0	2,548	520	0	0	0	0	0	2,441	520	0	6,029	
	O & M	Contract out	0	0	0	0	0	0	0	0	0	0	0	0	0
		Direct	0	0	0	662	820	820	820	820	820	820	820	820	7,222
	Land fee	0	0	33	33	33	33	33	33	33	33	33	33	330	
Total		60	174	5,056	1,799	1,437	853	853	853	866	3,296	1,373	853	17,473	
Total		134	11,355	12,834	10,737	10,045	9,422	4,133	4,271	9,094	6,862	4,543	3,925	87,355	
Initial Investment															
BP Etapa-IV		33	10,977											11,010	
BP Etapa-V		41	204	4,230										4,475	
Composting		60	174	5,023	1,104	584								6,945	
Total		134	11,355	9,253	1,104	584								22,430	

B/D : Basic design, D/D :Detailed design, S/V :Supervision, P/P : Pilot project, O&M : Operation and maintenance

Table 5: Cost of Priority Projects, Case of Contract-Out (Case 2)

Table 3: Cost of Vientiane Projects, Case of Contract out (Case 2)

Unit : US\$ 1,000

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
BP Etapa IV	B/D	33	0	0	0	0	0	0	0	0	0	0	0	33
	D/D & S/V	0	298	0	0	0	0	0	0	0	0	0	0	298
	Construction	0	7,902	2,164	0	0	0	1,883	1,874	0	0	1,773	1,528	17,124
	Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
	O & M													
		Contract out	0	0	1,499	0	0	0	1,499	1,499	0	0	1,499	1,499
	Direct	0	0	21	111	21	111	21	111	21	111	21	111	660
		Land fee	0	0	425	425	425	425	425	425	425	425	425	425
Total		33	8,200	4,109	536	446	536	3,828	3,909	446	536	3,718	3,563	29,860

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	
BP Etapa V	B/D	41	0	0	0	0	0	0	0	0	0	0	0	41	
	D/D & S/V	0	204	162	0	0	0	0	0	0	0	0	0	366	
	Construction	0	0	4,068	7,464	7,224	7,001	0	0	3,915	2,022	0	0	31,694	
	Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	
	O & M	Contract out	0	0	0	1,499	1,499	1,499	0	0	1,499	1,499	0	0	7,495
		Direct	0	0	0	0	0	94	13	70	13	70	13	70	343
	Land fee	0	0	231	231	231	231	231	231	231	231	231	231	231	2,310
Total		41	204	4,461	9,194	8,954	8,825	244	301	5,658	3,822	244	301	42,249	
Landfill Total		74	8,404	8,570	9,730	9,400	9,361	4,072	4,210	6,104	4,358	3,962	3,864	72,109	
Composting	B/D	50	0	0	0	0	0	0	0	0	0	0	0	50	
	P/P	10	10	0	0	0	0	0	0	0	0	0	0	20	
	D/D & S/V	0	164	99	33	33	0	0	0	13	2	0	0	344	
	Construction	0	0	2,376	551	551	0	0	0	0	0	0	0	3,478	
	Equipment	0	0	1,250	177	0	0	0	0	0	1,142	177	0	2,746	
	O & M	Contract out	0	0	0	1,051	1,186	1,186	1,186	1,186	1,186	1,186	1,186	1,186	10,539
		Direct	0	0	0	101	124	124	124	124	124	124	124	124	1,093
	Land fee	0	0	33	33	33	33	33	33	33	33	33	33	33	330
Total		60	174	3,758	1,946	1,927	1,343	1,343	1,343	1,356	2,487	1,520	1,343	18,600	
Total		134	8,578	12,328	11,676	11,327	10,704	5,415	5,553	7,460	6,845	5,482	5,207	90,709	
Initial Investment															
BP Etapa-IV		33	8,200											8,233	
BP Etapa-V		41	204	4,230										4,475	
Composting		60	174	3,725	761	584								5,304	
Total		134	8,578	7,955	761	584								18,012	

B/D : Basic design, D/D :Detailed design, S/V :Supervision, P/P : Pilot project, O&M : Operation and maintenance

7 Recommendation

7.1 Study Continuity

This development study (The Study on Solid Waste Management for Mexico City in the United Mexican States), under the JICA's technical cooperation program, will be finalized and ended when the Final Report of the Study is submitted to the GDF around May 1999. The solid waste management M/P and the priority projects are formulated through the study for the Mexico city. If the M/P and priority projects were not implemented, it means that all time and resources devoted to the study result in vain. Furthermore, benefits such as "promotion of citizens' well-being", "implementation of sustainable SWM" and "contribution for environmental conservation" expected in M/P and priority projects implementation will not be attained. Therefore, the study team strongly recommends that the M/P and priority projects should be implemented.

It is judged that the GDF has reserved the technical capability and financial affordability necessary for the implementation of the M/P and priority projects. Therefore, they can be considered to be ready for implementation.

Generally speaking on the other hand, when a new government is introduced after an election, plans and projects prepared by a former government often disappear before their implementation. In a worst case, reports and/or documents on plans and

projects disappear. It makes it impossible even to review all the former plans and projects prepared.

In order to avoid this study from suffering such an unproductive ending, efforts should be made to create such circumstances that the study can be continuously followed up and promoted. In practice, it is recommended that a SWM expert, who can be familiar with the study and politically, institutionally and technically be in a neutral position to advise about SWM, should be dispatched to the DGSU. The dispatch of JICA expert, which is another JICA's t/c scheme, is opportune to provide such an expert being neutral and with least to none cost burden on the counterpart institution (i.e., DGSU). The study recommends that DGSU should make a request of expert dispatch for JICA.

7.2 Compilation and Utilization of Data

It is recommended that data and information regarding such as "waste-flow" should systematically be measured, compiled and utilized every year in order to follow and verify what are assumed and planned in the M/P. Such compiled data and information will be extremely important to review and modify the M/P when in future it becomes necessary. At the same time, annual trends in respective SWM particulars can then be actually understood. Such data will possibly suggest a key for upgrading the SWM system of the DGSU.

7.3 Policy Approach for Recycling

It is estimated that recycling activities will be increased in line with the M/P. Resources recovered in SWM are increasingly distributed in the market. On the other hand in its consequence, it is anticipated that sales prices of recycled products may be lowered in response to increased supply of the products and it will contrarily impinge the recycling activities. Therefore, it is recommended that the policy approach (presented in Section 7.2.2 of the Main Report) to promote expanding markets of recycled products should be implemented.

7.4 Financial and Economic Aspect

If the following conditions were satisfied, the DGSU would be able to implement the priority projects by self-financing of the GDF without relying on the external funding, which will be the least cost solution from the financial viewpoint.

- The GDF in the year 1999 decides to commit an investment during 1999 to 2003 equivalent to 30 million US\$ for the priority projects.
- The DGSU, after the construction of the priority projects, annually continues to allocate the budget for operation and maintenance of the priority projects, which should be about 10 to 17% of the DGSU's annual budget amount.

