

## CHAPTER 2 INSTITUTIONAL FRAMEWORK

### 2.1 Introduction

Moroccan citizens have the right to live in a clean and healthy living environment, and to enjoy their environment and nature to the full. The government should run the country in such a way that this right is recognized by everybody, and fairly distributed all over the national territory.

Today, it is accepted that waste collection should be carried out to maintain public health and hygiene. Unfortunately, in many cases, waste management depends on discipline, public-spiritedness, or simply on the state of information about the generators of waste. At times persons in charge of this sector manage it without any consideration for hygiene and environment. The situation is not yet dramatic, because no case of major disaster has been observed, but the possible risks are increasing.

In Morocco, life expectancy (which is one of the indicators of public welfare) is relatively short, and the child mortality rate is high. Therefore, many things still have to be done, including the improvement of public hygiene, which may be encouraged by sound waste management.

Improvement in SWM is one of the factors required to accomplish human well-being. However, so far, this field has not been given much importance in Morocco, because it is not likely to generate economic growth directly. Therefore, it has not been a priority.

It is true that this field will still not be a communal priority in the future. If people are made aware of this field at the national level, it will be an important indicator of the evolution of attitudes toward SWM in Morocco. An improvement of the quality of this sector means an improvement in the quality of life for the whole country. However, in view of the costs involved, it is necessary to be rigorous in determining priority areas for improvement.

To give a fresh boost to SWM at the national level and to encourage communes to strengthen their efforts in this field, the central government should be involved. Its determination will be expressed by strengthening the institutional framework in order to lead, accompany, and control initiatives at the local level.

The present chapter aims to present :

1. SWM administration at the national level,
2. Coordination of responsibilities between concerned Ministries,
3. Institutional provisions necessary for SWM,
4. Creation of new sections within the involved Ministries

## **2.2 SWM Administration at the National Level**

### **a. Inadequacy of SWM Today**

In theory, waste management is carried out by the persons or the bodies in charge of this field. If this concept is not implemented, there will undoubtedly be problems. We are obliged to note that this is the case in Morocco.

#### **1. At the level of the local governments, (urban communes and communities):**

- Adequate waste collection services are not always provided.
- There are no environmentally satisfactory systems of solid waste treatment.

#### **2. Industrial establishments and hospitals**

- Companies producing hazardous waste have not made environmentally satisfactory arrangements for waste disposal.
- Hospitals do not have sound management of infectious waste.

From the point of view of the environment, the problems of SWM are :

- Disposal sites of local communities cause nuisances such as smoke, dust, odors, production of biogas and leachate,
- These sites may cause damage to water resources, and pose risks to public health and environment.

According to the Communal Charter dated September 30, 1976, these problems should be solved by the local communities. This principle being established and recognized, it is not advisable to leave them alone in this specific field. It is necessary to define uniform and applicable rules for the whole country, particularly if the regulation in question requires special technical knowledge as in the case of the treatment of hazardous and infectious waste.

### **b. Need for an Institutional Framework for SWM**

The government should establish the institutional framework necessary for correct implementation of SWM by clearly defining responsibilities.

The principle of division of responsibility between national and local governments in the field of SWM may be defined as follows :

#### **1. Local governments should :**

- Be in charge of domestic waste collection ;
- Be able to manage part of industrial and commercial waste that may be treated in the same way as domestic waste.
- Have the power to control industrial companies with a view to protecting the environment ;

## **2. Regarding local governments, the national government should:**

- Provide them with a legal framework for SWM which defines responsibilities of the concerned parties, namely waste producers and municipalities.
- Motivate them to carry out sound SWM.
- Provide them with the necessary technical training and information on SWM.
- Establish a pollution monitoring system where local governments do not have the technical means to do so.
- Provide support at the national level for training industrial managers in charge of recycling and waste disposal.

### **2.3 Coordination of Responsibilities between Concerned Ministries**

#### **a. Position of Each Ministry in the Field of SWM**

The decrees related to the responsibilities and organization of the concerned ministries define the fields of competence of each of them. When a ministry directly uses its competence in a field, this is the vertical line; if it acts indirectly, its action is horizontal. In the field of SWM, the Ministry of the Interior, which is responsible for local government policy, assumes the vertical line. The Ministry of Environment has for its part a horizontal, cross-cutting function.

The Communal Charter lays down the principle of the autonomy of the urban communes and communities as regards SWM. Their budgets and investments are however subject to the control of the Ministry of the Interior.

The main ministries involved in the field of SWM are the Ministries of Public Health, of Commerce and Industry, and of Public Works.

The Ministry of Public Health is the competent authority to supervise hospitals and care centers throughout the country. It also controls the quality of drinking water by carrying out analyses in its regional laboratories.

The Ministry of Commerce and Industry is the supervising authority for commercial and industrial activities. As such, it acts as an advisor for their waste disposal and for the establishment of recycling and resource recovery activities.

The Ministry of Public Works is the competent authority in the field of water resources. It constructs and manages infrastructure such as dams, canals, etc. It has written the Law on Water, which establishes a system for the protection of water resources by creating water basin agencies, and for the control of any discharge capable of polluting them.

Compared with these manager-ministries, and in spite of its commitment for the environment, the Ministry of Environment does not yet have a direct managerial responsibility. It is mainly concerned with coordination, collection of data, studies,

and drafting of laws, regulations, and standards related to the environment.

**b. Lack of Definition of the Legislative and Statutory Framework for Environmental Aspects of SWM.**

The administrative system for managing the environment has not yet been established, particularly those aspects concerning waste disposal, pollution of the atmosphere, coastal pollution, and dispersion of chemical matters in the environment. A coherent legal framework covering impacts on human life and the ecosystem through air, water, soil, etc., has not yet been constructed. This is in contrast to water management where the Law on Water covers the creation of water basin agencies and control of pollution of water resources.

In the field of waste management, the power to control waste disposal has not yet been legally defined. It has not been specified whether the power to plan or operate SWM facilities falls within the responsibility of local communities, the municipal or provincial bureaus of hygiene, the competent bodies (communes and Ministry of Public Works) basin authorities, or any other unit specially created for this purpose.

Would it be preferable to confer the administration and management of SWM on one or several ministries? It is difficult to answer this question, but the experience of the OECD countries shows that sharing responsibilities in this field has never been efficient.

**c. Need to Establish a Direct Channel for SWM Administration**

Regarding the management of municipal and hospital waste, it is recommended that the existing procedures and hierarchy of the Ministry of the Interior and the Ministry of Public Health should be used.

Tasks of the national government in the field of SWM :

**Relating to local communities:**

1. Supervision of the execution of sound SWM at the communal level ;
2. Approval of impact studies for waste disposal facilities ;
3. Approval of authorization to construct such facilities ;
4. Control of the running of such facilities ;
5. Providing the required technical information and guidelines on waste disposal facilities ;
6. Training of communal SWM staff ;

**Relating to companies:**

7. Supervision of the execution of sound SWM carried out by companies ;
8. Approval of impact studies for waste disposal facilities within companies;
9. Approval of authorization to construct such facilities
10. Control of the operation of such facilities
11. Providing required technical information and guidelines on waste disposal facilities ;

12. Training of staff in charge of SWM within industrial establishments producing waste, and more particularly those which produce hazardous waste ;
13. Supervision of waste transport between several Regions.

The Ministry of the Interior and the Ministry of Public Health have their own decentralized organizations which can assume these tasks.

The Ministry of the Interior supervises the urban communes and communities through the Walis and the Governors, backed up by engineers belonging to their technical services. At the level of tasks 2, 3, 4, and 5, the procedures have not yet been defined in the absence of legal texts in this field. Concerning training, the Department for the training of the executives of the Ministry of the Interior is the appropriate structure for performing this role.

The Ministry of Public Health has a department for hospitals and ambulatory care, which is in charge of supervising care establishments and hospitals. Through the provincial, prefectural and municipal bureaus of hygiene, the public health sector is present at the level of each commune. However, in the field of household waste it has not yet any direct involvement.

Water basin agencies will very soon be in charge of controlling the potential risks to groundwater from disposal sites (leachate). On the other hand, they will not be responsible for controlling other nuisances which these disposal sites may cause to the environment.

It is to be noted that actually there exists no governmental body having responsibility for control of all the factors which may harm the environment.

It is always desirable to use as much as possible the existing administrative structure, but the main problem which remains is the coordination of actions required for protection of the environment. The control of pollution requires global and coherent action.

The environment is comprised of many different interrelated components. Atmospheric pollution control generates solid waste (dust trapped in the electro-filters) for example. Waste water treatment causes the production of activated sludge which is classified as hazardous waste. A cross-media approach must be considered for the management of the different media concerned with the environment.

If several governmental bodies act in an uncoordinated fashion, confusion will result, and it will be extremely difficult to maintain the unity of public administration for waste management.

Ratification of the Basle Convention by Morocco involves the national government in controlling transboundary movements of hazardous waste. The signatory of the convention is the Ministry of Foreign Affairs, but the interlocutor of international authorities in this field will be the Ministry of Environment. To comply with the provisions of this convention, SWM should also enforce regulations concerning cross-border movements of hazardous waste.

This ratification will also permit the intensification of exchanges between Morocco and other signatories of the convention in research and development and will facilitate the exchange of technologies.

**d. Need for R&D (Research and Development) in the Field of SWM and Incentives to Reduce the Volume of Waste**

Several countries are carrying out actions aiming to reduce the volume of domestic waste by reusing and recycling the materials capable of being recovered. Industrial research has permitted the reduction, and sometimes the elimination, of waste by introducing new techniques. Also, in Morocco, actions of this type may bring about positive results.

**Reduction of Waste Volume and Recycling**

The recycling of waste requires for its development the existence of industrial activities which offer possibilities for recovery of materials. Glass collection is justified if there is a glassworks, or paper collection if there is a paper manufacturing industry. The lack of technologies permitting reuse of materials, or the very high cost of the processes, prevents recovery, as is actually the case for plastics. Channels for recycling already exist in Morocco, whose operation is satisfactory according to existing market conditions.

In the field of industrial waste, the results obtained from recycling regulations and incentives have sometimes been spectacular. The producers of hydrochloric acid in the United States have completely eliminated waste from their processes. A voluntary approach for the reduction of waste volume and recycling can bring about positive results even in a sector neglected by the communes and government. Restrictive measures related to the discharge of industrial activities should be adopted by law.

To facilitate the enforcement of legal texts, accompanying measures should be taken by the national government so that the effort expected from industrialists will be economically realistic. A particularly positive measure for the national economy is to encourage research in manufacturing processes which limit or eliminate the production of industrial waste.

**Research and Development**

It is essential to research and to develop technologies that could be applied in Morocco to implement waste management, reduction and recycling. Such technologies will be applied particularly in the industrial field. Insofar as immediate profitability is not always possible, national level subsidies such as low interest rates will sometimes be needed.

As concerns high technology which may be imported to Morocco in this field, it is recommended that applicability of the proposed systems and their economic feasibility should be evaluated in light of Moroccan conditions.

The Ministry of Commerce and Industry has the responsibility to inform, advise and

support the requests of professionals in the field of industry and commerce. However, there is as yet no organization for research and development for waste management, reduction and recycling at the national level.

**e. Coordination of SWM Responsibilities**

The administrative organization of SWM has not yet been strongly structured and the procedures have not yet been established among the competent ministries. The Ministry of the Interior, the Ministry of Environment, the Ministry of Public Health, the Ministry of Public Works, the Ministry of Commerce and Industry and the Ministry of Agriculture all deal with SWM using their own approaches. In the future, there should be a specific law on solid waste which defines the administrative framework of SWM, and responsibilities between the involved ministries and procedures for management of this sector.

For this purpose, we will describe the division of tasks among the ministries in the following table.

As shown in Table 2.3-1, the most concerned ministry is the Ministry of Environment. The described tasks are therefore organized within the main axis of this ministry and with its coordination.

**Table 2.3-1 Competent Authorities in Charge of SWM Tasks**

<b>Administrative Tasks</b>	<b>Competent Authorities</b>
1. Drafting of laws and regulations	MoE, MoI, MoPW
2. National policy for waste	MoE, MoI, MoPW
3. Management of communal SWM	MoI
4. Environmental control of municipal disposal sites	MoI, MoE, MoPW
5. Supply of technical assistance and information to the local communities	MoI, MoE
6. Training of SWM executives in the local communities	MoI, MoE
7. Control of SWM for industrial and hazardous waste	MoCI, MoE, MoI
8. Environmental control of facilities for industrial and hazardous waste disposal	MoE, MoPW
9. Supply of technical assistance and information to the local communities for industrial waste	MoCI, MoE
10. Guidelines for reduction and recycling of industrial waste	MoCI
11. Control of SWM for infectious waste	MoPH, MoE, MoI
12. Supply of technical assistance and information for the facilities of infectious waste disposal	MoPH, MoE, MoPW
13. Supply of technical assistance and information relating to SWM for infectious waste	MoPH, MoE
14. Training in the field of SWM industrial and hazardous waste	MoCI, MoE
15. Control of waste transport between several Regions	MoFT, MoE, MoCI
16. Control of impact studies for facilities of waste disposal	MoE, MoPW (protection of water resources)
17. Use of waste in agricultural lands	MoA
18. Pollution of soil by waste	MoE, MoA, MoPW
19. Recycling of packaging material	MoCI, MoI, MoE
20. Research and development for SWM	MoCI, MoPW (water), MoE (environment)
21. Incentives for waste disposal facilities	MoF
22. Financial incentives for " clean " industries	MoI, MoCI



## **2.4 Institutional Provisions Necessary for SWM**

### **a. Enforcement of SWM Laws**

To clarify the existing situation concerning waste management, the national government should before anything else implement laws on waste management as soon as possible.

