ii. Waste composition

The composition and LCV (Lower Calorific Value) of MSW, except for domestic ash, road sweeping and bulky wastes, is estimated and tabulated in Table 5.2-2.

Table 5.2-2 Physical Composition and Lower Calorific Value of MSW (Wet Base) in Lublin

Category	Item		Ratio of Lublin	Ratio of Poznan
Combustible	Garbage	(%)	61.11	33.95
	Paper	(%)	14.18	19.33
	Textile	(%)	3.10	7.27
	Plastics	(%)	4.42	7.89
	Grass & Wood	(%)	2.33	5.90
	Leather & Rubber	(%)	2.09	2.26
	Sub-total	(%)	**87.22**	**76.60**
Noncombustible	Metal	(%)	3.29	3.76
	Glass	(%)	6.69	15.16
	Ceramic & Soil	(%)	2.81	1.53
	Others	(%)	0	2.93
	Sub-total	(%)	**12.79**	**23.38**
Total		(%)	100	100
LCV (Lower Calorific Value)		(kcal/kg)	1,441	1,805

Note: MSW here excludes domestic ash and road sweeping and bulky waste.

iii. Waste stream

Although the waste stream could not be complete, it was prepared as a draft for future study and shown in Fig.5.2-1.

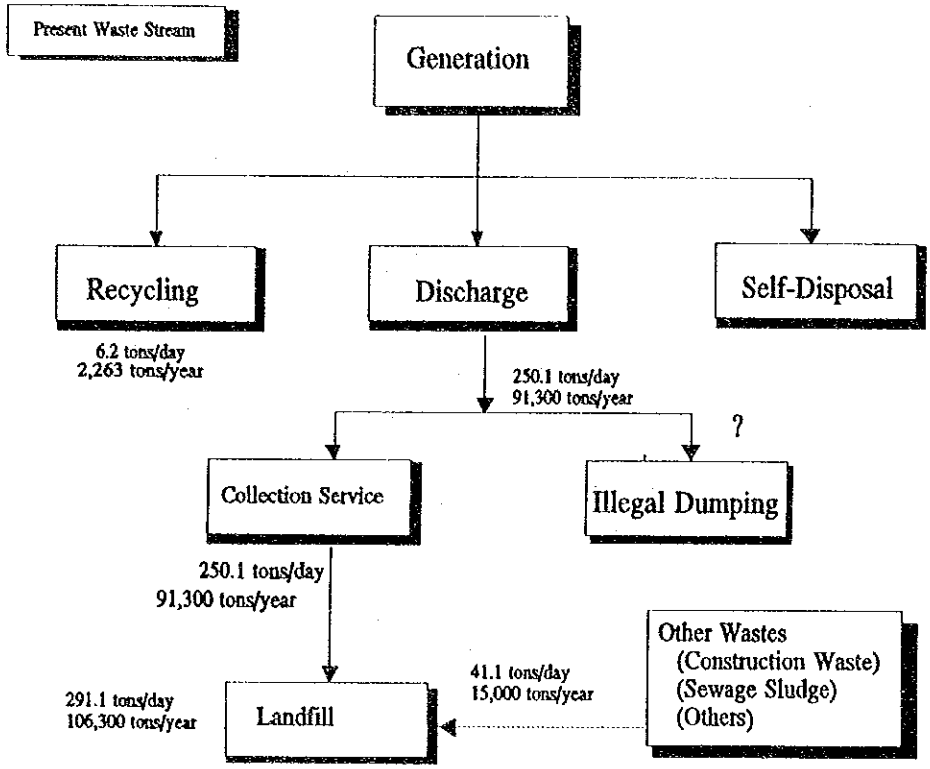

Fig.5.2-1 Present Waste Stream of MSW

b. Public opinion survey

A POS (Public Opinion Survey) was conducted in the same manner as the one carried out in Poznan. The following are some of the interesting figures obtained:

i. **More than 86 %** (93% in Poznan) of the citizens answered that they were willing to cooperate in the implementation of a separate waste collection system if introduced.

ii. **More than 93 %** (99% in Poznan) of the citizens answered that resource recovery of wastes and recycling are necessary, and one third of the citizens are aware of composting and heat recovery by incineration of wastes.

iii. **More than 91 %** (91% in Poznan) of the citizens consider public cooperation and public education campaign necessary to maintain the city and its environment. **More than 83 %** (90% in Poznan) state willingness to cooperate in maintaining the city and its environment.