1. The first part of the document is a list of names and addresses of the members of the committee.

2. The second part of the document is a list of names and addresses of the members of the committee.

3. The third part of the document is a list of names and addresses of the members of the committee.

4. The fourth part of the document is a list of names and addresses of the members of the committee.

5. The fifth part of the document is a list of names and addresses of the members of the committee.

6. The sixth part of the document is a list of names and addresses of the members of the committee.

7. The seventh part of the document is a list of names and addresses of the members of the committee.

8. The eighth part of the document is a list of names and addresses of the members of the committee.

9. The ninth part of the document is a list of names and addresses of the members of the committee.

10. The tenth part of the document is a list of names and addresses of the members of the committee.

11. The eleventh part of the document is a list of names and addresses of the members of the committee.

12. The twelfth part of the document is a list of names and addresses of the members of the committee.

13. The thirteenth part of the document is a list of names and addresses of the members of the committee.

14. The fourteenth part of the document is a list of names and addresses of the members of the committee.

15. The fifteenth part of the document is a list of names and addresses of the members of the committee.

16. The sixteenth part of the document is a list of names and addresses of the members of the committee.

17. The seventeenth part of the document is a list of names and addresses of the members of the committee.

18. The eighteenth part of the document is a list of names and addresses of the members of the committee.

19. The nineteenth part of the document is a list of names and addresses of the members of the committee.

20. The twentieth part of the document is a list of names and addresses of the members of the committee.

21. The twenty-first part of the document is a list of names and addresses of the members of the committee.

22. The twenty-second part of the document is a list of names and addresses of the members of the committee.

23. The twenty-third part of the document is a list of names and addresses of the members of the committee.

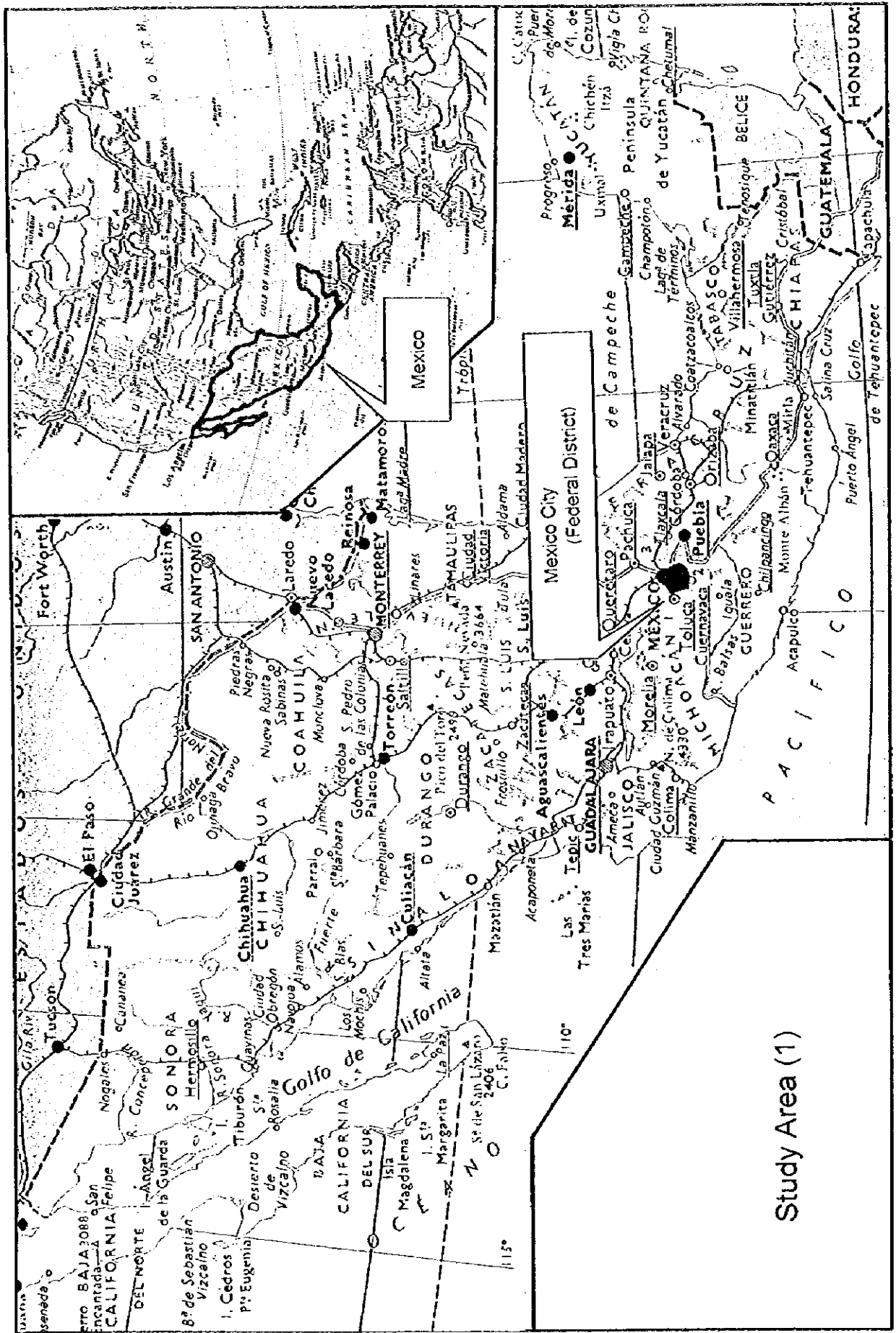
The Study on Solid Waste Management for Mexico City in the United Mexican States

List of Volumes

Volume I	Executive Summary
Volume I(S)	Executive Summary (Spanish Version)
Volume II	Main Report
Volume II(S)	Main Report (Spanish Version)
Volume III	Annex
Volume III(S)	Annex (Spanish Version)
Volume IV	Data Book
Volume IV(S)	Data Book (Spanish Version)
Volume V	EIA Report
Volume V(S)	EIA Report (Spanish Version)

This is the Executive Summary.

In this report, the project cost is estimated by using the September 1998 price and an exchange rate of 1 US\$ = 135.00 Japanese Yen = 9.10 Pesos.