Draft laws and the enforcement decree should be drawn up by the Ministry of Environment (agency mainly involved in SWM and the control of pollution). The Department of Observation, Studies and Coordination should draft the main component of the legal texts, should collaborate with the Department of Regulations and Control which will coordinate with other texts dealing with the environment (Law on Water).

It is recommended to organize an inter-ministerial committee in charge of following up these draft laws. The legal commission of the National Council of Environment is the appropriate body to fulfill this function. The Ministry of the Interior should participate through its advice on the elaboration of texts concerning the local communities from the initial stage.

The content of the laws and regulations to be drawn up is described in Chapter 1 of Book 1-Part 2.

### **b. Strengthening Administrative Procedures for SWM Services of the Local Communities**

SWM services of the local communities are not sufficiently controlled by their supervising ministry, the Ministry of the Interior. The role of the ministry's engineers detached to the Provinces and the Wilayas is primarily consultative, because they have as a rule to respect the autonomy of the urban communes and communities.

It is not necessary for the national government to exercise minute control over local governments' SWM operations. On the other hand, it is essential that it imposes national standards for public hygiene for the population's welfare. It comes within the scope of its duties to estimate the present state of the services carried out by the local communities all over the national territory, to show them the level of quality to be reached, and to encourage them to improve their services.

### **c. Establishment of Decentralized Bodies for Control and Supervision of SWM**

To look after the implementation of national policy in the field of environment, decentralized agencies of the national government should be established all over the national territory. At the present time, there is no structure within the Moroccan administration which may fulfill the task of coordinating environmental protection activities. This coordination of protective actions, including solid waste, turns on three complementary functions.

The first function concerns control and enforcement of laws and regulations in the field

of waste, pollution control and the prevention of ecological risks. Its mission is to control the construction and operation of municipal waste disposal facilities as well as their impact on the environment, the techniques used by the industrial establishments for waste disposal, in particular hazardous waste, and the processes used by hospitals for the treatment of infectious waste. Control also involves analysis of the authorization of documents of these facilities, then when they have been established, ensuring conformity of management with the operational authorization.

The second function concerns the management of actions in favor of environment. This includes information on the processes and techniques to be implemented to improve the existing situation. It serves as a go-between for technical ministries like the Ministry of Environment, the Ministry of Public Works, and the Ministry of Commerce and Industry, in particular regarding purchases of SWM equipment and technology. It is the link between research in the field of SWM and the users of the results of this research.

The third function provides incentive measures meant for investors or the establishments required to carry out projects in the field of SWM.

Future decentralized bodies for control and supervision will have to cover the three functions mentioned above, according to one of the two following organizational arrangements :

1. by technical offices in charge of the implementation of national laws and regulation, at the level of Provinces or Wilayas under the authority of the Governor or the Wali, or
2. by specialized offices in charge of environmental protection and SWM in each Economic Region under the authority of the Ministry of Environment.

This organization, once established, will be close to that functioning in France. However, it must be noted that D.R.I.R.E. (Regional Departments of Industry, Research and Environment) are placed under the authority of the Prefect of the region or the department, but they fulfill their missions for the Ministries of Environment, Industry and Research. These three ministries also constitute the supervising authority of ADEME (Agency for the Environment and Control of Energy) which through its 26 regional delegations coordinates actions and encourages research for the protection of environment. The basin's agencies in France play a major role in the policy of incentives to reduce the production of industrial and hazardous waste, a role which the basin's agencies would welcome imitation in Morocco although it is not yet provided for in the legal texts.

The French institutional framework has been completed by the establishment of "ECO-emballage" (ECO-packaging) and other companies involved in packaging waste management.

In Great Britain, the same functions are represented. The "Waste Regulatory Authority" functions as a control authority for waste disposal units (particularly controlled disposal sites), with greater flexibility in interpreting regulation more important than that which the D.R.I.R.E. has in France. On the other hand, the action

of the Ministry of Environment is quite limited at the level of counties, but strong at the national level: drafting of laws and regulations, and especially issuance of guidelines for the local communities. The basin's agencies, unlike the French example, have no incentive policies for industrial establishments.

**d. Strengthening Management and Control of Infectious Waste**

The function of the Ministry of Public Health as promoter and manager of hospitals and other medical institutions must be strengthened with regard to SWM. Also, measures by which municipalities can control SWM by public health establishments under their responsibility should be strengthened. Departments of Hospitals and Ambulatory Care must in particular introduce guidelines for the establishment of sound management of infectious waste and its disposal. A data bank should be established to collect the information available on this issue and to make it available to all medical institutions.

This action should be completed by training staff in charge of SWM within the establishments, as well as the staff of the department in charge of controlling the implementation of the Ministry's guidelines in this field.

**e. Creation of a Division Within the Ministry of Commerce and Industry to Promote Waste Recovery**

Waste recovery is for industrial companies the main road which opens itself for the management of their waste. Considering the diversity of Moroccan industry, and the vast range of manufacturing processes, only a case by case approach is possible. It is therefore desirable that the Ministry of Commerce and Industry strengthens its environmental services to help companies to solve their waste problems. The creation of a data bank to collect available information on on-going experiences in other countries will be useful for the industrialists. It will also encourage joint ventures in this area.

The Ministry of Commerce and Industry in collaboration with the Ministry of Environment and the Ministry of Public Works should take some measures to encourage industries to reduce the amount of waste they generate and to alleviate water pollution.

The initiatives already taken by the Ministry of Commerce and Industry in the field of training deserve to be followed and developed.

**f. Creation of an Institute for Research and the Dissemination of Environmental Techniques**

It is desirable to create a national institute for research and dissemination of environmentally benign technologies.

The Ministry of Environment has a national laboratory for studies and control of pollution and nuisances, which actually focuses on the analysis of the state of environmental pollution, and not on research or the development of technologies for

the protection of the environment.

To define the standards which should be enforced in the future, and to popularize appropriate waste disposal technologies in Morocco, the Ministry of Environment should be equipped with a research institute.

This research institute should have three main functions :

- To study the techniques available in the field of waste disposal, and to establish technical guidelines which aim to avoid the repetition of past errors.
- To define and implement programs for applied research.
- To carry out technical studies in the field of environment.

In this perspective, it is desirable to establish the equivalent of the National Laboratory of Hygiene for the environment sector.

#### **g. Strengthening of Training Programs**

Morocco needs experts to keep up with the rapid evolution of SWM technologies. Training of these experts should be done at the national level. Therefore, the national government should take responsibility for strengthening the training of staff involved in SWM.

The engineers and experts of the local communities already receive training organized by the Department for the training of executives of the Ministry of the Interior. Sessions dealing with SWM should be included within the programs. For the content of these training programs, refer to Chapter 6 of the current Part-2.

It is necessary to complete the training for local government executives by inclusion of specific education in SWM and its involvement in the environment. This aspect of training has not yet been organized. The Ministry of Environment has a mandate for implementing training programs which cover this field, which should be aimed at SWM executives of hospitals and establishments of medical care, SWM executives in the industrial companies, and executives of treatment centers. The training of executives of the decentralized units of the Ministry of Environment in the Regions should be a particular priority.

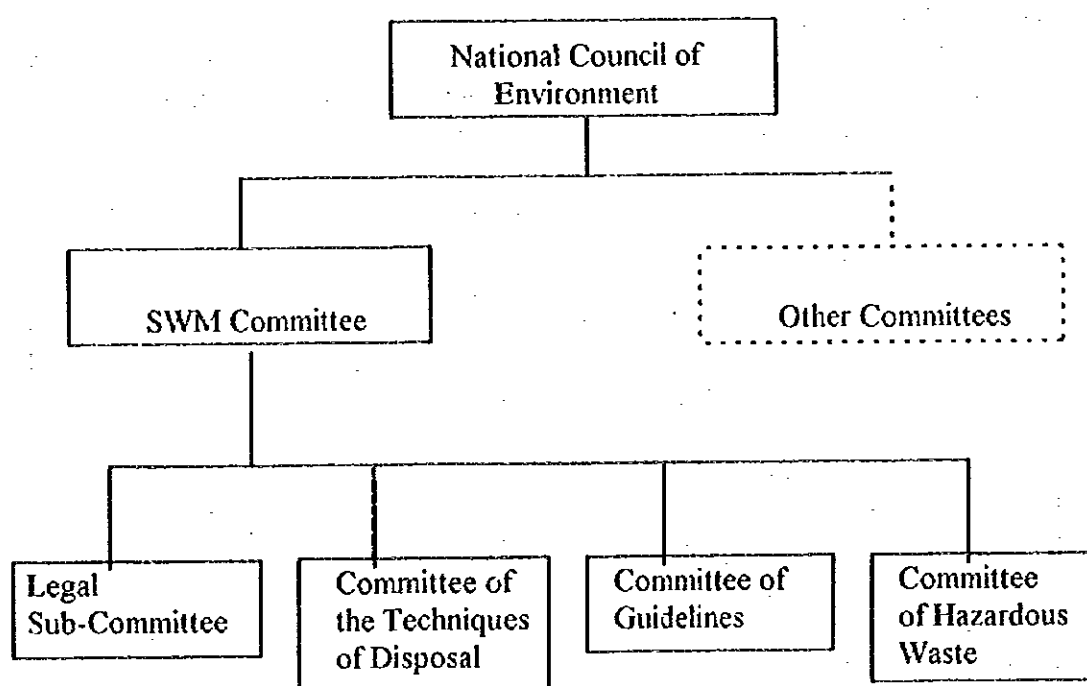
#### **h. Establishment of Standing and Ad Hoc Committees**

Waste management involves more aspects than generally thought. All human activities are related to waste. From a certain point of view, the whole population and all companies are linked to SWM. In addition, SWM involves many different activities, as implied by the varied nature of waste. It is clear therefore that SWM goes beyond the competence of one ministry or one body. It is therefore advisable to mobilize the energies and viewpoints of the different concerned socio-professional groups.

The National Council of Environment has already established 4 committees. It should complete its sphere of investigation and proposition with the creation of a "Cleansing

Committee" which would be competent in the field of waste. This committee should coordinate its work with the other committees: the legal, the strategic, the international and implementation committees, and the committee for rehabilitation of the basin of Sebou River. It should cover the following subjects as well as others as required namely, including: establishment of laws and regulations, improvement of waste disposal facilities, and drawing up of guidelines for the management of chemical products and other hazardous waste. Ad hoc committees should be established to address important issues as they arise, so that measures can be taken in a timely manner.

These committees should involve competent persons in a variety of fields, for example representatives of district associations, experts (university researchers, consultants), professional associations, ecological associations, and communal or provincial administrators.



**Figure 2.4-1 National Council of Environment and Its Sub-committees**

**i. Strengthening the Relationship between the Ministry of Environment and the Basic Agencies**

According to the water law, the Basin Agencies have comprehensive powers to control water pollution. The agencies should play a leading role in reducing emissions of liquid waste which may pollute public water bodies. For effective control of water pollution, there must be a close linkage between solid waste management and control of water pollution. For this purpose, collaboration between the Ministry of Environment and the Basin Agencies should be strengthened.

## **2.5 Creation of New Sections within the Involved Ministries**

### **a. Strengthening the Ministry of the Interior's Ability to Support Municipal SWM**

At the present time, the Department of Water and Sewerage of this ministry is composed of 15 persons, only one of whom is solely concerned with SWM. Solid waste activities should be strengthened so as to constitute a service endowed with a number of executives as numerous as that of the sewerage sector.

This service should be in charge of the following tasks : collection of data concerning SWM, synthesis of existing SWM operations, definition of objectives assigned to communes to improve SWM, the plan of action to achieve these objectives, staff training, and any form of action for the promotion of SWM.

To implement this program, there should be 2 persons for data collection, synthesis, definition of objectives and SWM planning, 2 persons for SWM administration and technical assistance to communes for this activity, and 1 person to control this activity. Training should be provided by the Department for executive training.

### **b. Creation of a Service Within the Ministry of Environment to Control Pollution Related to SWM**

It is recommended that a division of environmental pollution control be created within the Ministry of Environment which will be in charge of anti-pollution measures related to SWM. It will comprise the following sections :

- |  |            |
|--|------------|
| • Waste and soil pollution   | 1 person,  |
| • Management of disposal facilities  | 2 persons, |
| • Management of hazardous waste and interregional or international transport | 2 persons, |
| • Studies, project estimation, planning                                      | 2 persons, |
| • Training   | 2 persons. |

The staff assigned to these sections should include graduates in the following fields: engineer (chemical engineer, biologist, agricultural engineer, engineer in applied sciences, mechanical engineer, etc.).

At the level of each of the 7 Regions, an executive detached from the Ministry of Environment should be in charge of following up with industrial companies and municipal SWM facilities.

### **c. Strengthening the Administrative Structure of the Ministry of Public Health in Charge of Hospital and Infectious Waste**

The Ministry of Public Health should provide guidelines to hospitals and care centers for hospital and particularly infectious waste disposal.

To draft these guidelines and attend to their enforcement, it is necessary to create a

SWM section within the Department of Hospitals and Ambulatory Care. The main tasks of this section would be:

- Drafting and revision of guidelines concerning collection, transport, storage and treatment of hospital and infectious waste,
- Control of implementation and management of these guidelines, and adjustments which may be required in particular local situations,
- Training of SWM executives at the level of hospitals and care centers, and of executives of the Municipal Bureau of Hygiene who are in charge of enforcing laws and regulations concerning public hygiene,
- To collect the information required for creation of a data bank gathering technical documents on management and disposal of hospital and infectious waste,
- Technical assistance to hospitals and care centers for their SWM.

**d. Strengthening the Ministry of Commerce and Industry's Ability to Encourage Waste Reduction and Recovery by Industry**

The Ministry of Commerce and Industry has a Department for the Protection of Environment, which is comprised of only 2 persons. It should strengthen its manpower in order to be able to fulfill the following tasks :

- Establishment of a data bank presenting the most suitable practical information to be implemented in Morocco,
- Training and information of SWM executives within industrial companies,
- Drafting of guidelines for SWM, protection of the environment, resource recovery and reduction of waste volume, by industry,
- Technical assistance for companies which ask for it in order to plan the management of their waste and protect the environment.