3) Formulation of a Draft MSWM Master Plan

A draft MSWM master plan is being prepared based on the results of the Poznan Study, the above-mentioned field survey and the EC PHARE Report. In response to the request of the Lublin Municipality, the draft Master Plan will be prepared for the Lublin Agglomeration whose population is forecasted in Table 5.2-3.

Table 5.2-3 Population Forecast unit:person

Year	1985	1992	1995	2001	2005	2010
City of Lublin	326,500	352,500	371,000	411,000	440,000	479,000
Lublin Agglom-eration	NA	492,500	518,500	574,000	614,000	669,500

Waste amount and composition are forecasted in the following tables based on the results of the Study in Poznan.

Table 5.2-4 Forecast for MSW and Other Wastes, Lublin Agglomeration
unit:ton/day; 1 year=365 days

	1992	2001	2010
1. MSW			
Household	182.2	243.9	361.4
Domestic Ash	14.8	0	0
Shop	3.2	4.3	6.4
Catering	2.6	3.5	5.2
Market	4.2	5.7	8.4
Institutional	16.5	22.0	32.6
Road Sweeping	18.6	24.9	36.8
Bulky	8.0	10.7	15.8
2. Other Wastes	41.1	55.0	81.5
Total	291.2	370.0	548.1

Table 5.2–5 Forecast for Composition of MSW without Ash, Lublin Agglomeration unit:%

Composition	1992	2001	2010
Garbage	61.1	47.6	34.0
Paper	14.2	21.1	28.0
Textile	3.1	4.1	5.0
Plastic	4.4	6.2	8.0
Grass and Wood	2.3	3.2	4.0
Leather and Rubber	2.1	1.5	1.0
Metal	3.3	4.1	5.0
Glass	6.7	8.3	10.0
Ceramic and Soil	2.8	3.4	4.0
Others (Non-combustible)	0	0.5	1.0
Total	100.0	100.0	100.0

Note: MSW here excludes road sweeping and bulky waste.

6 RECOMMENDATIONS

6.1 Conclusion

1) Technical System

a. Present MSWM in Poznan

- Present amount of MSW discharged in Poznan City is 453.5 tons/day (769 g/person/day) in 1992, and the disposal amount at the present Suchy Las landfill including wastes other than MSW is 508.6 tons/day.

- The LCV (Lower Calorific Value) of MSW, excluding road sweeping and bulky wastes and domestic ash, was measured to be 1,854 kcal/kg. It is concluded that MSW in Poznan City does not require auxiliary fuel for an incineration plant.

- The Franowo–Michalowo site which shall be proposed as suitable for the management of MSW facilities in the Urban Development Master Plan of Poznan City to be formulated in December 1993, is also considered as the optimum site within the city in this study, provided that sufficient environmental measures are taken against the adverse impacts of the MSW facilities.

b. MSWM master plan

- It is forecasted that the amount of MSW discharged in Poznan City will be 537.7 tons/day (867 g/person/day) in 2010, and that the LCV of MSW excluding road sweeping and bulky waste will be 2,338 kcal/kg with a separate collection system and 1,924 kcal/kg without.

- The seven alternatives for the MSWM Master Plan were carefully examined. In order to achieve the goal established, Alternative 5 which consists of separate collection, public recycling centres, an incineration plant and a sanitary landfill was concluded to be the optimum technical system and approved by the Poznan City Council.

- The construction of MSWM facilities proposed in the Master Plan shall be implemented on a step by step basis, i.e. short term (1994–1998), middle term (1999–2003) and long term (2004–2010).

c. Feasibility Study

- The proposed cost is estimated based on the construction price in January 1993 as follows:

Table 6.1-1 Estimated Project Costs

Facility	Scale	Project Cost (mill.zl)
Public Recycling Centres	Large: 3,000 m^2 x 2 sites Small: 2,000 m^2 x 6 sites	16,264
Incineration Plant Phase I	Capacity: 10 tons/hour/1 line	539,155
Sanitary Landfill Section 1	Landfill capacity: 700,000 m^3	46,517

- The economic/financial analysis regarding the implementation of the 3 projects shown in the table above is conducted and it is concluded that the three projects are feasible. As for the incineration plant (Phase I), the EIRR (Economic Internal Rate of Return) is 15.8 %. The FIRR of the Poznan Treatment Disposal Company is 17.5 %.