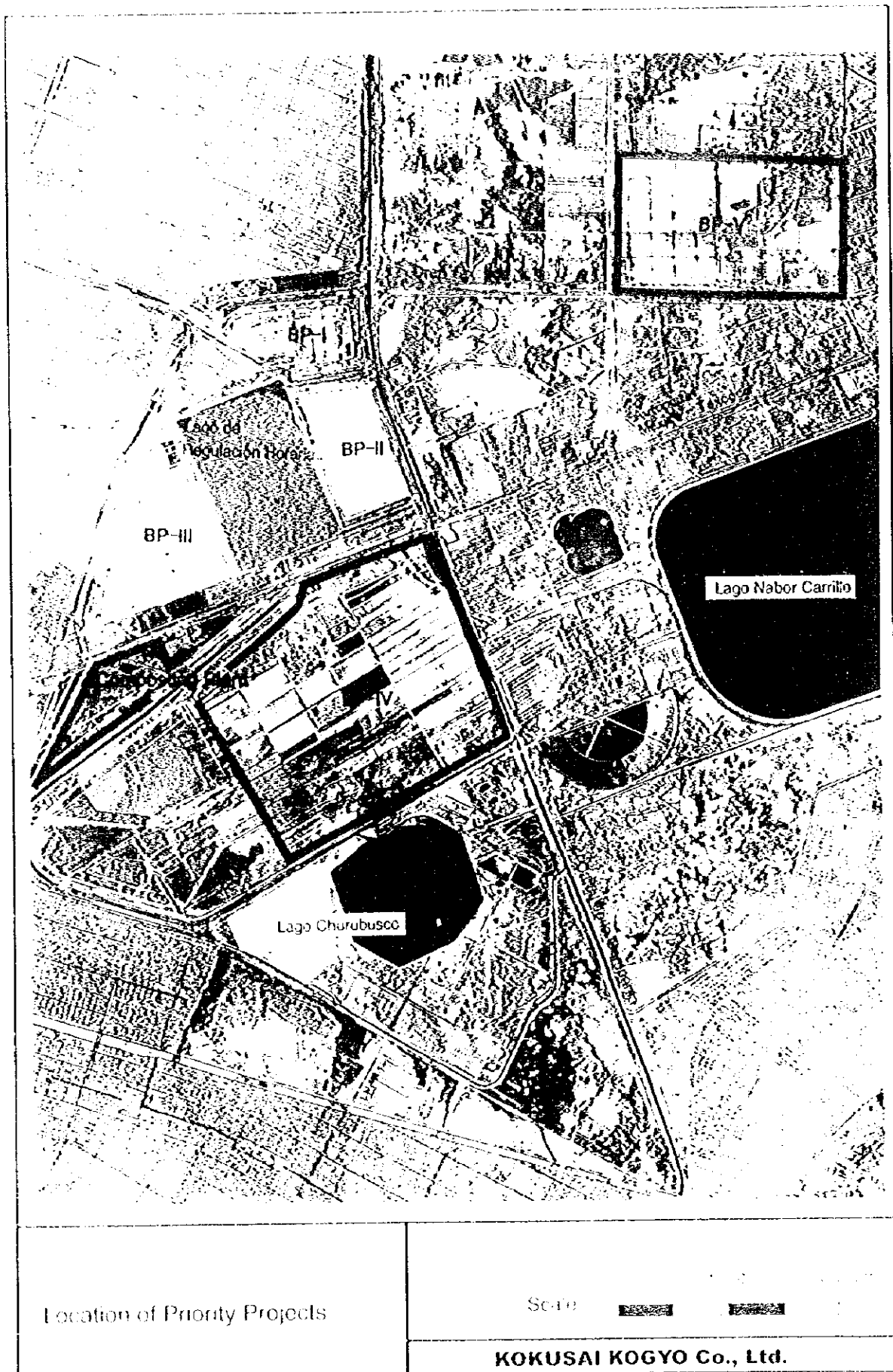


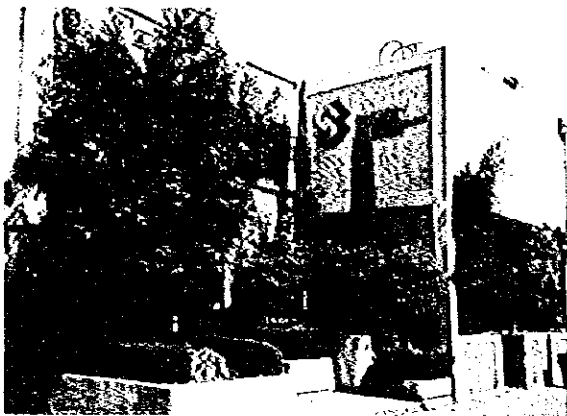


Location of Priority Projects

Scale: 0 1,000 2,000 m

KOKUSAI KOGYO Co., Ltd.





General Direction of Urban Services (DGSU), in which the study team set up its office.



A meeting on the Inception Report in July, 1998.



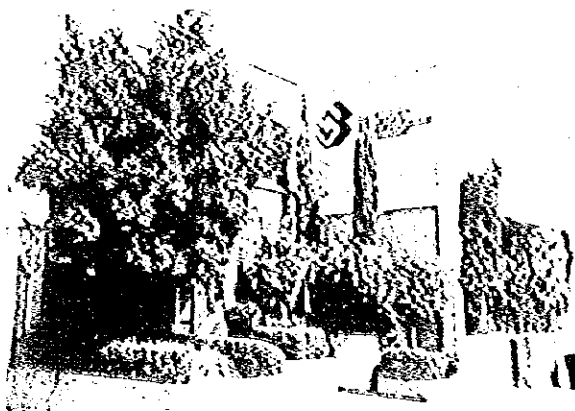
A workshop was held in September, 1998.



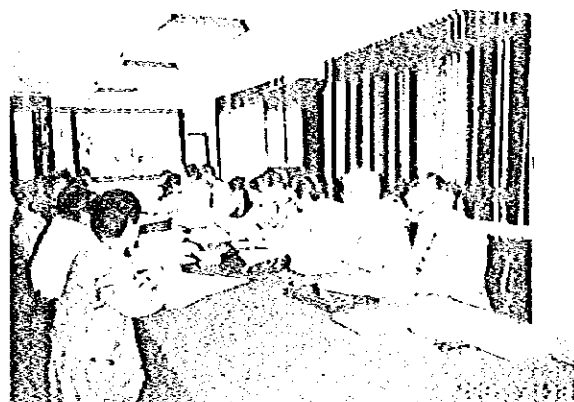
Signing the Minutes of Meetings on the Progress Report(1) in October, 1998.



A seminar regarding the Interim Report was held in November, 1998.



Arboreta and gardens of the University of Toronto



Students in the dining hall



Students in the classroom

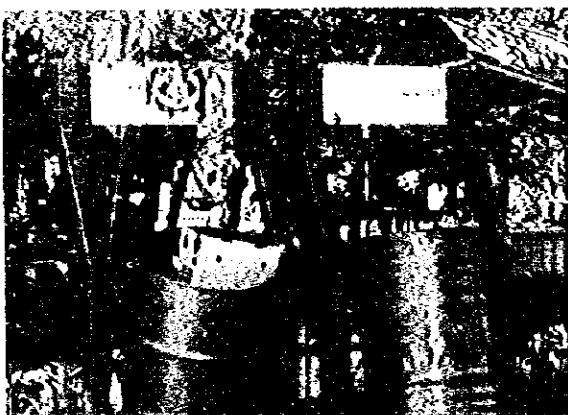


Students in the classroom



Students in the classroom





Oil drums are utilized for refuse containers



Oil drums are also utilized for handcarts



Recyclable materials (which are kept in plastic bags in the picture) are separately collected from non-recyclable waste.



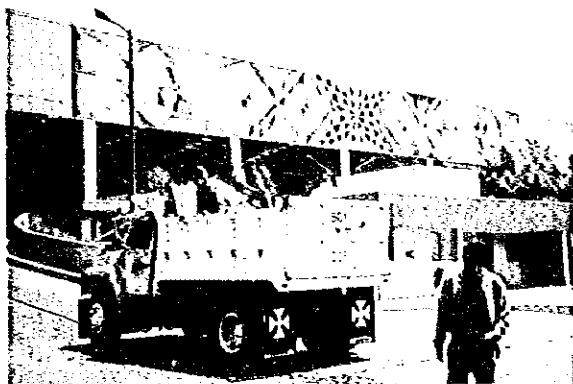
Waste collected by handcarts is transferred to collection vehicle.



The collection vehicle receives both recyclable and non-recyclable materials from the handcart.



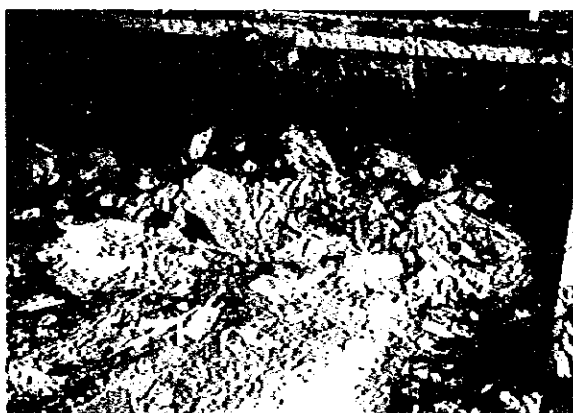
A collection vehicle running in the city



A collection vehicle coming into a transfer station



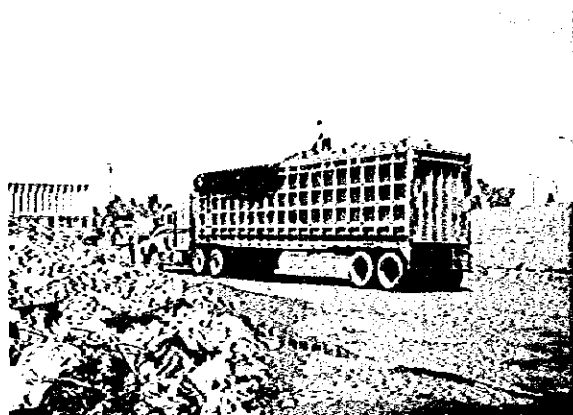
*Refuse inlet of the transfer station.
Waste will be transferred from collection vehicles to large-size trailers*



Waste moved to a large-size trailer



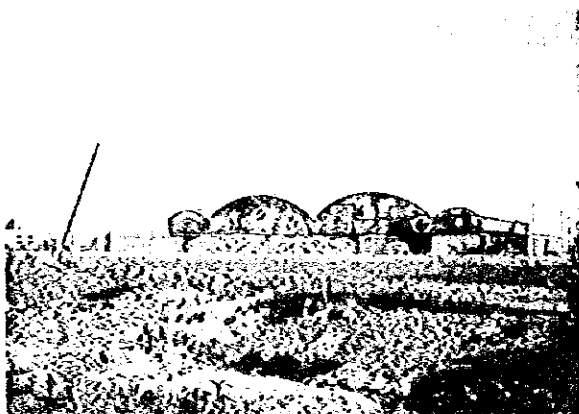
A large-size trailer and a charge chute



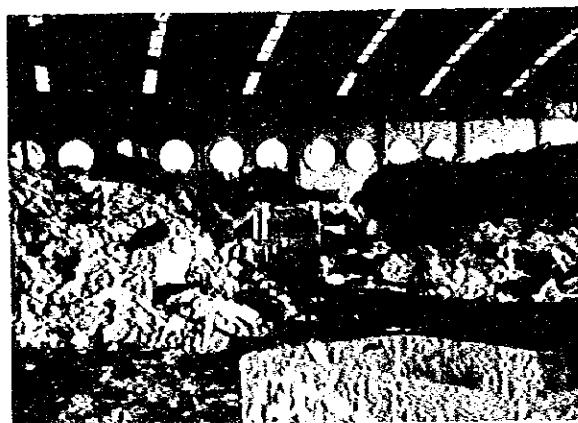
The top of a trailer has to be covered to prevent refuse from scattering.