All the foregoing provisions at the level of ministries involved in SWM will lead to strengthening structures capable of supporting actions of local communities in this sector. We will analyze in Chapter 4 of Book 2-Part 1 the optimization of SWM through strengthening its organization at the level of the urban commune and community.





## **CHAPTER 3 FINANCIAL AND ECONOMIC ASPECTS**

### **3.1 Financing Mechanisms**

#### **3.1.1 Financial Responsibility for Solid Waste Management.**

The central government has no explicit policy with regard to the financing of solid waste management in Morocco. It does not earmark funding for solid waste management at the municipal level, nor does it set guidelines or targets for expenditures on solid waste management by local governments, who have total responsibility for carrying out this service, including collection, transport and disposal. The situation is similar for industrial and hospital wastes; the central government has no policies to influence the amount or type of waste generated by the use of economic or financial incentives; nor does it have any mechanisms to generate funds of industrial or hospital waste management.

Nevertheless, the central government plays an extremely important, although indirect, role, in solid waste management. Thus hospitals are virtually totally dependent upon central government finance; and industrial production and therefore waste discharge is indirectly heavily influenced by government industrial and trade policy. More importantly for the present study, the local governments, which are responsible for a wide variety of functions, including solid waste, remain heavily dependent upon the central government for financial resources, and to a large degree are subject to central government control over how those resources are used, particularly with regard to capital investments.

The present role of the central government in solid waste management can therefore be described in terms of its financing of local government expenditures as a whole. The various mechanisms used by the central government to transfer funds to local authorities consist primarily of the share of Value Added Tax (VAT) allocated to local governments, and local taxes that are actually administered by the central government, namely the urban tax, the tax d'etilite (or "cleansing tax"), and the "patent", or business tax. In addition, almost the sole source of loans for local government investments is the FEC (Fonds d'Equipement Communale), of which the central government is the sole shareholder.

#### **3.1.2 Decentralization**

During the last 20 years, Morocco has been implementing a process of decentralization aimed at giving local authorities increased financial and administrative responsibility for economic and social development. Traditional areas of responsibility at the local level have included solid and liquid waste disposal, streets and certain tertiary roads, slaughter houses, wholesale markets, industrial zones, parks and green spaces. This policy of decentralization has been reinforced in the last few years with the implementation in 1988 of the decision to allocate 30% of VAT revenues to local governments. Subsequent reforms, which started to take effect in 1995, have involved the distribution of VAT revenues, and are designed to promote more efficient use of these funds at the local level by giving local governments more control over how

they are spent.

The process of decentralization has been limited in past years by the significant role played by the central government through various financial controls and mechanisms. This is illustrated by the system of investment transfers from central to local governments, which appear in accounting terms to be purely local government expenditures; however, a significant proportion of these expenditures are not controlled by local governments at all. Thus "shared expenditures", while of benefit to all local governments, are actually funds administered by the Ministry of Interior. The importance of central control is further illustrated by the decision in 1990 to transfer a number of central government programs to local budgets; these national programs included rural development, water supply, education, and health; rural electrification and civil protection were added to this list in 1991. This action was taken in order to relieve the fiscal situation of the central government. Together, shared expenditures and transferred programs accounted for about one third of the VAT distributed to local governments over the 1990-95 period.

Although the recent expansion of the FEC has provided local governments with an additional source of funding, they still remain heavily dependent upon the central government for funds. Table 3.1-1 below shows that national government transfers to local governments from the proceeds of VAT have fallen as a proportion of total local government income in recent years. Although still representing 44 percent of total local government income, VAT transfers grew by a modest rate of 28 percent between 1990 and 1994, compared with a growth for all sources of income of 55 percent (further details are presented in Table 6.2-1 in Chapter 6 of Book 2-Part 1). Actually, using the consumer price index as a deflator, the real growth in the share of VAT going to local governments over the period was about zero, while other sources grew by about 23 percent in real terms. Combined with the fact that much of the VAT has been used for activities undertaken by the central government itself, these financial data provide an effective illustration of the decentralization process in Morocco in recent years.

**Table 3.1-1 VAT Transfers to Local Governments and Total Local Government Income 1990-94**

Unit: million DH

Source	1990	1991	1992	1993	1994	% 1994	% Increase 1990-94
Share of VAT	3,565.0	4,019.0	4,447.0	4,375.0	4,560.0	43.8	28
Other Income	3,777.7	4,240.8	4,322.5	5,566.0	5,858.9	56.2	55
Total Income	7,342.7	8,259.8	8,769.5	9,941.0	10,418.9	100.0	42

Despite efforts to decentralize, central-local fiscal relationships remain highly complex and involve constant and close interaction, particularly between local governments and the Ministry of Interior, which has to approve local budgets, as well as the Ministry of Finance. Nevertheless, recent trends in rationalizing the system of central government transfers combined with the growing importance of FEC as a means of inducing greater

fiscal responsibility and competence at the local level are extremely important steps in making decentralization an effective reality.

The rationale for the retention of tight fiscal and administrative controls at the center is that local governments do not have the administrative, managerial and technical skills to plan and execute development projects and systems. An audit of 150 local government operations conducted in 1995 provided some evidence to this effect. In particular, the audit revealed a lack of co-ordination between the various functions carried out by local governments, with local finance bureaus failing to play an effective management role. The government's strategy is to progressively increase local administrative capability and to bring about increased involvement of local officials in financial management. This is recognized as a priority given the importance of the traditional functions of local governments; provision of technical assistance to achieve this end is therefore a major objective of the recently expanded FEC.

### **3.2 Expenditures on SWM**

#### **3.2.1 Existing Municipal Expenditures on SWM**

Existing expenditures on solid waste management are difficult to quantify accurately, due to inadequate accounting procedures, (to be discussed below). This applies in particular to estimates of operating costs, or recurrent costs. Also aggregate data must be treated with care: huge variations between different local governments exist. In particular there are major differences between services provided for the 47% of the population who live in urban communities, and the remainder living in rural areas.

##### **1) Capital Expenditures**

Over the period 1990-94, total capital expenditures by local governments amounted to 21,033.26 MDH or 4,206.65 MDH annually. Of this, 141.69 MDH annually was spent on solid waste, the source of such funding being FEC loans (80.36 MDH) and local taxes and fees (61.33 MDH). (In 1994 itself, FEC loan commitments for SWM amounted to 185 MDH.) SWM investment thus represented a very small amount (3.4%) of total investment at the local level. Applying this percentage to 1994 data (see Table 6.1-1) results in an estimate of actual capital expenditure on SWM for that year of 145.6 MDH. This is equivalent to 5.4 DH per capita per year for the whole country; however, virtually all capital investment in SWM has been in urban areas. When applied to the urban population alone, this expenditure becomes 11.6 DH per capita annually.

These aggregate data were checked against a specific city study, namely that of the Urban Commune of Yacoub el Mansor (Rabat-Sale Wilaya) which shows that over the period 1987 to 1991, solid waste equipment costs accounted for about 2 percent of the municipal equipment budget. For 1991, the cost of investment in solid waste equipment, averaged across the whole municipal population, was 12.5 DH per capita.

Adjusting the above estimates to reflect inflation, aggregate data indicate capital costs of about 13 DH per capita in 1996 prices while for Yacoub el Mansor, the figure

becomes 16 DH per capita.

## **2) Operating Costs**

Aggregate data are available for total local government expenditures, but not for expenditures on SWM. Two specific city studies provide some evidence in this respect. The study of Yacoub el Mansor referred to above estimates operating costs in 1991 as 18% of total operating costs incurred by the municipality, the cost per capita being 32 DH. In 1996 prices this would be about 42 DH. A study in Fes for 1994 estimates that SWM accounts for 30% of the municipality's operating costs which results in an estimate of 57 DH or 65 DH in 1996 prices. Assuming that a representative figure for recurrent costs would lie somewhere between the two cases cited, per capita recurrent expenditures would be about 55 DH.

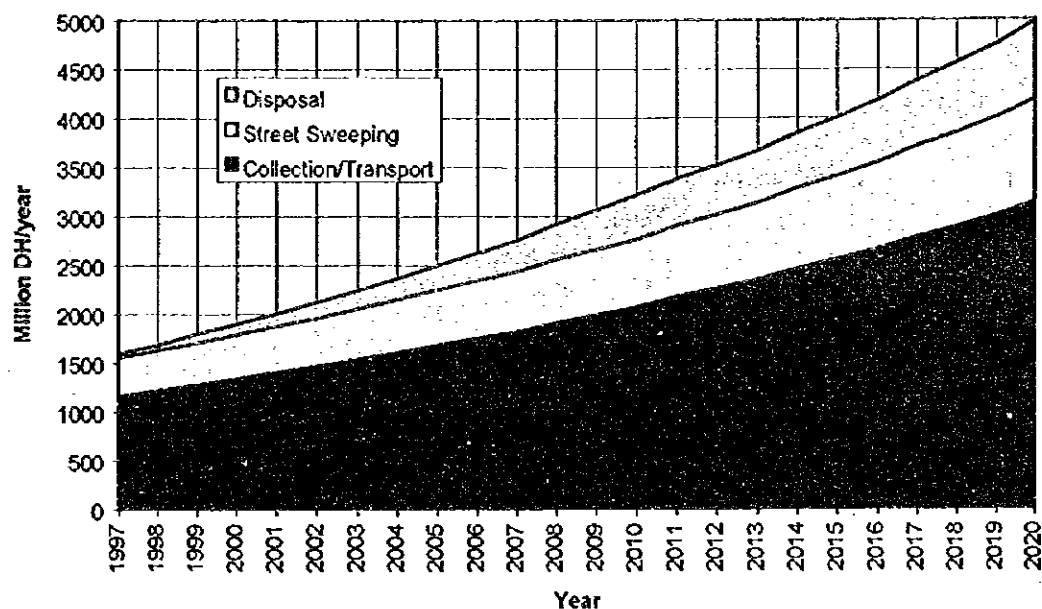
## **3) Total Expenditures on SWM**

The present level of all expenditures on solid waste for the urban population may therefore be estimated at about 70 DH per capita annually. Adding a further 10% to cover overheads, such as administrative and building costs that are shared by various local government activities, this becomes 77 DH per capita. Note however that these data refer to expenditures incurred irrespective of the quality of service or its coverage. If less than 100% of the urban population receive SWM services in that year, the cost per person actually served would be correspondingly higher).

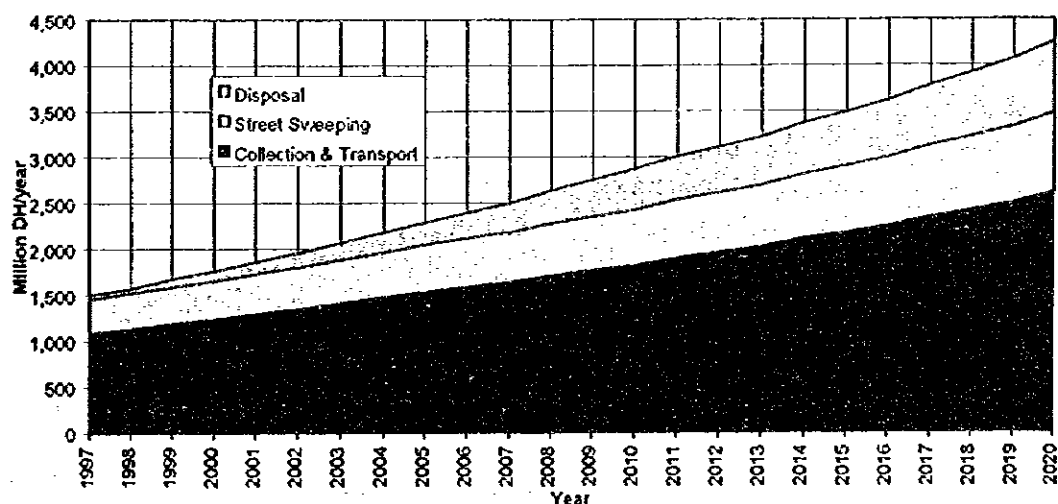
### **3.2.2 Projected Municipal Expenditures on SWM**

#### **1) Projections**

Expenditures on SWM are projected over the period 1997-2020. Figure 3.2-1 shows aggregate urban and rural SWM costs by type of service (disposal, street sweeping, collection and transport), the dominance of urban areas being demonstrated by comparison with Figure 3.2-2 which provides equivalent information for urban areas alone.



**Figure 3.2-1 Aggregate Urban and Rural SWM Costs by Type of Service**



**Figure 3.2-2 Urban SWM Cost by Type of Service**

The projections in the above figures assume that gradual improvements in service quality (collection and disposal) are implemented in accordance with recommendations elsewhere in this report including an improvement in the collection rate in urban areas from the current level of 85% to 100% by 2020, as well as improved disposal techniques. It also assumes that institutional, educational regulatory and economic reforms are gradually implemented, using the experience of Japan in the period 1965-85. Other assumptions include a 4% annual rate of growth in GNP over the period, with waste generation increasing at 0.75% of the rate of growth in GNP, i.e. 3% per annum. Capital costs are estimated as annual straight line depreciation, with no

interest payments included. To specific SWM capital and operating costs are added a further 10% for overheads.

## 2) Financial Implications of Projections

The projections imply an increase in aggregate SWM expenditures over the 1994-97 period from 1,023 MDH (i.e. 77 DH per capita in urban areas) to 1,601 MDH, (which is dominated by expenditures in urban areas). After 1997, a continued gradual increase in expenditures is projected.