2) Institutional Development

For institutional development, the following conclusions on the study may be presented:

a. General conclusions

- The complete transition of the Polish society from a socialist, centralised system to a capitalistic, decentralised community with free market economy inevitably led to transitional problems due to the lack of tools in the local level required in managing public duties. Therefore, there is a need for tools to be transferred from national and regional levels to the local level.

  For MSWM, the problems in transaction includes lack in legislative tools related to the enforcement of compulsory waste services and tools for financing through local taxation and the municipalities' capability in raising loans.

- Generally, it is difficult to overcome opposition and to obtain land for waste facilities due to lack of procedures for compulsory purchase of land for projects benefiting the whole community.

- General discussions should be conducted on standards appropriate for the MSWM, e.g. to determine the time schedule required for the transition to EC-standards.

- The implementation and evaluation of the project in terms of the provision of feasibility analysis for decision-making, execution of competitive bidding in the purchase phase and supervision of construction works were not adequately managed.

- The custom for public subsidization results in low financial contributions from the users leading to a lack of public monitoring and control of the services.

b. Conclusions for Poznan municipality

- Generally, the MSW-services in Poznan Municipality are carried out in a satisfactory way.

- The institutional system of MSWM in Poznan Municipality is being reorganized and strengthened. Furthermore, SANITECH is strengthened through the joint ownership of the municipality and a private German contractor possessing technology and the financial resources.

  Nevertheless, the municipality still requires further improvement and strengthened control over activities as majority of the shares are held by the private investor.

- The present method in the collection of fees for waste services, performed by the executing contractor, is insufficient and tends to provide unequal services to the citizens.

- The newly issued regulation for MSW services deals with deficiencies hindering the maximization of the collection service and competitive bidding. Furthermore, without enforcement from the controlling authorities the level of cleansing services in the city may vary.

- Sanctions in controlling the disposal of construction waste are essential to the prevention of illegal dumping.

6.2 Recommendations

1) Technical System

a. Obtainment of basic data and its utilization

- Basic data on the waste stream diagram and composition were obtained from the Study. It is, however, insufficient for the formation of the detailed design of an incineration plant. Therefore, the execution of a periodical waste amount and composition survey and the reviewal of basic data for the successful design, construction and operation of the incineration plant are recommended.

- As for the amount of waste collected and disposed, measurement by volume shall be replaced by weight. Continuous observation of the amount of waste disposed shall be conducted in order to obtain the seasonal fluctuation in waste discharge to establish the capacity of the incineration plant. Consequently, the execution of a year-long measurement of the amount of waste disposed and preparation of a more precise waste flow diagram are requested.

b. Collection

- A separate collection system for combustible and non-combustible wastes shall be introduced in order to achieve a highly efficient of combustion process.

- Bulky wastes will be brought to public recycling centres by the citizens. And a bulky waste collection system shall be provided to citizens who can not transport their wastes to the centres.

- For the introduction of a separate collection system, a pilot area shall be selected for experimentation. Based on the results of the experiment, an expansion plan for the whole city shall be made.

- The same system will be used for the collection equipment. However, ownership of public containers not less than 1.1 m^3 shall belong to collection companies, while dustbins (110 l) shall belong to the citizens.

- To improve collection efficiency, the curb collection shall be adopted for the collection of dustbins and small public containers (1.1 m^3).

c. Recycling

- Eight public recycling centres shall be constructed as soon as possible. As the main purpose of public recycling centres is the prevention of illegal dumping, it is not advisable for profit-orientated private companies to have direct control over the operation. Instead, it is recommended that the Department for MSWM shall sublet, under a fixed budget, the operation to private companies

- It does not seem to be necessary for the Municipality to construct any special facility for recycling. However, the Municipality as well as the Central Government shall promote recycling activities in order to avoid stagnation due to decrease in the prices of recyclable materials. If necessary, they should offer incentives or subsidies for recycling activities because of the savings from collection and disposal costs to be gained.

d. Incineration plant

- In response to the need to reduce waste disposal amount, the citizen's intense awareness concerning environmental conservation and demand for heat supply in the area, the construction of the incineration plant (phase 1; capacity 10 tons/hour) is recommended.

- Financial aid from international lending agencies for the construction of the plant is recommended.

- In order to reduce the financial burden and smooth the operation of the plant, full incineration shall be performed step by step until 2010.