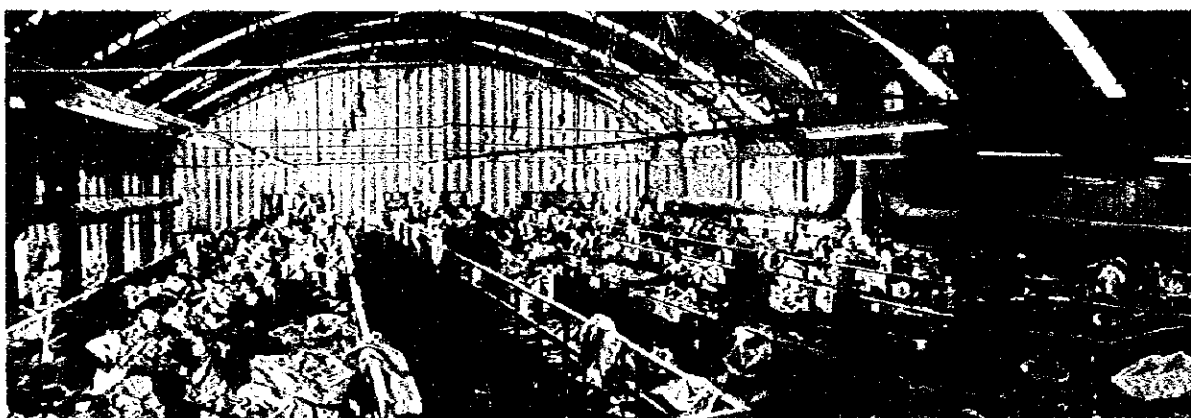
Large-size trailer (70 m³) hauling waste



Bordo Poniente Selection Plant



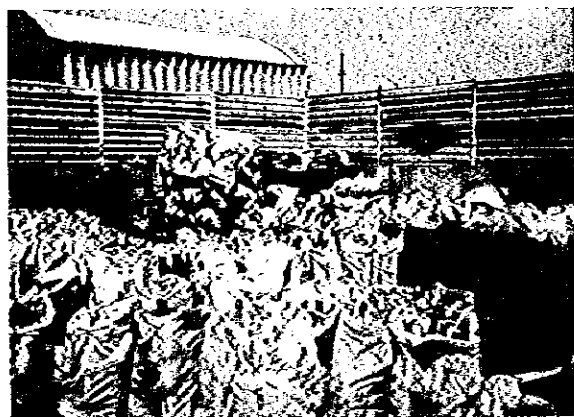
Platform of the Selection Plant



Picking belt conveyor (capacity : 500 ton/day x 3 lines)



Compression packing equipment for P.E.T. bottle



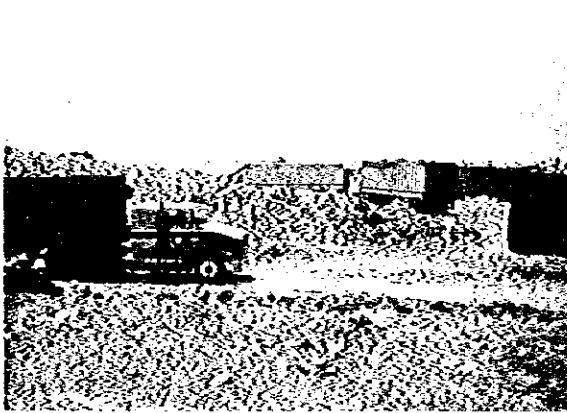
Collected glass bottles are stored with being classified into each type.



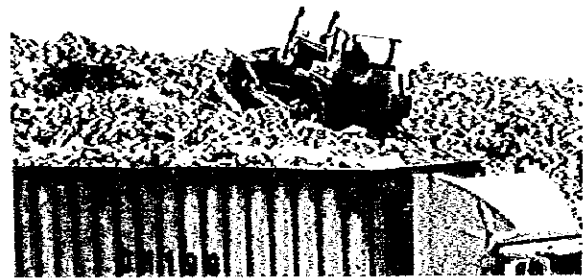
Weighbridge at the entrance of Bordo Poniente Etapa IV Landfill



Trailers waiting to unload waste



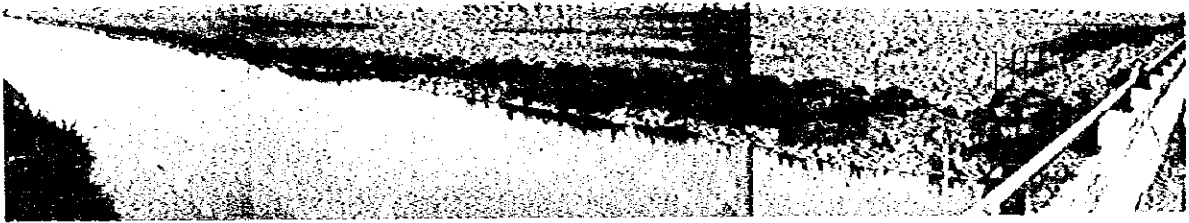
A waste unloading area at Bordo Poniente Landfill



Spreading and compacting waste by a bulldozer



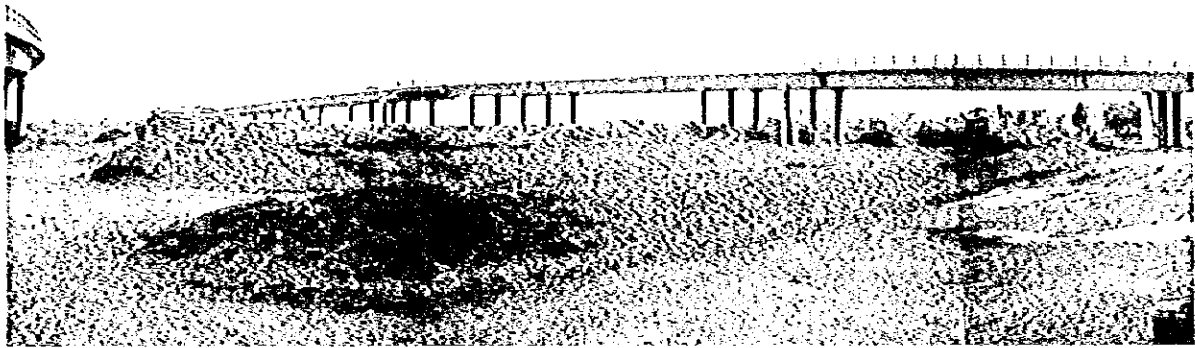
*Bordo Poniente Etapa IV Landfill.
The foreground shows a future cell being under construction of impermeable liner.
The distant view presents a cell being currently filled.*



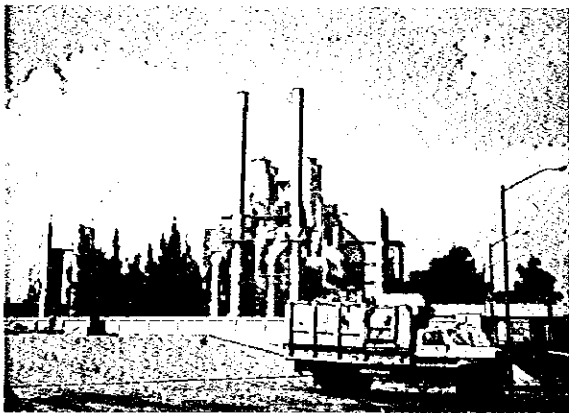
Canal de la Campesina flowing along the Bordo Poniente (Etapa IV) Landfill Site