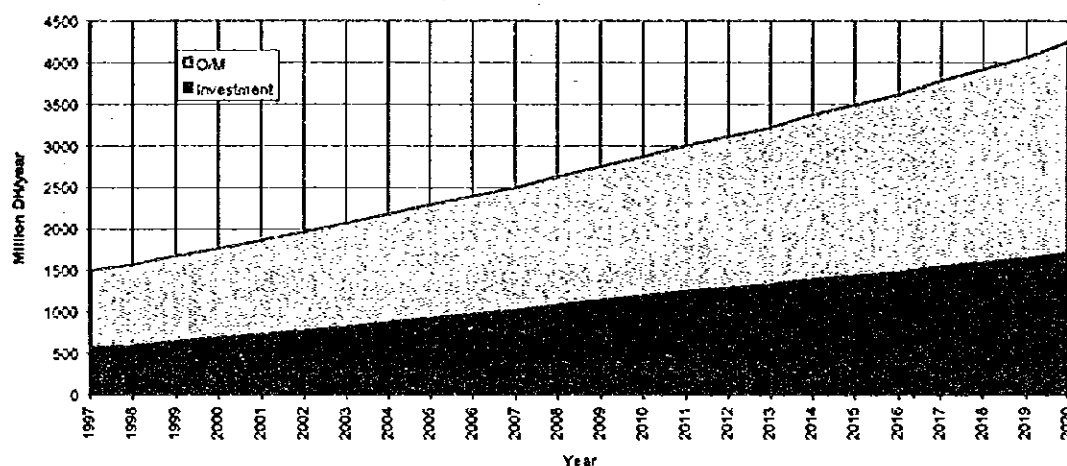
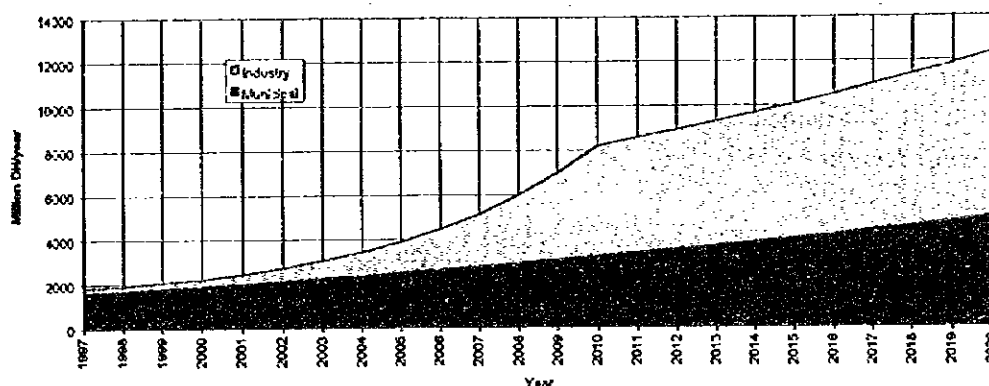


Figure 3.2-3 Urban SWM Operating and Investment Costs

The main feature of this increase in required expenditures is that they involve a particularly large increase in investment. Figure 3.2-3 shows trends in operating and investment costs over the period considered. On a per capita basis, compared with 1994, operation and maintenance costs in 1997 would increase from 60.5 DH (55 DH plus 10% overheads) to 68.4 DH per year, an increase of 13%. Past data on capital costs refer to cash cost incurred on a year by year basis; since investments have been fairly constant in recent years, annual cash costs are comparable to the depreciation costs used in the projections, as long as the economic lifetime of future investments are realistic. In contrast to the small increase in operating costs (actually a reduction in real terms), the projections imply that investment costs should increase from 16.5 DH (15 DH plus 10% overheads) to 41.3 DH per year, an increase of 150%. In view of existing procedural and staffing constraints at the local level, it may not be feasible to implement such a sharp increase in investment costs immediately; in practice therefore it is likely that some phasing of this increase over the first few years of the projection period would be required.

Existing (1994) expenditures on SWM are about 0.6% of GNP. Even with the proposed increases, SWM expenditures would continue to be small in national accounting terms. Consequently, there is no real case to be made for any change in national government fiscal allocations to local governments to help them meet the additional expenditures required. The financing burden clearly falls entirely upon the local governments themselves, as is consistent with the principle of decentralization. These issues are further explored in Chapter 6 of Book 2-Part 2.

### 3.2.3 Industrial Waste



**Figure 3.2-4 Municipal and Industrial SWM Costs**

Figure 3.2-4 shows that the costs of industrial waste management will increase dramatically over the projection period, particularly after the year 2000, by which date enforcement of a new anti-pollution law will take place. In fact, the figure understates the real magnitude of industrial waste, which can be divided into two categories. The first of these, which refers specifically to waste materials that are only generated by industry, are defined as industrial waste in the above figure. However, industry also generates waste that may be collected and disposed of together with conventional municipal, or household refuse; increases in this amount are included under municipal waste in Figure 3.2-4.

In view of the substantial growth in total waste generated by industry, there is an urgent need to begin laying the foundations for the economic, financial, and other policies relating to industrial SWM in order to anticipate the problems that will otherwise arise as industrialization proceeds. However, subject to the possible actions noted below, there does not appear a need for the national government to provide specific support in the form of subsidies for industrial waste management.

### 3.2.4 Alternative Approaches to Financing SWM

In considering the appropriate role of the central government in financing SWM, the considerable advantages of continuing the process of decentralization must be recognized; effective operation of SWM functions as well as other local activities is clearly encouraged by such a policy. Nevertheless, there are, as will be shown below, certain areas where financial and economic measures explicitly aimed at SWM requires a more proactive policy on the part of the national government. Such measures will in effect support, rather than weaken, the process of decentralization and local decision-making.

Two aspects of the financing issue may be considered, namely cost containment or cost-effectiveness of SWM operations, and revenue enhancement. As noted, the projections embody assumptions about technical progress and institutional and policy reform that will take place over the projection period, using, inter alia, international

experience as a basis for such judgment. However, although, as national incomes increase, it may be expected that such reforms, as well as revenue generation, will increase, this will not happen automatically. This report thus makes recommendations about reforms required in these areas if the projections are to become a reality. Responsibilities for such reforms will be shared between governments at the national and local levels. Financial and economic actions at the national level are discussed in the following section.

### **3.3 Economic and Financial Instruments at National Level**

#### **3.3.1 Criteria for Choice of Instruments**

Although governments in both developed and developing countries have for the most part relied on regulatory instruments in their efforts to mitigate the problems of solid waste generation, collection and disposal, there has in recent years been a growing interest in the application of economic instruments in order to improve the efficiency of the waste management process. In this regard, there appear to be several areas in which the national government's role in environmental management in general, and in solid waste in particular, could be come more proactive. In addition to specifying environmental standards and responsibility more clearly in legislative and administrative terms, there are a number of possible economic and financial instruments that might be considered in the Moroccan context.

Some of these measures are most appropriately implemented at the local level; others, on the other hand, are best implemented at the national level. These include environmental taxes of various forms, deposit-refund systems, and subsidies, and are discussed below. Whether implemented at the local or national levels, there are a number of generic criteria to be used in determining whether or not economic and financial instruments are appropriate. These are briefly noted below.

##### **1) Environmental Effectiveness**

A major objective will be to reduce the amount of waste discharge, and specifically those elements most harmful to the environment. The effectiveness of the instrument is mainly determined by the ability of waste dischargers to react to the incentives created. Effectiveness is enhanced if the instruments can provide a permanent incentive to waste reduction, innovation and recycling. Such instruments should be able to target the most damaging products or substances.

##### **2) Economic Efficiency**

Ideally this criterion requires that the amount of waste generated should be optimal in the sense that pollution and abatement costs are equated at the margin. In practice, it is probably more useful to aim for a more limited definition of efficiency in which compliance costs associated with a given environmental benefit is minimized. Setting the price for collection and or disposal according to the economic costs involved would, subject to the other criteria listed here, be a means to this end.



### **3) Equity and Acceptability**

Different policy instruments have different distributional consequences, and to be politically and socially acceptable any system must be accepted as being equitable. However, definitions and perceptions of what is equitable differ; charging the full cost for service may not appear to be fair if those charged are poor, for example. Acceptability requires provision of adequate information to those affected; consultation with industrial and community groups, and timely announcements of proposed economic and financial instruments. The latter is specially important in that it may facilitate incorporation of these costs in industrial investment decisions.

### **4) Financial Effectiveness**

An obvious characteristic of financial instruments is that they have implications for public revenues. The level and structure of environmental taxes may be evaluated in terms of the revenues they raise, while subsidy programs require critical evaluation in terms of the net burden they impose upon public budgets.

### **5) Administrative Feasibility and Cost of Implementation**

All types of policy instruments involve implementation and enforcement structures; this applies both to economic and financial instruments as well as to regulatory approaches, and is a major constraint to the introduction of efficient cost recovery policies.

#### **3.3.2 Environmental Taxes**

Ideally, environmental taxes would be set so that waste discharge would take place up to the point that the additional benefit of waste reduction equals the additional cost of achieving it. Introduction of environmental taxes, based upon the "polluter pays" principle are becoming increasingly common in the industrialized countries; this experience is of relevance to the developing countries, in which, as a general rule, there is less institutional capacity for administering complex taxation systems.

In principle, one of the main advantages of environmental taxes is that they provide a continuous incentive effect which stimulates waste generators to seek out the least-cost combination of disposal, recycling and reuse that is available to them. However, the efficiency and environmental effectiveness of such instruments is conditioned by the institutional context in which the instruments are introduced. Many developing countries, including Morocco, lack an extensive and effective waste and pollution control system (legislation, facilities and infrastructure) and enabling agencies. In such an institutional context there is a high probability that a substantial increase in discharge fees will simply merely provide waste generators with an increased incentive for avoidance and stimulate more illegal dumping of waste. The end result will be a significant increase in costs, both in terms of increased health hazards and increased monitoring and enforcement costs, which developing economies can ill afford. In effect this means that charging individual households on the basis of the waste they discharge is typically impracticable, although it may be more feasible for large industrial waste dischargers. This is further discussed in Chapter 6 of Book 2-Part 2, which deals with financial aspects of SWM at the local level.

However, this problem applies mainly to effluent or discharge fees which are levied at the point of discharge. An alternative approach is to make use of blunter instruments which are based on the presumed environmental damage or disposal costs involved in the use of certain materials in production or consumption. These instruments are known as product charges (or presumptive charges), in which there is a presumed relationship between the use of a resource and its eventual contribution to pollution. In view of the smaller administrative costs associated with presumptive charges, the use of such instruments has been growing at a faster rate in the industrialized countries than effluent or discharge fees. It is also a characteristic of the blunter instruments that they must normally be implemented at the national, rather than the local level.

Product charges can be applied to products or materials that are used in production or consumption in large quantities and diffuse patterns. Items that have been subject to product charges in OECD countries include those on non-returnable beverage, packaging materials, plastic bags, and batteries. Taxes may be levied on the product, or tax differentiation can be used to discourage the use of products that are highly polluting or difficult to dispose of, and at the same time encourage the use of more environmentally friendly alternatives (where however a product is highly toxic and its use should be completely eliminated or substantially reduced, a partial or total ban will be preferable). Product charges may be used both for incentive purposes or for raising revenues. They may be introduced at various points, such as a surtax on import duties, or a surcharge may be placed on the price of products, perhaps as part of the VAT system. In principle, charges should be based upon the total cost (including environmental cost) of disposing of the waste material after the product has been utilized.

The potential use of such instruments in the Moroccan context deserves further research; this will require, inter alia, an investigation into the contribution toward the country's overall solid waste problems of various materials in order to determine priorities. The costs of disposal should then be used as a basis for determining the charge. The point at which the fee or tax should be levied, and the administrative costs involved should be determined in order to decide if such a system is worthwhile.

One general point is relevant for all types of economic instrument: they should not be introduced in isolation, and their effectiveness is conditioned by the institutional framework that exists and by the extent of market failure in the macro economy. In recent years, market liberalization in Morocco has been moving rapidly, so the use of economic instruments for solid waste management should be feasible from this aspect. However, even the introduction of the blunt instruments referred to above will require creation of an institutional structure to ensure that the system is implemented efficiently.

### **3.3.3 Deposit-Refund Systems**

Consideration should be given to the introduction of deposit-refund systems for products or substances which can be reused, recycled or which should be returned for destruction. Traditionally operated for beverage containers for strictly financial purposes, the approach this system is eminently suitable for environmental ones.

Deposit-refund systems are widely used in the OECD countries for products such as containers, batteries, crates, and car hulks. Since substantial parts of household waste consists of packaging deposit-refund systems, particularly in parallel with a system of product charges, can considerably reduce waste volumes, and in particular to a reduction in the release of toxic substances into the environment, such as from the disposal of batteries or incineration of plastics. Deposit-refund systems may also be used as a part of life-cycle management for certain products that require special handling such as electric appliances.

### **3.3.4 Earmarking and Specific Subsidies**

One possibility to consider would be to require a certain proportion of central government transfers to be used by local governments for specific environmental purposes (or FEC could be required to earmark a certain proportion of its lending). Possibly the funds obtained from environmental taxes could be specifically earmarked for designated environmental purposes. One aspect of this to be considered is earmarking of funds for waste disposal in hospitals, either by transfer to the Health Ministry or directly to hospitals themselves.

One reason why explicit national government financial support for solid waste might be justified is that the benefits of solid waste management (or environmental protection in general) do not always accrue solely to the area in which these activities take place. For example, inadequate solid waste disposal by one community may adversely affect another, possibly by the impact upon water resources that are used by more than one community. Complete decentralization of responsibility for solid waste management to local governments may result in solid waste disposal practices that are inadequate from a national viewpoint. The possible presence of inter-jurisdictional "externalities" might justify explicit financial support from the central government as well as legislative intervention.