- Although the construction of phase 1 will commence in 1998, the schedule shall be renewed in case national/regional economic conditions and the financial state of the Municipality may not afford such a large investment.

- An EIA (Environmental Impact Assessment) shall be conducted before the construction.

e. Final disposal

- Since there is no disposal site in Poznan city, the immediate construction of the Franowo–Michalowo sanitary landfill, which will meet the EC environmental standard, is most desirable.

- The transfer of the landfill from Suchy Las to Franowo will bring about opposition to the Municipality from the nearby residents. Therefore, to obtain a consensus it is necessary to explain the impact of the establishment of the landfill site on the surrounding environment by using predicted data. The formulation of a periodical monitoring plan on environmental items, like water and air quality etc., is recommended.

- An EIA shall be conducted before construction.

2) Institutional Development

For institutional development the following recommendations are proposed:

a. General recommendations

- In order to provide the optimum conditions for the implementation of appropriate MSWM at the local level, the national authorities should complete:

  . The national MSW–policy including the determination of appropriate target years for implementation of specified (minimum) services complying with the standard applied. After determination of the policy, a period of at least 4–6 years should be settled for implementation and gaining of experience before new demands are imposed.

  . The necessary legislation including appropriate administrative tools for municipalities' implementation of compulsory waste service. With the administrative tools, the municipalities could control and supervise the private companies involved in the MSWM.

  . The necessary legislation that will provide appropriate tools for the acquisition of land under compulsory powers in order to facilitate localization of the waste treatment and disposal facilities needed.

. The necessary tools for the implementation of competitive bidding including preparation of a general regulations concerning Tender Works.

. The necessary financial tools for financing local MSWM through local taxation and raising loans for feasible projects.

- Establishment of a new regional authority responsible for licensing waste utilities. This new authority will supervise the performance of these utilities and whether environmental standards are met. This duty will be enforced particularly during the updating of the licences, which should take place every 4 years. Non-compliance and violation of the environmental standards would lead to confiscation of license and termination of operation.

- To compensate for the urgent need for improved surveillance during construction, provincial authorities should carry out a more intensive supervision of the projects to ensure that environmental protection measures are implemented.

- In order to heighten public awareness, education programmes should be implemented. Schools and the media are the best ways to reach the public.

b. Recommendations for Poznan municipality

i. Establishment of the Department of MSWM

A clearer division in responsibilities and duties in MSWM is necessary to secure municipal control over the activities, and an unified and better service to the citizens. Furthermore, the division of responsibilities and duties for compulsory municipal services would entail informing the citizens of the definition of the various level of services, the methods in the handling of complaints and - most importantly -the determination and collection of fees.

Generally, a Department wholly responsible for Municipal Solid Waste Management must be formed. The department shall be responsible for overall planning, administration and control, and supervision of executing bodies.

ii. Executing bodies

The execution of compulsory municipal waste services, operation of facilities etc., will be tendered to private companies and also entrusted to companies to be established under municipal jurisdiction.

The newly formed Rethman–Poznan Waste Management Co. Ltd., regardless of the participation of Poznan Municipality, lack ultimate municipal control over the activities to be called a municipally (controlled) company. Consequently, we recommend that full control and supervision should be carried out on the activities of the company by the administrative tools of the Municipality. However, since the Municipality is not granted with these tools, contracts on municipal services may be given directly to the company, provided that the contract price for tendered districts were used as basis of the payment.

We recommend the execution of the following waste services:

Waste collection services

- Tendering by district (min. 25% of the total volume).
- The remainder is given to Rethman–Poznan Waste Management Co. Ltd., using the contract price for the tendered districts as basis of payment.

Incineration plant and sanitary landfill

- Formation of a new company under full municipal control to be responsible for construction and operation. Construction of the facilities will take place through competitive bidding.

Road sweeping and public area cleansing

- The responsible bodies will conduct tendering directly.

iii. Determination and collection of fees

- It is desirable to have a waste fee system based on the discharge amount (weight). However, it would be difficult at the moment to calculate waste fees by measuring each generation source. Therefore, the establishment of a waste fee system which consists of

collection fees (zl/person/month) and solid waste tax (for treatment and disposal costs) in accordance with income, is recommended.

- Poznan Municipality, in cooperation with other local governments, is highly recommended to make a request to the Central Government for the modification of the law related to MSWM, to enable local governments to regulate the above mentioned waste fee system and fee collection system.

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