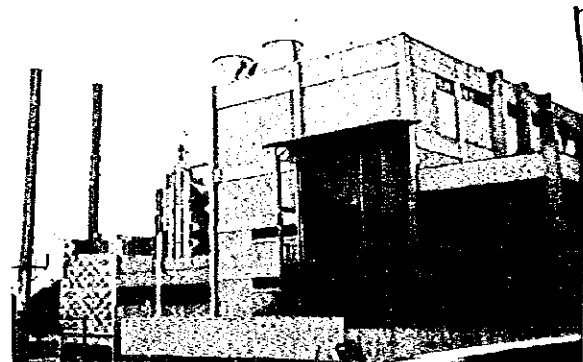
Santa Catarina Landfill



Yard trimmings composting facility



Experiment incineration plant for municipal solid waste (capacity: 50 ton/day x 2 units) which are currently not operated.



Close-up of the experiment incineration plant



Current condition of waste discharge in the central market



Loading waste discharged from the Central Market



Start of the survey



Mixing of sample waste



Reduction of sample waste



Classification of sample waste



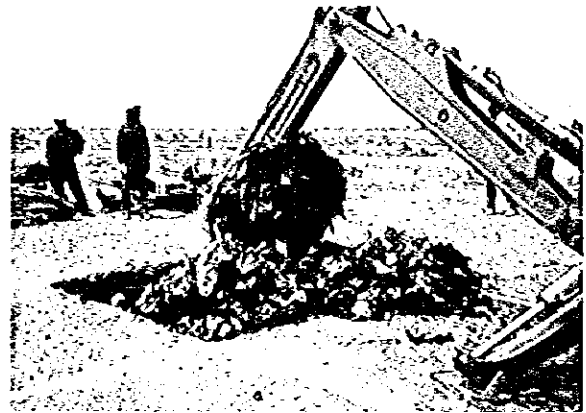
Classified samples



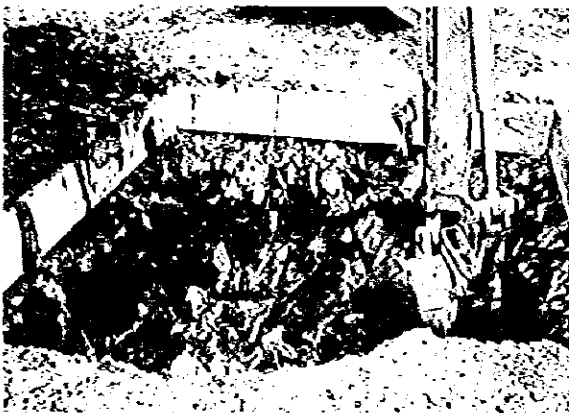
Weighing samples



Removal of the final cover (20 to 30 cm thickness)



Sampling



Sampling



Sampling



The waste sampled was weighed by the weighbridge of Bordo Poniente Etapa IV Landfill.



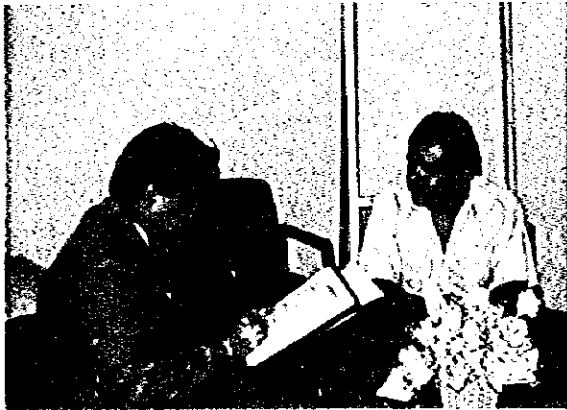
Waste Reduction Method was employed for the physical composition analysis



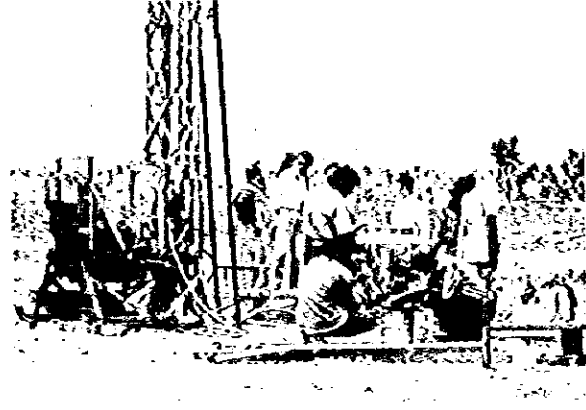
Public opinion survey (POS) (1)



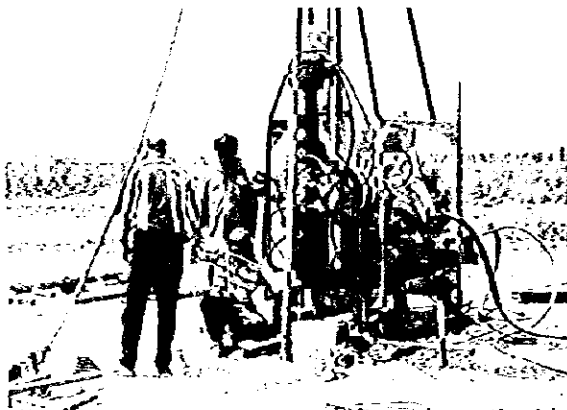
POS (2)



POS (3)



*Environment survey (1) :
Boring survey on Bordo Pontiente III landfill*



*Environment Survey (2) :
Boring survey on Bordo Pontiente (Etapa III)*



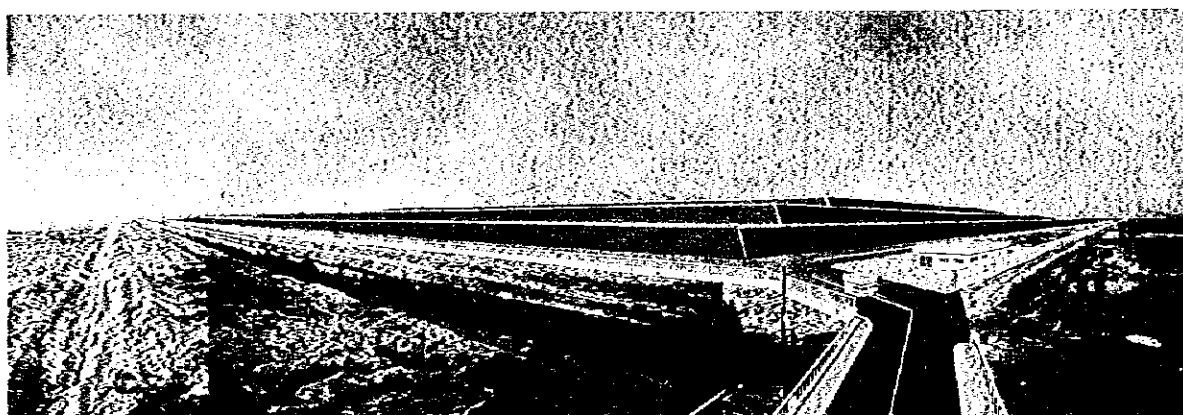
*Environment Survey (3) :
Investigation of samples*