In many countries, industrial investment in environmental controls or recycling efforts has been encouraged by a variety of government subsidies, primarily by means of tax relief and low interest loans. Other measures have included low rail freight rates for materials being sent for recycling. Such inducements have typically been found necessary to obtain the co-operation of powerful industrial groups. It has also been used where the social costs of requiring an industry to improve its environmental performance (perhaps due to unemployment created if a firm has to curtail its operations) are deemed to be excessive.

While the immediate impact of a subsidy program is, by definition, to place a burden on public fiscal resources, in the longer term this might be offset, at least to some extent; by reducing waste discharges and thus the need for public investment in waste management. However, while the potential contribution of such measures in the Moroccan context should be examined, it should be noted that such subsidies are in direct contravention of the widely accepted "polluter-pays" principle, and that administration of such a system to avoid possible abuses is extremely complex.

### **3.4 Other National Government Actions**

#### **3.4.1 Policy Directives**

There are a number of areas in which the national government could effectively support decentralization by means of policy directives relating to financial and economic aspects of solid waste operations. Although actual responsibility for implementation of these operations lies with local governments, improved practices would be disseminated more efficiently by an agency at the national level. The Ministry of Interior, perhaps working in collaboration with FEC would appear to be the appropriate agency to provide such guidance. Topics include user charges (discharge fees), privatization, accounting procedures, and priority setting for investments in SWM. These are briefly referred to below; more details are to be found in a subsequent chapter dealing with financial aspects of local government SWM operations.

##### **1) User Charges**

Increased revenues and more efficient solid waste management may result from the introduction of specific user charges for at least some aspects of this service. Although actually implemented at the local level a consistent policy in this respect should be established by the central government, and guidance provided on implementation.

##### **2) Privatization**

Similarly, privatization of certain solid waste management functions - including collection as well as disposal - may yield operational efficiencies and thus cost-savings. The central government should create the legislative and administrative conditions conducive to privatization, including removal of the actual or perceived constraints currently faced by local governments in entering into multi year contracts.

##### **3) Accounting**

The national government should take a lead role in developing financial training programs for local government officials involved in SWM. This training should be specifically tailored to the needs of local authorities at different stages of development, staffing resources and equipment.

##### **4) Establishing Priorities**

Determination of the relative priority to be given to solid waste and other environmental expenditures should be assisted by epidemiological and other studies, including the cost of threats to water supplies. These should be carried out primarily at the central government level. Methodologies for practical project evaluation, and identification of priorities based primarily upon cost-effective approaches (using appropriate discount rates and definitions of social costs) for meeting physical targets rather than sophisticated valuation methods should be developed and disseminated to local governments.

### **3.4.2 Local Tax Collection and Assessment Procedures**

About 25 percent of local government income is accounted for by three taxes (the urban tax, the tax d'etiltite, and the "patente"), which are collected by locally based Ministry of Finance staff. Keeping up to date with assessments is costly, and collections are frequently hindered by disputes. Delays in the collection of these taxes are due not only to disputes but also to inadequate assessment and collection procedures. Although the rationale for central government involvement in the collection process is that greater administrative capability is to be found at this level, only about 85 percent of the assessed taxes are actually collected. The cost of this failure is borne by local authorities; moreover, the uncertainty involved has an adverse effect on local government financial planning and budgeting, and all services, including SWM, suffer as a result. Improvement in local tax assessment and collection is thus a priority.



## ANNEX

### ECONOMIC INSTRUMENTS FOR ENVIRONMENTAL MANAGEMENT

#### A. Introduction

Some reference has been made in the body of this report to the role of economic instruments for environmental management in general and solid waste management in particular. This annex provides a brief review of the extent to which economic instruments are actually used for environmental management, and trends in their use, in both industrialized and developing countries. It is important to recognize that economic instruments, or indeed any form of public control over polluting behavior should recognize the interrelationships between various sorts of waste discharge and that a holistic approach to "residuals management" is required. Thus to supplement the discussion in the main report, which is essentially about solid wastes, and to put it into a more general context, this annex reviews the use of economic instruments as they apply also to air and water pollution.

In recent years a good deal of analytical work has addressed the potential role of economic instruments in dealing with environmental problems, and this has been matched by a perceptible shift in actual policies, particularly in the industrialized countries. Attention has focused to a considerable extent on pollution, which itself is of concern primarily because of its implications for public health, this being particularly true of solid waste management, where other concerns such as visual amenity are much less important, particularly in a developing country context.

Economic instruments take a variety of forms, ranging from explicit pollution charges and taxes, to user charges for services such as water supply, which have direct health impacts, as well as for energy and transportation, where inefficient usage has adverse environmental consequences. Economic policies and instruments at the macroeconomic level may also have profound health impacts via their effects on the efficiency of resource use, and therefore on the environment.

This annex briefly reviews the use of economic instruments explicitly designed to address environmental objectives, particularly those that relate to human health. These are referred to in the following discussion as "explicit instruments". Trends in their use in the industrialized countries are briefly reviewed. It is shown that while there has been a considerable rate of increase in their usage, very little use is still made of theoretically preferable taxes on actual emissions or discharges of waste, whether in liquid, gaseous, or solid form. The trend is clearly to make greater use of blunter instruments, known as product, or presumptive, charges, which are administratively easier to enforce. The annex then reviews recent surveys of the use of explicit instruments in developing countries. Predictably, even less use is made of such instruments than in the OECD countries, although some signs of change are emerging. Perhaps even more than in the case of the industrialized countries, the administrative problems of enforcing emissions taxes point to the need to introduce blunter instruments, and to some extent this is already happening.

## B. Explicit Instruments

**Definition and Criteria.** Explicit instruments may be defined to include charges and taxes (with an important distinction being made between emissions charges/taxes and product charges/taxes), subsidies, deposit-refund schemes and performance bonds, market creation and financial enforcement incentives. The general rationale for market based instruments as opposed to regulatory methods has been extensively covered in the literature, which shows that in practice, economic and regulatory instruments tend to be used in combination with each other. In selecting the appropriate environmental policy instrument, the following criteria should be employed:

- Environmental effectiveness
- Economic efficiency (in terms of benefit-cost, or cost-effectiveness tests)
- Revenue Raising
- Equity, Fairness, Acceptability
- Administrative Feasibility and Cost

**Use of Explicit Instruments in OECD Countries.** To date the use of market based instruments for pollution control has been fairly limited in the industrialized world. An OECD survey in 1987 of the range of market based instruments used for pollution control in industrialized countries<sup>1/</sup> concluded that while user charges (e.g. charges for water supply, landfilling waste, etc.) were widespread, specific environmental taxes were comparatively rare. In general, the levels of these charges were rarely adequate to have any incentive effect; indeed, rather than influencing environmental behavior, recovery of the administrative costs of regulation appears to have been the primary objective. Command and control, or regulatory methods were dominant. Moreover, of the 150 instruments identified, about 40 were in the form of subsidies, which in general run counter to the arguments in favor of market based instruments.

Recognition of the important role that economic incentives can play in environmental management has become more apparent in recent years, and appropriate pricing and taxation structures are gradually emerging, although actual levels still generally fall well below those necessary to effect major behavioral change. In January 1991, guidelines for the application of market-based instruments (in conjunction with regulation) in environmental policy were presented at the ministerial meetings of the Environment Committee of the OECD. The announcement was partly motivated by the experience of OECD countries, indicating the feasibility of such instruments. It was also partly due to recognition of increased regulatory costs as environmental controls are further strengthened in industrialized countries.<sup>1/</sup>

Recent developments in the OECD countries<sup>1/</sup> indicate a substantial increase in the use

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1/ J. B. Opschoor and H. B. Vos, The Application of Economic Instruments for Environmental Protection in OECD Member Countries, OECD, Paris 1988.

2/ See OECD, Environmental Policy: How to Apply Economic Instruments, OECD, Paris, 1991.

3/ As summarized in "The Role of Economic Instruments in OECD member



of economic instruments since the 1987 survey, it being estimated that the number has increased by perhaps as much as 50%. The important thing to note is that the instruments that have been introduced most frequently are product charges (otherwise known as presumptive charges), the impact of which in practice has however been difficult to assess, and deposit-refund systems. In the countries for which data are available, the increase in the use of these approaches have been 35% and 100% respectively. Emissions charges do not appear to be used more frequently now than they were in 1987, and there are in fact a limited number of convincing examples of successful application of emission charges. Exceptions are the systems in place in Germany and Netherlands, but these require highly sophisticated monitoring and enforcement capability.

Revenues from such charges and are generally earmarked for environmental expenditure, and their role in creating incentives for improved environmental behavior continues to be small. On the other hand, tax differentiation in the automobile transport sector, in particular, with regard to leaded gasoline, has typically had an overtly environmental objective, and been aimed, with some success, at shifting production and consumption from leaded to unleaded fuel. User charges for waste collection and disposal and for sewerage and sewage treatment are common in OECD countries. Marketable permits have also been introduced in the US.

Specifically, some recent developments in OECD countries include UK's increasing reliance upon environmental taxes and fees rather than command and control. Examples of actual taxes and charges aimed specifically at altering consumer and producer behavior include differential pricing of gasoline, with a higher price applying to gasoline containing lead additives; this has been adopted by France, Germany, Norway, Sweden and UK, while some other countries rely upon regulation of the maximum allowable concentration of lead in gasoline.

Other energy pollution taxes, typically based upon inputs rather than emissions, (i.e. product or presumptive charges), are becoming increasingly advocated in OECD countries. Sweden has been a leader, having, for example, introduced the world's first carbon tax in 1991; in the energy sector the tax is levied on oil, coal, natural gas and liquid petroleum gas; in the transport sector the tax is imposed on gasoline, diesel and on domestic air traffic. A value added tax also applies to all fuels and electricity. Sweden also has a sulfur tax. France has announced plans for nitrogen oxide and sulfur dioxide taxes, and Italy and the Netherlands are considering the introduction of carbon taxes. With regard to air pollution from fuels, France has introduced charges on the sulfur content of fuels, and Finland and Sweden have charges on vehicle fuels. Finland and Germany have lubricant oil charges, while charges for solid waste, especially relevant for products that require recycling or safe disposal, are to be found in an increasing number of countries.

Agriculture input taxes, aimed at reducing chemical pollution, have also been introduced; once more, Sweden has taken the lead. It levies a special charge on

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Countries", paper prepared by OECD Secretariat for the Informal Workshop on the Use of Economic Instruments in Environmental Policies, OECD, Paris, October 1993.

nitrogen and phosphate fertilizers and another on the acreage of land treated with pesticides. Revenues raised by Swedish taxes are used for research in forestry, agriculture and environmental issues, but there is evidence that they have had some effect in reducing fertilizer and pesticide consumption.

Deposit-refund schemes, which are variants of pollution taxes, are now widely employed. When the product is purchased its price contains a tax which is then refundable on proper disposal or recycling of the product. Traditionally used for purely commercial purposes for beverage containers, this approach continues to be used for bottles and aluminum cans, and has been extended to car hulks in Norway, Sweden, and Germany.

Tradeable permits are employed in the US for air pollutants, and were introduced for a limited period for lead in gasoline and for one case of effluent to a watercourse. The permit system introduced under the US Clean Air Act is the most ambitious to date. The amount of trading activity between different polluters has been less than anticipated. This has possibly been due to uncertainties regarding other firms' willingness to trade, the costs of obtaining regulators' permission to trade, uncertainty about just what emissions credits ensue under legislation, and uncertainty due to the prospect of rising permit prices. However, emissions trading either within firms or between firms have apparently resulted in considerable cost savings compared with a command and control approach.

Although the "polluter pays principle" is widely advocated, in fact, in many cases, governments actually provide subsidies to induce industry to co-operate in pollution abatement policy. Various forms of subsidy are to be found, and used either as purely political measures to ensure co-operation, or to alleviate short term transition problems, such as the avoidance of industry closure or unemployment. Subsidies might take the form of low interest loans, tax breaks such as accelerated depreciation, or outright grants. Japan, for example, has a comprehensive program of assisting small businesses to meet increasingly stringent environmental standards. Subsidy programs (as US experience indicates) clearly have major disadvantages; these include large administrative costs of ensuring that subsidies are used for the intended purpose; distortion of investment decisions where some expenditures qualify for subsidy while others do not; and of course the fiscal costs of the program.

Compared with many other industrialized countries, Japan does not make much use of economic instruments explicitly for environmental purposes. However, municipal solid waste management costs are largely financed from general municipal revenues, and in recent years, a trend in the increasing use of the beneficiary pays principle (BPP) is evident for various types of municipal services, including waste collection.

An increasing number of local governments now require citizens to use plastic bags supplied by them specifically for solid waste collection. In some cities, citizens have to buy such bags. In other cities, citizens can get the bags free of charge up to a certain quantity per period, but have to pay for additional bags. There are however always some people who do not follow the system, and use bags which are not provided by local governments. The local governments usually give citizens some time to get accustomed to the new system, and gradually strengthen enforcement by not collecting waste from those who fail to comply with the new system. It is generally

reported that introduction of this system has been successful in most cities.

It is reported that this system has been effective in reducing waste generation. In addition it has brought about some additional revenue for local governments.

In Japan, generators of industrial waste (which is specified in law) are responsible for management of their waste. In many cities, generators can take non-hazardous waste to municipal disposal sites by paying tipping fees. Large scale generators of commercial waste can have their waste collected by municipalities by paying certain fees. The city will collect commercial waste at no charge when the is less than a specified amount.