New Landfill (Etapa V) present landscape



New landfill (Epata V) landscape expected in 2002



New landfill (Etapa V) landscape after closure



*Present condition (1) :
An entrance is planned to be constructed here*



*Present condition (2) :
Middle of the site*



A view of the site from the west



A view of the site from the east

Contents

Preface	
Letter of Transmittal	
Outline of the Project	
List of Volumes	
Maps	
Study Area (1)	
Study Area (2)	
Location of Priority Projects	
Plates	
Plate 1: DGSU office, Meetings, Workshop and Seminar	
Plate 2: Present Situation of Municipal Solid Waste Collection in Mexico City	
Plate 3: Present Situation of Transfer Stations	
Plate 4: Present Situation of Selection Plants	
Plate 5: Present Situation of Bordo Poniente Etapa IV Landfill	
Plate 6: Canal de al Campana, Santa Catarina Landfill	
Plate 7: Existing Composting Plant, Experiment Incineration Plant, Central Market	
Plate 8: Field Investigation (1) Waste Amount and Composition Survey	
Plate 9: Field Investigation (2) Landfill Mining Survey	
Plate 10: Field Investigation (3) Public Opinion Survey and Environmental Survey	
Plate 11: Present and Future Landscape Of the New Landfill (Etapa V)	
Plate 12: Present Situation of the Candidate Site for the Composting Plant	

	Page :
1 Introduction	1
1.1 Background.....	1
1.2 Objectives of the Study.....	1
1.2.1 Objectives of the Study.....	1
1.2.2 Study Area.....	1
1.2.3 Solid Waste to be Covered Under the Study.....	2
1.2.4 Target Year.....	2
1.3 Key Assumptions (Population, Economic, etc.).....	2
1.4 Work Schedule of the Study.....	3
1.5 Study Organization and Persons Involved.....	5
1.5.1 Study Organization.....	5
1.5.2 Persons Involved.....	5
1.5.3 Technology Transfer.....	6
2 Profile of the Study Area	7

3 Current Situation of Solid Waste Management	8
3.1 Field Investigation.....	8
3.2 Current Situation of Solid Waste Management	8
3.2.1 Waste Stream.....	8
3.2.2 Technical System.....	12
3.2.3 Social Aspects	20
3.2.4 Institutional and Organizational System.....	22
3.3 Assessment of the Present Condition and Confirmation of Key Issues.....	23
3.3.1 Technical System.....	23
3.3.2 Institutional System	26
3.3.3 Social Aspects	26
3.3.4 Organizational System.....	27
3.3.5 Ascertainment of Aggregate Unit Cost of Solid Waste Management in DF, 1998.....	27
4 Setting up Planning Frameworks for the Master Plan	29
4.1 Scope of Planning Frameworks for the Master Plan.....	29
4.2 Goals, Targets and Strategies.....	30
4.2.1 Goals and Targets Year	30
4.2.2 Examination of the Master Plan Framework.....	30
4.2.3 Targets and Strategies.....	32
5 The Master Plan	38
5.1 Outline of the Mater Plan.....	38
5.1.1 Discharge and Storage System	38
5.1.2 Collection and Haulage System.....	39
5.1.3 Intermediate Treatment System.....	39
5.1.4 Final Disposal System	40
5.1.5 Outline of the Master Plan.....	40
5.2 Description of the Master Plan	42
5.2.1 Projection until 2010	42
5.2.2 Waste System	46
5.2.3 Institutional System of the M/P.....	49
5.2.4 Social Approach toward the M/P	51
5.3 Projects Cost Estimates.....	53
5.4 Evaluation of the Master Plan.....	55
5.4.1 Technical Evaluation	55
5.4.2 Financial Evaluation.....	56
5.4.3 Economic Evaluation.....	56
5.4.4 Institutional Evaluation	56
5.4.5 Social Evaluation.....	57
5.4.6 Environmental Evaluation.....	59
5.4.7 Overall Evaluation.....	60
5.5 Phased Implementation Plan.....	61

5.6 Selection of Priority Projects	61
5.7 Initial Environment Examination.....	61
6 Feasibility Study for the Priority Projects	63
6.1 Outline of the Projects	63
6.1.1 Target.....	63
6.1.2 Outline of the Projects.....	65
6.2 Preliminary Design of Technical System.....	65
6.2.1 Composting Facility	65
6.2.2 Final disposal Sites.....	77
6.2.3 Cost of Priority Projects	92
6.3 Institutional Plan	93
6.3.1 Alternatives.....	93
6.3.2 Conclusion.....	95
6.4 Public Education Plan	95
6.4.1 Public Education Program.....	95
6.4.2 Education Plan for Priority Projects	95
6.5 Financing Plan	97
6.5.1 Guiding Principles for Analysis of Finance Needs Assessment.....	97
6.5.2 Financing Plan.....	98
6.5.3 "Totem Pole" Evaluation.....	99
6.6 Environmental Impact Assessment (EIA).....	101
6.6.1 Scope of EIA Work	101
6.6.2 EIA for the Composting Plant	102
6.6.3 EIA for the Etapa V Project.....	104
6.7 Project Evaluation.....	107
6.7.1 Technical Evaluation	107
6.7.2 Institutional Evaluation	108
6.7.3 Social Evaluation of Priority Projects	108
6.7.4 Environmental Evaluation	110
6.7.5 Financial Evaluation.....	110
6.7.6 Economic Evaluation.....	111
6.7.7 Total Evaluation	112
7 Conclusions and Recommendations	113
7.1 Conclusions.....	113
7.2 Recommendation	115
7.2.1 Technical aspects.....	116
7.2.2 Institutional Aspect.....	117
7.2.3 Social Aspect.....	118
7.2.4 Environmental Aspect	119
7.2.5 Financial and Economic Aspect	119

List of Tables

	Page :
Table 3-1: Waste Composition	10
Table 3-2: Generation Ratio.....	11
Table 3-3: Purchase Years of Existing Collection Vehicles.....	14
Table 3-4: Outline of S/P.....	16
Table 3-5: Annual Recovery Amount and Ratios in 1997.....	16
Table 3-6: Operation and Maintenance Cost in 1997	16
Table 3-7: Landfill Structure of BP IV and SC.....	18
Table 3-8: Landfilling Operation of BP IV and SC.....	19
Table 3-9: Hospital Waste Generation Ratio at the Medical Institutions in the GDF	20
Table 3-10: Daily Waste Generation Amount	20
Table 3-11: The Income of Sweepers per Month.....	21
Table 3-12: Revenues of Driver, Assistant and Volunteer	21
Table 3-13: Competencies for Municipal SWM in the DF.....	22
Table 4-1: Basic Alternatives for the M/P	30
Table 4-2: Target Figures for the SWM System.....	33
Table 4-3: Recommended Alternative for the Strategies in Phase 1 for the Master Plan (1999-2001).....	34
Table 4-4: Recommended Alternative for the Strategies in Phase 2 for the Master Plan (2002-2004).....	35
Table 4-5: Recommended Alternative for the Strategies in Phase 3 for the Master Plan (2005-2010).....	36
Table 4-6: Institutionalization Alternative for the M/P	37
Table 5-1: Source Separation Item.....	38
Table 5-2: Outline of the Master Plan.....	40
Table 5-3: Population Forecast	42
Table 5-4: Waste Generation Ratio.....	42
Table 5-5: Forecast of Waste Generation Amount in DF.....	44
Table 5-6: Waste Composition	45
Table 5-7: Institutionalization Alternative for the M/P	50
Table 5-8: Criteria and Strategies to Solve Critical Social Aspects	52
Table 5-9: Summary of Investment and Operation and Maintenance Cost	53
Table 5-10: O & M Cost of Transfer Station and Transport.....	54
Table 5-11: Operation and Maintenance Cost of Selection Plants	54
Table 5-12: Social Evaluation of the Proposed M/P.....	58
Table 6-1: Outline of the Projects.....	65
Table 6-2: Design Parameters.....	67
Table 6-3: Quantity and Quality of Compost Product	67
Table 6-4: Construction Schedule of Composting Facility.....	73
Table 6-5: Preliminary Cost Estimate of Composting Plant.....	74
Table 6-6: Procurement of Equipment in Case 2.....	75
Table 6-7: Priority Project Cost (Composting Facility).....	76
Table 6-8: Subsoil Conditions	77
Table 6-9: Result of Slope Stability Calculation (Bishop Method).....	78
Table 6-10: Waste Disposal Amount from 2001 to 2010.....	79
Table 6-11: Outline of the Conceptual Design for the Vertical Expansion Plan	80
Table 6-12: Waste Disposal Amount in Etapa IV.....	81
Table 6-13: Summary of Costs for the Vertical Expansion Plan (Case 1)	81

Table 6-14: Summary of Costs for the Vertical Expansion Plan (Case 2)	82
Table 6-15: Subsoil Conditions	83
Table 6-16: Duration of Settlement	83
Table 6-17: Result of Slope Stability Calculation (Bishop Method)	84
Table 6-18: Outline of the Conceptual Design for A New Landfill Development	85
Table 6-19: Waste Disposal Amount in Etapa V	86
Table 6-20: Summary of Costs for A New Landfill Development (Case1)	91
Table 6-21: Summary of Costs for A New Landfill Development (Case 2)	91
Table 6-22: Cost of Priority Projects, Case of Direct Operation by DGSU (Case 1) ..	92
Table 6-23: Cost of Priority Projects, Case of Contract-Out (Case 2)	93
Table 6-24: Options for the Operation of CP and SL	94
Table 6-25: Public Education Program	95
Table 6-26: Educational program for Priority Projects	96
Table 6-27: Institutional Framework (Cases)	98
Table 6-28: Funding Source	98
Table 6-29: Finance Needs within DGSU by Option	98
Table 6-30: Summary "Income Statements" by Option	99
Table 6-31: Summary of Scoping	102
Table 6-32: Preconditions to Prevent Environmental Impacts	104
Table 6-33: Preconditions to Prevent Environmental Impacts	106
Table 6-34: Social Evaluation of Priority Projects	109
Table 6-35: FIRR by Benefit Variation and Project Component – Alternative 1	110
Table 6-36: FIRR by Benefit Variation and Project Component – Alternative 2	110
Table 6-37: FIRR by Benefit Variation and Project Component – Alternative 3	111
Table 6-38: FIRR by Benefit Variation and Project Component – Alternative 4	111
Table 6-39: Summary Net Cash-Flow for ENPV	112
Table 6-40: Summary of Economic Feasibility by Components and Measurement Indices	112

List of Figures

	Page :
Figure 1-1: Schedule of Study Work	4
Figure 1-2: Study Organizational Structure	5
Figure 3-1: Sectors and Sub-Sectors of Waste Sources	9
Figure 3-2: Waste Stream in 1997	12
Figure 3-3: Present Collection and Haulage System	12
Figure 3-4: New Collection and Haulage System	13
Figure 3-5: Landfill Structure of Bordo Poniente Etapa IV	17
Figure 3-6: Landfill Structure of Santa Catarina Site	18
Figure 3-7: Aggregate Unit Cost of Solid Waste Management (2)	28
Figure 4-1: Scope of the M/P	29
Figure 4-2: Present Waste Stream	31
Figure 4-3: Separate Discharge and Collection Program	32
Figure 5-1: Separate Discharge and Collection Program	38
Figure 5-2: Present Waste Stream	46
Figure 5-3: Optimum Waste Stream	47
Figure 5-4: Waste Stream in 2004 (F/S)	48

Figure 5-5: Waste Stream in 2010 (M/P).....	49
Figure 5-6: Phased Implementation Plan.....	61
Figure 6-1: Location of Priority Projects	64
Figure 6-2: Flow Sheet of Proposed Composting Facility.....	68
Figure 6-3: Materials Balance of Composting Facility.....	69
Figure 6-4: Layout of Proposed Composting Facility.....	71
Figure 6-5: Cross Section A-A of Proposed Composting Facility.....	72
Figure 6-6: Leachate Generation.....	79
Figure 6-7: Landfill Layout of Etapa V	87
Figure 6-8: Plan of Waste Transport Control Facilities.....	88
Figure 6-9: Cross Section.....	89
Figure 6-10: Cross Section of Roads	90
Figure 6-11: Totempole Evaluation - Preferential Order Amongst Options.....	100
Figure 6-12: Cause Effect Relations (Composting Plant Project)	103
Figure 6-13: Cause Effect Relations (Etapa V Landfill Project)	105

List of Abbreviations

ALDF	DF Legislative Assembly (<i>Asamblea Legislativa del DF</i>)
AMCRESPAC	Mexican Association for Solid and Hazardous Wastes Control (<i>Asociación Mexicana para el control de residuos sólidos y peligrosos</i>)
AURIS	Urban Action and Social Integration Institute (<i>Instituto de Acción Urbana e Integración Social</i>)
BANOBRAS	National Development Bank for Public Works and Services
BOD	Biochemical Oxygen Demand
BP	Bordo Poniente
C/N	Carbon/Nitrogen
CAM	Metropolitan Environmental Commission (<i>Comisión Ambiental Metropolitana</i>)
CNA	National Water Commission (<i>Comisión Nacional del Agua</i>)
COD	Chemical Oxygen Demand
CORETT	Commission for the Regulation of Land Tenure (<i>Comision par la Regulacion de la Tenencia de la Tierra</i>)
CP	Counterpart
CP	Composting Plant
DDF	Department of the DF
DF	Federal District (<i>Distrito Federal</i>)
DF/R	Draft Final Report
DGMA	General Direction of Environment (<i>Dirección General del Medio Ambiente</i>)
DGSU	General Direction of Urban Services (<i>Dirección General de Servicios Urbanos</i>)
DSR	Debt Service Ratio
EF	External Fund
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
FDS	Final Disposal Site
F/S	Feasibility Study
FIRR	Financial Internal Rate of Return
FIVIDESU	Housing, Social and Urban Development Trust (<i>Fideicomiso de Vivienda, Desarrollo Social y Urbano</i>)
GATT	General Agreement on Tariffs and Trade

GC	Gathering Center (<i>Centro de Acopio</i>)
GDF	Government of the Federal District (<i>Gobierno del Distrito Federal</i>)
GPS	Global Positioning System
GRP	Gross Regional Product
HDPE	High-Density-Polyethylene
IC/R	Inception Report
IEE	Initial Environmental Examination
IMSS	Mexican Social Security Institute (<i>Instituto Mexicano del Seguro Social</i>)
INARE	National Institute of Recyclers (<i>Instituto Nacional de Recicladores</i>)
INDECO	National Institute for the Development of Rural Community and Popular Housing (<i>Instituto Nacional par el Desarrollo de la Comunidad Rural y de la Vivienda Popular</i>)
INE	National Institute of Ecology (<i>Instituto Nacional de Ecología</i>)
INEGI	National Institute of Statistics, Geography and Informatics (<i>Instituto Nacional de Estadística, Geografía e Informática</i>)
INFONAVIT	National Institute for the Workers Housing Promotion. (<i>Instituto Nacional de Fomento a la Vivienda del Trabajador</i>)
ISSSTE	Institute of Security and Social Service for State Workers (<i>Instituto de Seguridad y Servicios Sociales para los Trabajadores del Estado</i>)
IT/R	Interim Report
JICA	Japan International Cooperation Agency
L/C	Letter of Credit
LGEEPA	Ecological Balance and Environmental Protection Law (<i>Ley General de Equilibrio Ecológico y Protección al Ambiente</i>)
M/M	Minutes of Meeting
M/P	Master Plan
MIA	Environmental Impact Assessment Report (<i>Manifestaciones de Impacto Ambiental</i>)
NAFTA	North American Free-Trade Agreement
NIT	New Intermediate Treatment
NOM	Mexican Official Norm (<i>Norma Oficial Mexicana</i>)
OCR	Ordinary Capital Resource
OF	Own Fund