**Explicit Instruments in Developing Countries.** Although the evidence is somewhat fragmentary, the following review of available material - which does not pretend to be comprehensive, but should at least be illustrative - suggests that there are few cases in which explicit economic instruments are effectively used in developing countries, although they may have existed in a legal sense for some time. This is unsurprising in view of the slow rate of adoption of market based instruments for pollution control in the industrialized world. There are however signs that this situation is changing. Some examples are as follows<sup>4</sup>:

**Emissions Charges.** Effluent charges for water pollution and emission fees for air pollution have been used for a number of years in China. In cases where pollutants discharged fail to meet state or local standards, an additional fee, based upon the amount and concentration of pollutants is levied. Until recently about 75% of the levy was actually returned to the enterprise, the balance being used to finance the regulatory agency. Problems with this system have been due to the fact that the levy has been too low to be effective, enforcement has been inadequate, and there is little incentive to do more than just meet the minimum standard.

In Izmir and Istanbul, Turkey, sewer charges are assessed for industrial discharges into the sewer system, motivating factories to treat industrial effluents. Enterprises face both treatment and disposal costs (sewer charges). Charges are low relative to sewage collection and treatment costs; however, if they were much higher, the problem of illegal disposal would arise - a generic issue in environmental management. (A similar problem has been encountered in Sao Paulo, Brazil).

In Poland, emission fees have been in existence for a number of years, but have not been effective. This has primarily been because enterprises have lacked the incentive to respond efficiently to such charges, because the price mechanism in general did not work; also the level of fees was too low to matter.

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4/ This draws upon Janis D. Bernstein, Alternative Approaches to Pollution Control and Waste Management: Regulatory and Economic Instruments, Urban Management Programme Discussion Paper, World Bank, 1993, which should be consulted for further details on environmental management instruments in both industrial and developing countries.

Some efforts have recently been made to introduce emissions taxes in some of the rapidly industrializing economies of Asia. Taiwan's air pollution prevention fee includes an emission charge on stationary sources of air pollution, while in Korea emission charges for air and water can be levied on enterprises whose emissions fail to meet legislated standards. Charges are however not related to the level of excess emissions nor is there an upper limit on the amount of the levy. As in China, there is therefore no incentive to do other than just avoid violation of the existing standards.

A review of a number of countries in Latin America also shows little evidence of effective use of emission fees, although four states in Brazil are in the process of introducing effluent charges for industrial sewerage based upon pollution content. It is too early to judge the results of these policies. Brazil also has a system of fining violators of emission standards, but the fines are not related to the damage done by actual emissions, and vary more according to frequency of violations rather than to toxicity or intensity. Similarly, in Buenos Aires, Argentina, discharge of waste into the air or water requires an operating certificate, without which fines may be imposed, depending on the level of violation; in practice, fines are so low that there is no incentive to adopt control measures. On the other hand, it has been found that fines set according to the severity of pollution have contributed to the control of surface water pollution in Mexico.<sup>5/</sup>

Monitoring of emissions is of course considerably reduced if emission charges are restricted to a relatively few major dischargers of waste, and particularly if those dischargers are fairly homogeneous. A notable exception to the generally unsatisfactory experience with such charges is provided by Malaysia, which is of general relevance, and not simply for developing countries. In that country, the imposition of effluent charges for the palm oil industry helped reduce total pollutant loadings into water by a factor of almost 300 over the decade beginning in the early 1980's.

**Product (or Presumptive) Charges.** Developing countries typically lack the institutional capability for implementing an environmental management system that relies heavily upon monitoring, inspecting, and regulating the activities of large numbers of polluters or other sources of environmental degradation, and in levying charges or fines. Even in industrialized countries, this is a major problem, and one which applies equally to command and control systems as well as those based upon market based instruments. Administrative realities therefore suggest the need to look beyond explicit, narrowly focussed environmental interventions, particularly where pollution is caused by large numbers of waste dischargers. Blunter instruments, which can be introduced at a higher level in the economic system and which have pervasive impacts, not only upon environment, but on other aspects of development are more likely to be required in developing countries. The most direct approach is to make use of product or presumptive charges, which are based upon a presumed technical relationship between (a) certain inputs such as coal or gasoline which are used in production processes or final consumption, and (b) the environmental damage that is caused by these uses.

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<sup>5/</sup> Quoted in Bernstein, op cit.

It is fairly apparent that developing countries lag behind the OECD countries in making effective use of such charges. Indeed, there remain many cases of where products which can be assumed to have adverse environmental health impacts when used are actually subsidized rather than taxed. Agricultural pesticides and fertilizers are perhaps the clearest example; recent improvements in this regard, assisted by the introduction of integrated pest management systems in countries such as Indonesia are however encouraging. Similarly, the traditional subsidization of low quality (high sulfur content) coal in China is now being phased out. Price differentiation, to reflect variations in environmental damage of otherwise similar products, has also recently been introduced to encourage the substitution of unleaded for leaded gasoline in a number of countries, including Thailand and Taiwan. Incorporation of sewerage pricing into water pricing can be seen as a form of product charge, this being further discussed below, as is the use of gasoline taxes in general. While documentation of the extent to which product charges exist is entirely inadequate, it does appear that many opportunities exist for reforms along the lines that are now being observed in the OECD countries, and that these should merit high priority.

Marketable permits, rare in the industrial countries, are even less apparent in the developing countries. An exception is to be found in the case of Chile, where air pollution rights have been allocated to fixed sources in Santiago. Still in the process of evolution, the system allocates the maximum level of daily emissions, to be reached by the end of 1997. Any emission above the limit and below the emission standard must be compensated by reduction of emissions from some other source. A number of administrative and other issues are still to be resolved, but this system appears to be developing quite well. Singapore has also introduced auctionable permit systems for rights to import and use ozone-depleting substances.

Deposit-Refund Systems. These are now being introduced in a number of non-OECD countries, particularly in the Asia region. For example, Korea and Taiwan have recently introduced deposit-refund systems. These cover items such as food and beverage containers, pesticide containers, lubricant oil, plastics, and certain domestic appliances. However, deposit rates tend to be too low to achieve significant results. Nevertheless the administrative mechanisms are in place and this potentially could be a significant policy instrument.

User Charges for Solid and Hazardous Wastes. Solid waste operations in developing countries are commonly financed by local taxes, user charges, or some combination thereof. Charging for collection on the basis of amount of municipal waste disposed of might yield benefits, but problems of illegal dumping arise, as experience in a number of countries, such as Guatemala and Mexico has shown. A more common approach is to incorporate a fixed charge into the local property tax. Monitoring and enforcement of such a system is in principle more straightforward for larger waste dischargers. Tipping fees for solid waste transfer and disposal are sometimes used; problems of illegal tipping also constrain such a policy. For obvious reasons, discharges of hazardous and toxic wastes are usually subject to regulations, or outright bans, rather than to pricing instruments.

Subsidies. Although not well documented, it is believed that specific subsidies for environmental purposes are widespread; typically these form part of a carrot and stick approach, in which they complement other economic or regulatory instruments. The Asia region again provides good examples. Thus in Taiwan, Thailand, and Indonesia, various forms of subsidy are available for investment in pollution control equipment. Depending on the country, these may take the form of duty free imports, reduction in corporate income taxes, accelerated depreciation, low interest loans, and so on. While often a necessary price to pay to achieve the co-operation of industry in environmental management, subsidy programs are in general undesirable, not simply because they involve a fiscal burden for government, but also because they distort investment decisions. Even more prevalent than specific environmental subsidies are those sectoral subsidies which in effect subsidize environmental degradation, as noted in the next section.

### **Sector Pricing and Macroeconomic Policies and Instruments in Developing Countries**

In addition to explicit environmental policy instruments there is a wide range of economic instruments that, while not designed explicitly for environmental purposes, might have profound consequences for it. There are many examples, primarily in developing countries, where price reform, justified in its own right, will also have benefits in terms of its environmental impact. While not always the case, there are therefore many opportunities for so-called "win-win" policy reforms; no package of environmental tax reform is complete without consideration of such reforms which may in fact exert far greater leverage than the explicit policies themselves. Perhaps the best examples are to be found in pricing of water and energy. In Japan, for example, energy pricing based upon strict economic principles, has led it to be the most energy-efficient of the major industrial countries, and is certainly far ahead of most developing countries, which tend to price energy at less than its economic - and certainly environmental - cost.

Numerous obstacles obviously have to be overcome if policy reform is to be achieved; reduction in long standing subsidy programs or increases in the prices of goods and services supplied by government, or over which government has control, is notoriously difficult. In addition, economic theory itself often suggests that immediate pricing reform in a particular sector should be treated with caution. First, in the short run, demand may be inelastic, requiring considerable increases in prices to bring about change; these might be politically unacceptable, and therefore ultimately counter-productive. Second, reform of pricing or introduction of what may appear to be at first sight a move toward economic efficiency in any particular sector of the economy may in fact be a move away from it if optimal conditions do not prevail elsewhere; i.e. a "second best" policy may be called for. For example, the introduction of economic incentives in a sector - perhaps dominated by parastatals - may in fact be an inferior substitute for command and control, if economic incentives in general do not prevail in that sector. Or a tax on commercial energy may simply result in switching consumption to untaxed fuels, and elimination of agricultural input subsidies may have undesirable environmental and economic side-effects.

A major constraint is therefore imposed by general market imperfections. Bringing about reforms at the sector level may be counter-productive in the absence of major economic policy reforms. This has been demonstrated in countries such as China, Central and Eastern Europe. General market imperfections might reduce the effectiveness of sector-specific policies, in particular when they rely upon market based instruments; their introduction will therefore often best be phased to conform with general trends in market liberalization.

### **Some Implications for Future Environmental Policy**

The foregoing brief review indicates that although little use is currently made of economic instruments as a conscious means of achieving environmental objectives in developing countries, some changes are beginning to take place. With regard to pricing policies in key sectors, beneficial environmental health impacts of policy reform are typically just a by-product of improved policies, which are typically justified in their own right. And the potentially massive leverage exerted by macroeconomic policies on the environment certainly merits improved analysis and action.

The review also suggests that use of economic instruments for environmental purposes is greater in richer than in poorer countries; examples from Africa are conspicuous by their absence. In view of the contribution of economic instruments to efficiency in resource use, the achievement of cost-effective solutions, and generation of public revenues, it can be argued that their value is potentially even greater in developing than in industrialized countries. Indeed, the scope for "win-win" policy reforms is particularly large in developing countries.

While we do not find many examples of success stories in developing countries, trends in the industrialized world do point toward strategies applicable to the poorer countries. A common theme throughout the debate on economic instruments revolves around their administrative feasibility. With regard to explicit policies, the OECD countries are increasingly emphasizing the use of product charges and taxes, which are administratively manageable, and therefore contrast with other economic or regulatory methods which depend upon continuous monitoring of large numbers of waste dischargers. The use of deposit-refund systems also appears to be on the increase in both developing and industrialized countries; administration of such schemes does not seem to have posed major problems.

Administrative simplicity is of particular importance in a developing country context, in which institutional capacity tends to be much less than in the industrialized countries. In light of this, four recommendations regarding the use of economic instruments in developing countries are made. First, given the undoubted merits of emissions taxes, to identify the relatively few, large scale waste dischargers, and apply emissions charges to that group (i.e. the Malaysian palm oil industry example). This should apply to large scale solid waste dischargers, where tipping fees and other charges based upon use, such as collections, can be administered effectively. Second, devote a major effort to the design and implementation of presumptive product charges and taxes - as well as deposit refund schemes - in the developing countries. This would be particularly appropriate for solid waste.

The third recommendation is to give priority to sectoral price reform, consciously aimed at environmental health objectives. As noted, developing countries also tend to lag behind industrialized countries in their sector pricing policies, which commonly encourage excessive resource use. As far as utilities such as water and energy are concerned, the first task is to increase prices so that the utilities can function efficiently, and expand to new areas, ensuring that as necessary tariff structures are adjusted to accommodate low income consumers. This goal may be assisted by privatization, as long as it is subject to public regulation. The next task is to raise prices still further, to reflect costs of resource depletion and of external, or environmental damage. Achievement of this goal is presumably a long way off, but achievement of the first task would be a step in the right direction, and have major environmental health benefits.

While raising prices raises various administrative problems, the structure for recovering costs of water and electricity consumers already exists. Moreover, reduction in subsidies actually involves a dismantling of the administrative structure involved. It is also administratively quite straightforward to introduce complementary blunt instruments, to cover the costs of sewerage, or of the damage done by utilization of high sulfur coal or gasoline. Finally, while macroeconomic policy reforms may be the most powerful of instruments, in view of their country-wide and cross-sectoral impacts, they are also the bluntest of instruments, and impact on all aspects of life. The key administrative issue here is to develop the institutional capacity to understand the various linkages between economic policies and the environment. The fourth recommendation is therefore that environmental agencies develop the ability to be able to influence economic policies, and to take measures in anticipation of their effects.



## **CHAPTER 4    INFORMATION SYSTEM**

The Government should develop an information system to strengthen the administration of solid waste. Information systems are needed for both municipal solid waste and industrial waste, and are discussed in Sections 4.1 and 4.2 respectively.

### **4.1      Municipal Solid Waste Management (MSWM) Information System**

#### **4.1.1    Purpose of MSWM Information System**

At present, the government has little information on the state of art of municipal solid waste management (MSWM) as the government has no monitoring or reporting system. The government needs information on MSWM to:

1. evaluate the current situation of MSWM
2. assess impacts of solid waste on public health and environment
3. formulate policy concerning MSWM
4. regulate SWM operators
5. provide local governments with advice and information on MSWM upon request

In order to regularly obtain MSWM information of reliable quality, the government must establish an information system. The Ministry of Interior is the most suitable ministry to assume this responsibility.

The Ministry of Environment should be responsible for data processing and analysis of collected information concerning waste collection quantity and waste disposal, which affect the environment.

Apart from the information system discussed in this section, it is recommended that the Ministry of Environment should establish a reporting system which requires local governments to report to the Ministry of Environment concerning new disposal sites when they plan to construct them.

By requiring local governments to report on MSWM to the national government, local governments should improve their own information system.