O&M	Operation and Maintenance (<i>Operación y Mantenimiento</i>)
OECD	Organization for Economic Cooperation and Development
OW	Organization of Workers
P/R	Progress Report
PAHO	Pan-American Health Organization
PEMEX	Petróleos Mexicanos
PET	Polyethylene terephthalate
POS	Public Opinion Survey
PP	Processing Plant
PROFEPA	Office of the Federal Attorney for Environmental Protection
RIMEX	Mexican Industrial Recycles
S/P	Selection Plant
SC	Santa Catarina
SCT	Secretariat of Communication and Transport (<i>Secretaría de Comunicaciones y Transportes</i>)
SDN	Secretariat of National Defense (<i>Secretaría de la Defensa Nacional</i>)
SECOFI	Secretariat of Trade and Industrial Development (<i>Secretaría de Comercio y Fomento Industrial</i>)
SEMARNAP	Secretariat of Environment, Natural Resources and Fishing (<i>Secretaría del Medio Ambiente, Recursos Naturales y Pesca</i>)
SERVIMET	Servicios Metropolitanos, SA
SHCP	Secretary of Finance and Public Credit (<i>Secretaría de Hacienda y Crédito Público</i>)
SJA	San Juan de Aragón
SL	Sanitary Landfill (<i>Relleño Sanitario, RS</i>)
SM	Secretariat of Navy (<i>Secretaría de Marina</i>)
SMA	Secretariat of Environmental of the GDF (<i>Secretaría del Medio Ambiente</i>)
SOS	Secretariat of Works and Services (<i>Secretaría de Obras y Servicios</i>)
SSA	Secretariat of Health and Assistance (<i>Secretaría de Salud</i>)
SWM	Solid Waste Management
T/S	Transfer Station
TDS	Total Dissolved Solids
TGs	Task Groups

UNAM	National Autonomous University of Mexico (<i>Universidad Nacional Autonoma de Mexico</i>)
WACS	Waste Amount and Composition Survey
WB	World Bank
WTP	Willingness to Pay
ZMVM	Mexico Valley Metropolitan Area (<i>Zona Metropolitana del Valle de México</i>)

Glossary

1. Botes: 10-30 liters capacity containers.
2. Cabos: Operation supervisor.
3. Chácharas: Mechanic apparatus, furniture and other articles thrown away as waste Artifacts, menages and other goods thrown away.
4. Finca: Fees paid by large and medium waste generators.
5. Láminas: Ferrous metal sheets and tin plate.
6. Pepenador: Waste-picker.
7. Propina: Tip paid by minor waste generators.
8. Tambos: 200 liters drum container.

1 Introduction

1.1 Background

Mexico expands over an area of 1.97 million km² with a population of 93 million. In 1994, GNP per capita was US\$ 4,010. The world's largest metropolitan area, Mexico City and its neighboring Mexico State, is located in Mexico Valley (ZMVM) -- home to approximately 17 million people. The Government of the Federal District (GDF), an administrative body with 16 delegations (delegaciones), governs an area of 1,505 km² and 8.7 million citizens.

Reports indicate that approximately 11,000 ton of waste are generated daily in the Distrito Federal (DF) that are transported to two final disposal sites via 13 transfer stations. Its operation scale is extremely large; 2,011 vehicles and 236 large haulage trucks are used, and in total, 17,000 km of roads are swept.

Given these conditions, the Government of Mexico requested a master plan (M/P) to be made on SWM in the DF and the implementation of a feasibility study (F/S) of (a) selected priority project(s) to the Government of Japan. In response, the Japan International Cooperation Agency (JICA), Japan's technical assistance implementing agency, decided to implement the studies (both of which will be referred to as the study) in close cooperation with the relevant authorities of the Government of Mexico.

The JICA appointed Kokusai Kogyo Co., Ltd. as the consultant of the study.

1.2 Objectives of the Study

1.2.1 Objectives of the Study

The study covers the DF as its subject and aims to achieve the following objectives.

- Formulate an SWM master plan for the target year 2010.
- Carry out the feasibility study of the priority project(s).
- Pursue technology transfer regarding SWM to the counterpart personnel.

1.2.2 Study Area

This study covers the area under the jurisdiction of the Government of the Federal District of the United Mexican States.

1.2.3 Solid Waste to be Covered Under the Study

The following six "solid waste" types are covered during the study.

- 1) Domestic waste.
- 2) Commercial waste.
- 3) Institutional waste.
- 4) Market waste.
- 5) Street sweepings waste.
- 6) Medical waste.

1.2.4 Target Year

The target year of the Master Plan is 2010 and that of the Feasibility Study on the priority projects, which was selected during the Phase II of the study, is 2004.

1.3 Key Assumptions (Population, Economic, etc.)

The following assumption were used in this study.

a. Socio-economic Conditions

Item	unit	Present*	2001	2004	2010
1. Population					
Population of study area	persons	8,610,000	8,747,000	8,896,000	9,206,000
Annual growth rate	%/year	-	0.57	0.57	0.57
2. Economic					
GRP(nominal term)	billion pesos	3,182.3	6,169.7	9,630.4	23,463.4
Annual real growth rate of GRP	%/year	7.0	4.4	6.0	6.0
Budget of the GDF (nominal)	billion pesos	31.1	60.3	94.1	229.3
Inflation rate	%	15.7	12.0	10.0	10.0
Currency exchange rate			USD 1=9.1 pesos		

Note : *data of 1997

b. Waste Amount and Composition

Item	unit	Present*	2001	2004	2010
1. Waste generation amount					
Household	ton/year	1,926,000	1,965,000	1,998,000	2,072,000
Commercial	ton/year	1,210,000	1,223,000	1,236,000	1,267,000
Service	ton/year	636,000	649,000	657,000	669,000
Special	ton/year	130,000	134,000	136,000	140,000
Others	ton/year	267,000	270,000	275,000	282,000
Total	ton/year	4,169,000	4,241,000	4,302,000	4,430,000
2. Waste composition					
Spatula	%	0.030	0.030	0.030	0.030
Colton	%	1.300	1.300	1.300	1.300
Cardboard	%	6.680	6.680	6.680	6.680
Leather	%	0.110	0.110	0.110	0.110
Paper container	%	1.910	1.910	1.910	1.910
Vegetable fiber	%	0.690	0.690	0.690	0.690
Synthetic fiber	%	0.850	0.850	0.850	0.850
Gauze	%	0.050	0.050	0.050	0.050

Item	unit	Present*	2001	2004	2010
Bone	%	0.270	0.270	0.270	0.270
Vinyl	%	0.370	0.370	0.370	0.370
Disposable syringe	%	0.040	0.040	0.040	0.040
Cans	%	1.240	1.240	1.240	1.240
Ceramics	%	0.300	0.300	0.300	0.300
Wood	%	1.240	1.240	1.240	1.240
Construction waste	%	2.140	2.140	2.140	2.140
Metal	%	2.560	2.560	2.560	2.560
Nonferrous metal	%	0.490	0.490	0.490	0.490
Paper	%	4.410	4.410	4.410	4.410
News paper	%	4.960	4.960	4.960	4.960
Toilet paper	%	5.890	5.890	5.890	5.890
Disposable diaper	%	1.620	1.620	1.620	1.620
X-ray film	%	0.000	0.000	0.000	0.000
Plastic film	%	4.530	4.530	4.530	4.530
Hard plastic	%	3.490	3.490	3.490	3.490
Polyurethane	%	0.160	0.160	0.160	0.160
Foamed polyurethane	%	0.580	0.580	0.580	0.580
Food waste	%	37.700	37.700	37.700	37.700
Garden waste	%	3.180	3.180	3.180	3.180
Sanitary napkin	%	0.040	0.040	0.040	0.040
Rags	%	1.220	1.220	1.220	1.220
Bandage	%	0.010	0.010	0.010	0.010
Color glass	%	2.620	2.620	2.620	2.620
Transparent glass	%	4.610	4.610	4.610	4.610
Fine fraction	%	1.710	1.710	1.710	1.710
Others	%	3.000	3.000	3.000	3.000
Total	%	100.000	100.000	100.000	100.000

Note : data of 1997

c. Life Span of Equipment and Facilities

	Life span (year)	Salvage value (%)
Truck and heavy equipment	7.0	10
Machinery	15.0	0
Buildings	30.0	0

Note : The life span of civil works and facilities other than building or the disposal site depends on the period of its operation.

1.4 Work Schedule of the Study

The study consisted of the following two phases.

Phase 1: Study on the present condition of SWM and formulation of Master Plan (June 1998 to November 1998)

Phase 2: Feasibility Study on the Priority Projects (November 1998 to May 1999)

The schedule of the study work is shown in Figure 1-1.