The following sections describe:

1. type of information to be obtained
2. reporting system
3. data base

#### 4.1.2 Type of Information to be Obtained

Information should be collected concerning waste, service coverage, expenditures and personnel. A detailed list of information and collection frequency is shown in the following table.

**Table 4.1-1 Suggested Type and Frequency of Information to Be Obtained**

Type of Information	Frequency
1. Waste generation quantity	every year
2. Waste composition	once in 3 years
3. Collection service coverage 1) coverage in terms of population 2) coverage in terms of waste quantity	Every year
4. Expenditure on SWM services 1) by type of service (collection/transport, street sweeping, disposal) 2) investment and operation/maintenance	Every year
5. Personnel involved by type of work	Every year
6. Estimated remaining life of the existing disposal sites	Every year
7. Level of disposal site	Every year

Truck scales are necessary for local governments to obtain accurate information on waste collection quantity. The Ministry of Environment should encourage local governments to purchase them.

#### 4.1.3 Reporting System

It is advised that the national government should require each local government to prepare and submit a report on MSWM once a year by using a format specified by the government.

A report should be prepared at both urban commune and urban community level.

#### 4.1.4 Data Base and Its Use

The Ministry of Environment should compile an annual report based on information provided by local governments. The annual report should contain aggregate information on waste quantity, service coverage, costs, and personnel. The report should also include the number of communes which have controlled landfill disposal sites, and an analysis of information obtained.

It is recommended that the Ministry of Environment should prepare a report once every five years which analyzes recent trends and changes.

Both reports should be made publicly available. MSWM data obtained will be useful for local governments to evaluate themselves in comparison with other local governments.

## **4.2 Industrial and Hazardous Waste**

### **4.2.1 Information on Administration of Industrial Waste Management**

#### **1) Need for Administration and Information Development for Industrial Waste Management**

Serious damage caused by solid waste is often due to inadequate disposal of industrial waste. Industrial waste contains more hazardous substances than municipal waste does. From the viewpoint of environmental pollution control, much stricter regulations should be imposed on industrial waste discharges than on municipal waste.

Extraordinarily strict legal regulations should be placed on hazardous waste whose toxic contents are harmful and dangerous to public health and the biosphere. As already mentioned in Chapter 1, waste that requires such strict regulation is named special waste.

The role of the national government with regard to management of toxic industrial and hazardous waste is to build a regulatory framework to require business establishments, which are responsible for waste management. Business establishments must respect disposal standards in accordance with waste types and conduct intermediate treatment as necessary to satisfy the standards. Disposal and intermediate treatment facilities must satisfy legal requirements.

Administration of industrial waste management is required to authorize the location of treatment and disposal facilities, to monitor disposal activities and disposal facility operations, to issue notices to improve the activities and facilities, and to instruct industrial waste managers to fulfill disposal standards by checking completion reports of activities and operations.

In order to implement this administration, legal authority and institutions must be established. More importantly at present, information on industrial waste should be databased. It is obvious that a considerable amount of industrial waste is generated in Morocco, but details are lacking. So the government cannot adequately plan the handling of industrial waste.

## 2) Necessary Administrative Information on Industrial Waste Management

Information on industrial waste administration is necessary for controlling industrial waste management. In Agenda 21, it is recommended that inventories of hazardous waste should be developed. The OECD countries are proposing "Pollutant Release and Transfer Register (PRTR)." The PRTR, however, is not intended for regulatory purposes. It includes information on solid waste and the amount of hazardous materials used, and intended to reduce the release of chemical materials into environment.

Inventory information is necessary for industrial administration and to allow administrative officials to be able to plan. These inventories should include information on waste and on treatment facilities. Items for each type of information are listed as follows. Although all the information listed here is desirable, essential information is marked with "I" and less essential information with "II".

### a) Information on Industrial Waste

- |  |    |
|--|----|
| 1. Types of product  | I  |
| 2. Categories of production process (whether or not production is done at assembly factories.) | I  |
| 3. Hazardous waste used in production process  | I  |
| 4. Generation points for industrial waste  | II |
| 5. Types of industrial waste   | I  |
| 6. Contents of industrial waste  | II |
| 7. Generation of industrial waste by type  | I  |
| 8. Methods of intermediate treatment   | I  |
| 9. Amount and contents of treated waste (final waste)  | II |
| 10. Methods of disposal  | I  |
| 11. Location of disposal   | I  |
| 12. Name of private disposal contractors   | I  |

### b) Information on Treatment and Disposal Facilities

- |  |    |
|--|----|
| 13. Storage and containers of waste, and facilities  | II |
| 14. Types of treatment facilities                    | I  |
| 15. Specification of treatment facilities            | II |
| 16. Location of treatment facilities                 | I  |
| 17. Operation and control of treatment facilities    | II |
| 18. Environmental control of treatment facilities    | II |
| 19. Annual amount of waste treated                   | I  |
| 20. Operating hours and days of facilities           | II |
| 21. Components of facilities at disposal site        | I  |
| 22. Annual amount of waste disposal by type of waste | I  |

It is very important to gather information on types of products and categories of production processes. Based on these two types of information, it is possible for process engineers to estimate what materials are used for production and the types of waste generated. It is also important to specify the types of waste. Specification of special waste is based on the types and property of chemical materials; therefore, based

on these two specifications, the types of waste will be numerous. Preparing these data will be a hard task. It is feasible for the government to define types of waste primarily according to the property of waste. It is practical to specify materials that may cause environmental pollution and add waste that contains those materials to the types of waste. (See Chapter 5 and 3 for more details.)

It is also important to have information on methods of treatment and the amount of waste treated. These two sets of information will help to estimate most components of SWM as currently carried out.

In order to make the above assumptions, the government must accumulate basic information, including the following.

1. Technical information on production processes and waste generation
2. Information on toxicity of chemical materials
3. Technical information on treatment
4. Technical information on treatment operations

### **3) Methods to Check SWM by Using the Above Information**

It is impossible to judge if disposal standards are respected or not just on the basis of the above information. In order to make this judgment, on-site inspection must be conducted without giving prior notice. (See 3 for more details.)

1. On-site inspection of operating conditions at disposal and treatment facilities
2. Confirmation by matching operation records and reported data
3. Analysis of waste samples

### **4) Methods of Information Gathering**

Inventories should be based on reported information. It is necessary to define obligatory SWM reports in specified factories which use hazardous materials related to generation of special waste or which use specific processes. Before SWM reporting becomes obligatory, the government may have to employ a questionnaire survey or interview the factories.

It is necessary to gather technical information primarily by conducting on-site inspection in representative factories. Information can also be obtained from technical reports in foreign countries. This method is generally a hard task because the information is not sorted deliberately for administrative use. To make a shortcut, technical assistance from foreign countries should be sought.

Using a data base on toxicity of chemical materials is a convenient method. Common data and information can be obtained from the IRS data base of EPA (US Environment Protection Agency). Chemical material information is available in the form of floppy disks and CD-ROM. Since these media are updated every year, maintenance costs will be relatively high.

## 4.2.2 Inventory Information Management for Hazardous Waste

### 1) Policies for Developing Inventories

#### a. Objectives

An inventory of hazardous waste should be developed as a data base for preventing damage to the environment and public health by assisting in proper management of hazardous waste. Another objective of the inventory is to indirectly improve abilities of SWM managers in business establishments through creating an inventory report. It should be noted that establishments mainly responsible for SWM are businesses, and improvement of their capacity in this area is an essential goal.

#### b. Policies

Policies for developing inventories include the following.

- Inventories should be easy to use as an administrative tool.
- Inventories should not require much investment.
- Updating data, maintenance, and management should be easy.
- The inventory system should be expandable.

### 2) Business Establishments to offer Inventory Information

Business establishments from which inventory information will be gathered are specified factories where special waste may be generated. Procedures determined in law should be followed to specify the factories. (See 3 for more details.)

### 3) Composition of an Information System

A basic information system will have the following structure.

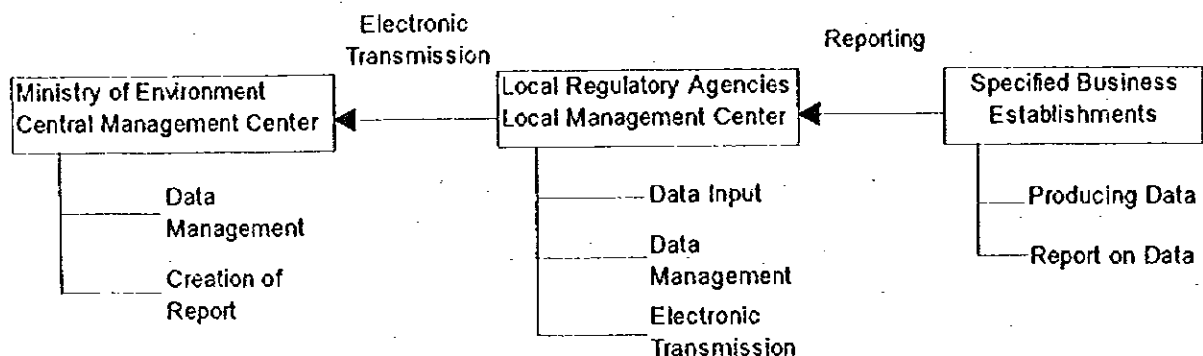


Figure 4.2-1 Structure of A Basic Information System

A considerable amount of data can be handled with one personal computer. Updating data will require larger computer memory. It is, however, not recommended that advanced computer hardware be used for this purpose.

Custom-made software will create problems when it becomes outdated. Software available in the market is recommended, but additional software will be indispensable for sorting data and creating tables and figures for the report.

#### **4) Information Gathering**

For information gathering, it is recommended that forms be prepared and specified business establishments instructed to fill in the data. Introductory meetings should be held for personnel who will fill in the forms for the first time.

From the second survey, forms can be distributed to the establishments periodically, and it is recommended that they report to local regulatory agencies.

#### **5) Data Processing and Utilization of Data**

Gathered data will undergo the following two processes:

1. Checking if treatment is properly done in accordance with the types of waste.
2. Obtaining the total amount of waste by type, and the total amount of waste treated properly or improperly.

The above information should be gathered into one as an annual report.

Data obtained can be used to separate business establishments into two categories; the one cooperative in information gathering and the other uncooperative. This separation can be done based on the number of items filled in and comments made in detail. Establishments that fill in few items and make insufficient comments can be regarded to have a poor level of management.

These data should show, by region, the rate of forms returned, and the number of establishments which provided insufficient comments, and these two indicators can be used for administrative purposes.

Comparing factories whose products and production processes are similar will help confirming if the reported data are precise.

### **4.2.3 Development of Technical Information on Hazardous Waste Treatment**

#### **1) Development of Information System**

Much information on hazardous waste has been published. The textbook that is most commonly read is "Hazardous Waste Management" (Michael D. Lagerga, Environmental Resources Management Group, McGraw-Hill). This recently published book is very comprehensive but covers very advanced technology as well. The most practical is "World Bank Technical Paper Number 93: The Safe Disposal of Hazardous Wastes, The Special Needs and Problems of Developing Countries." published in World Bank Technical Papers Series, in November 1993. This technical paper is very rich in practical information and seems to be the best of its kind.

Literature on information systems is abundant, but it is often theoretical rather than practical. Engineers should observe how various types of waste are treated in treatment facilities and confirm the theories of SWM.

Since it is difficult to domestically offer such opportunities in Morocco, technical assistance from foreign countries in providing training courses should be utilized where possible.

Seminars should be held jointly with manufacturers of treatment equipment since they have accumulated practical experience. Manufacturers will provide new and valuable information in order to help expand their markets.

## **2) Development of Technical Manuals**

Information gathered is meaningless if not utilized. When persons who gather information do not make it public, it is not being used effectively.

It is indispensable to implement information sharing and exchange among officials of local regulatory agencies so that they can pass on such information to local business establishments. Developing technological manuals is one way to realize this. It is useful to include information obtained through business experience in the manuals. It is recommended that officials of local regulatory agencies should be involved in the process of creating the manuals.



## **CHAPTER 5 TECHNICAL STANDARDS**

### **5.1 Introduction**

#### **1) Need for Administrative Objectives**

To strengthen the national administration for SWM requires strengthening of the whole system. The system is a set of administrative means by which central and local governments administer responsible persons or parties to accomplish a proper level of SWM. Strengthened administration includes objectives, leverage, and institutions for legislative enforcement.

Administrative goals for SWM are to improve public welfare and to maintain public health and environmental resources by preventing environmental pollution. These are, however, only principles. There must be ways to confirm if the principles are respected. Objectives must be clarified in detail to confirm this.

In this context, there are two types of goal. One sets out the goals that individuals (SWM managers) are required to achieve. The other is a target goal that sets the number of SWM managers who should achieve the first goal in a given time. This chapter deals with the first of these, which includes technical standards. Without these standards, it is impossible to judge if SWM is conducted properly or not. Preparing the criteria to make this judgment a very important role of the national government.

#### **2) Setting up Technical Guidelines**

Technical standards for SWM have not yet been established in Morocco. In order to bring standards into force, laws must be linked with them. Laws should clearly state that violation of the standards may result in penalties. Therefore, the standards must be issued when SWM laws are established.

Waste is of course already being generated and disposed of while the laws under preparation. Therefore, the standards should be prepared as soon as possible, even before the laws are prepared. While the standards are not yet linked with laws, the standards still can be regarded as guidelines.

Technical guidelines present required standards for SWM and should be prepared based on discussions about sanitation, prevention of damage to public health, and other damage caused by environmental pollution. The guidelines, however, should be upgraded. They should be prepared with balanced consideration of the feasibility or technological aspects and social acceptability of costs, sacrifice, and risks.

#### **3) Objectives of this Chapter**

This chapter sets out necessary technological standards for SWM and the contents of the standards. In other words, it is intended to offer a framework for technical standards for SWM. The task of adding details to the framework remains with the national government of Morocco.

Technical standards to be developed for municipal, industrial/hazardous, and infectious waste are presented in the following paragraphs. Collection of packaging waste and prevention of waste generation are not covered in this chapter. Proper treatment of the above three types of waste is a matter of urgency in Morocco.

## **5.2 Technical Standards that should be Established by the National Government**

### **1) Various Types of Technical Standard**

Solid waste must be managed properly in order to avoid damage to sanitary and healthy living and the environment. Specific criteria should be used to judge SWM performance.

Criteria and standards for judging whether SWM is conducted in a proper or unsatisfactory way will include the following technical standards.

1. Criteria for defining special waste
2. Standards for disposal and collection of waste
3. Technical standards for treatment facilities and equipment
4. Standards for operation of treatment facilities
5. Standards concerning environment

#### **a. Criteria for Defining Special Waste**

Proper SWM starts with separation of specific waste from other waste.

Definition of special waste should be made by decree. Since definitions in decrees will not generally contain great detail, ministerial ordinances should convey the details.

It is a technical issue to create judgment criteria for special waste based on specific characteristics and its source of generation since some waste is difficult to define as special waste. It is primarily a technical issue to prepare judgment criteria for industrial/hazardous waste. It is a difficult task to set these criteria since various factors must be taken into consideration, such as hazardous waste contained in municipal solid waste and damage to public health.

#### **b. Standards for Disposal and Collection**

Standards for disposal and collection define how the waste must be disposed of in order to maintain public sanitation and minimize damage to the environment. It will be necessary to set up standards for methods to be applied for disposal and collection.

Standards for disposal should contain restrictions; that is, only authorized disposal sites can accept waste, and disposal sites equipped only with ordinary facilities are not allowed to accept special waste. The standards should rule out liquid waste (acid, alkali, and waste oil) from disposal sites.

Standards for methods to neutralize specific materials are necessary. Such standards are "disposal standards."

It is necessary to ensure by the use of standards that infectious waste and liquid waste is transported in specific containers, and that special waste is transported separately from other waste. Such standards are "collection standards".

As already mentioned, judgment criteria for landfills that can accept any waste except special waste will be necessary. Japanese criteria employ a method using concentration of dissolved matter in waste. Density criteria are ten times stricter than those for drinking water, taking the risk of drinking groundwater polluted by leachate into consideration. German criteria include the content of hazardous materials. Both criteria are established, taking risks to public health, in which environmental pollution by landfilling may result, into consideration

#### **c. Technical Standards for Facilities and Equipment**

It is necessary to set up standards for facilities and equipment to judge if proper treatment is conducted or not. Such standards are generally linked with requirements for location of treatment facilities. The standard should be set up for the following facilities and equipment.

1. Landfill facility
2. Treatment facility for special waste
3. Composting plants
4. Storing containers and facility of special waste
5. Transporting containers and collection equipment of special waste, etc.

The standards should be set legally with regard to general principles, and details should be fixed as the government accumulates experience with this matter.

#### **d. Technical Standards for Operation of Facilities**

Treatment facilities must be operated properly. Even fully equipped facilities will not perform adequately when their operation is poor. It is especially necessary to properly operate landfill facilities and composting plants. At landfill sites, daily management is a key for preventing bad smells, smoke, and insects.

At treatment facilities for neutralizing special waste, it is an important duty of the operational management to confirm that waste is completely neutralized. Confirming this is very difficult. Therefore, in a practical sense, the confirmation will be made indirectly by checking indicators for operation control.

There are virtually no ways to confirm complete neutralization of infectious waste. Therefore, judgment criteria for a proper neutralization processes should be checked based on operating conditions that secure complete neutralization. The criteria should be based upon technical analysis.

#### **e. Environmental Standards related to SWM**

Environmental standards should be defined within the legal framework for preventing environmental pollution. Environmental standards related to SWM should include the following.

1. Environmental standards for emission gas from treatment facilities
2. Environmental standards for waste effluent from treatment facilities
3. Environmental standards for noise, smell, etc. from treatment facilities

#### **2) Linkage between Legislation and Setting of Technical Standards**

Standards mentioned so far should be enacted in decree or ministerial ordinance, or in applied guidelines, which may be classified as a ministerial circular. Standards can be presented in the form of manuals, which may or may not be legally enforceable. It is at the decree level where important items such as legal responsibility for SWM and its costs should be defined. Basic criteria for separating special waste and standards for its treatment should also be defined by decree. It will be more effective to have applied guidelines when enforcing the laws. Details should be developed in ministerial ordinance.

In order to instruct SWM managers before SWM related laws are established, manuals that include draft guidelines for various standards should be prepared. The ministry should distribute the manuals as circular notes to concerned parties.

#### **3) How to Formulate Standards**

It will be useful to research successful cases in foreign countries before preparing the standards. It will not be a hard task to draft the standards based on such research. The most serious obstacle will be to implement these standards.

It is not recommended that all the standards should be established at once. The most urgent problems should be addressed first. For example, it is practical to start preparing standards for landfill sites and hazardous and infectious waste.

It is more effective to make these standards public as technical guidelines for SWM before laws bring the standards into force. To create the guidelines, it is recommended that a committee be set up consisting of specialists, ministries, and agencies to prepare the technical standards.

It will be useful to elaborate the contents of standards for future use based on the outcome of activities such as specifying pilot facilities to be examined, implementing necessary research, and launching pilot projects that meet the draft standards.

## **5.3 Technical Standards for Municipal Solid Waste Disposal**

### **5.3.1 Disposal and Collection Standards**

#### **1) Disposal Standards**

The national government should determine disposal standards taking into consideration the environmental protection measures to decrease the impacts on the surroundings and living environment.

Disposal standards prepared by the national government should include the following provisions:

- Wastes must be disposed of only in sites specified as disposal sites and having the facilities that meet the technical standards for disposal.
- Only municipal waste shall be discharged at the disposal site.

#### **2) Collection and Transport Standards**

Collection and transport operations should be implemented in such a manner so as not to have a negative impact on the surrounding environment.

### **5.3.2 Technical Standards Concerning Disposal, Collection and Transport and Intermediate Treatment Facilities**

#### **1) Disposal Facilities**

Technical standards for disposal facilities and its siting conditions should include the following;

##### **a. Siting Standards**

- Proper siting of disposal sites is required to prevent adverse environmental effects to surrounding areas. The thickness of the impermeable layer, groundwater level, distance from drinking water sources, etc. must be taken into consideration. For details of these conditions, refer to Chapter 2 , Section 2. 1, of the current Part.

##### **b. Basic Standards**

- Disposal sites shall be operated in such a way that prevents wastes from scattering or flowing out, by using measures such as enclosing fences, retaining walls, dams and other facilities.
- Disposal sites shall be constructed so as to preserve the living environment.
- Erection of enclosures around disposal sites, to certify the siting of the disposal site and control site access.
- Erection of notice boards indicating that subject sites are waste disposal sites.
- Erection of gates and on-site offices, to control incoming wastes/vehicles, landfill operation, site facilities etc.

- Closing of sites shall be made taking necessary measures for preventing scattering and outflow of wastes, contamination by leachate and occurrence of fire.

**c. Specific Standards Subject to Location Conditions**

- Land-slide prevention measures shall be taken.
- Subsidence prevention measures shall be taken.
- Necessary measures shall be taken to prevent leachate from disposal sites from polluting public water bodies and groundwater.
- Necessary measures for preventing inflow of rainwater to disposal sites shall be taken.

**2) Collection and Transport Facilities**

Technical standards for waste collection and transport service should include the following;

- Collection vehicles and haulage containers shall have the proper structure, to prevent waste scattering, or overflowing and creating an offensive odor
- Loading of collection trucks, in particular the secondary collection vehicles from the transfer stations shall not exceed design standards of the roads they use
- Collection vehicles shall be properly maintained and undergo daily, and periodic inspection checks
- Transfer stations shall be properly located from an environmental viewpoint
- Fences shall be erected around the transfer station, to identify the site and to control access

**3) Intermediate Treatment Facilities**

Technical standards for intermediate treatment facilities should include the following;

- Intermediate treatment facilities shall be properly located, from the view point of environmental protection.
- Adoption of standards for waste treatment at the intermediate treatment facilities.

**5.3.3 Technical Standards Concerning Operation of Facilities**

**1) Disposal**

At the disposal site, daily landfill control is indispensable to prevent adverse environmental effects, such as diffusion of offensive odor, breeding of vectors and insects, self-burning of the wastes etc. Periodic cover soil will overcome these negative environmental effects. Meanwhile, compaction of wastes is necessary for lengthening the life expectancy of disposal site, and it is also helpful to shorten the settlement period after landfill completion. Proper landfill equipment is required for these landfill operations.

The technical standards or norms should also stipulate that truck scales should be introduced at medium and large scale disposal sites. Installation of a truck scale is the first and basic element of solid waste control, by checking the amount of incoming wastes, number of incoming vehicles/trucks, working time of vehicles, preparation of future SWM plans, etc.

Technical standards for the disposal operation should include the following;

- Necessary measures shall be taken to prevent offensive odor, noise and vibration caused by landfill siting and/or operation.
- Necessary measures shall be taken to prevent scattering and outflowing of the waste.
- Necessary measures shall be taken for preventing occurrence of fire (self-burning of the waste).
- Necessary measures shall be taken to prevent the growth of rats, mosquitoes, flies or other harmful insects at disposal site
- Thickness of each waste layer should be less than three (3) meters, and the top of each waste layer should be covered by soil. This item is not necessary to apply to the small scale disposal site, where the area is less than one hectare or landfill capacity is less than 50,000 m<sup>3</sup>.
- When the disposal site is closed, the surface of the wastes shall be covered by 1 m thickness of covering soil.

## **2) Collection and Transport**

The technical standards set out by the national government should spell out the obligations of the Urban Communes concerning the collection and transport service as follows;

- All citizens living in the commune are entitled to receive collection service, but with lesser frequency for those living on the urban fringe or in low density areas, at a minimum of 1 day per week
- Locations of communal containers and collection points shall be selected within reasonable walking distances of 50 to 100 meters in principle, but may reach 200 meters in low density areas
- Discharge regulations shall be clearly communicated to the citizens, and shall include (i) proper discharge time (e.g. from 06:00 to 08:30), taking into consideration collection vehicle arrival times and to avoid keeping waste on the streets for a long time, and (ii) discharging waste packed in a suitable container (e.g. plastic bags or about 40 liters plastic container) to allow easy handling by the collection crews
- Collection vehicles shall not be allowed to idle on the collection route while the collection crews engage in other activities such as recoverable materials separation as this may cause emission of bad odor and inefficient vehicle utilization
- Collection crews shall be equipped with appropriate tools and proper clothing to handle the waste
- Waste shall not be allowed to remain at the transfer station for over 1 day

### **3) Intermediate Treatment**

The national government should determine the operational standards for intermediate treatment facilities taking into consideration the environmental impacts on the surrounding areas.

Proper operation of intermediate treatment facilities is very important. Even if the facilities are technically sufficient, the expected results may not be realized if operation is below standard. In some cases the produced product may even turn out to be harmful, thereby defeating the purpose of constructing the facility.

In the existing compost plants the proper operation should be evaluated through periodic sampling of the produced compost and analyzing its quality as to color, smell, humidity, content ratio of inorganic matters etc., and also by checking odor inside the plant, etc.

Technical standards for the operation of intermediate treatment facilities prepared by the national government should include the following;

- Adoption of sufficient countermeasures to avoid waste scattering and outflowing at the intermediate treatment facilities.
- Adoption of necessary countermeasures to protect the living environment against offensive odor, noise and vibration caused by its operation.

#### **5.3.4 Environmental Aspects related to Disposal Facilities**

Concern for the environment is necessary for waste disposal, especially with regard to problems such as scattering of solid waste, diffusion of offensive odor, breeding of vectors and insects, self-burning of the waste, and contamination of public water bodies and drinking water sources by leachate. Standards for introduction of daily soil cover, and liner, leachate collection and treatment facilities can be the proper countermeasures to eliminate these environmental effects. In addition, proper siting conditions for the disposal site can sometimes overcome these environmental affects.

As for collection and haulage, the negative environmental effects may be produced at the collection points, the routes the collection vehicle passes through, and at the transfer stations. In order to avoid this effect the national standards shall stipulate that;

- All municipal wastes discharged at collection points must be removed at the designated collection time and no wastes should remain at the points
- Collection vehicles shall be covered to avoid waste scattering and overflowing during collection and transport operation
- Necessary countermeasures shall be adopted to protect the living environment surrounding the transfer station against offensive odor, noise and vibration caused by siting and operation of the station by erecting a fence, maintaining a guard and not allowing waste to remain in the station for more than four (4) hours

As for composting, diffusion of offensive odor is one of the major issues of concern for the environment. Necessary countermeasures defined in the technical standards, such as proper operation, selection of siting, etc. shall be taken into consideration.



## 5.4 Technical Standards for Industrial and Hazardous Solid Waste Disposal

### 5.4.1 Judgment Criteria for Hazardous Waste

The importance of adequate treatment and disposal of hazardous wastes generated from industrial processes was learned the hard way in developed countries (the examples of Love Canal and Minamata). Accordingly developed countries have made much effort in defining and classifying hazardous wastes based on their industries and markets. Developing countries should form their own judgment criteria based on a detailed study of the industries and potentially hazardous wastes produced in the country, by regions and quantities. This section provides a general introduction on "how to define hazardous wastes" and more detailed information on this subject and the classification used in other countries are discussed in 3 of this report.

Wastes that may be characterized as toxic, carcinogenic, ignitable, corrosive, reactive, or infectious may have a negative impact on humans and/or the environment if they are handled inadequately, and are therefore considered as potential hazardous wastes. In developed countries two methods are adopted for defining hazardous wastes, separately or in combination; (1) analysis of hazardous characteristics, and (2) use of lists. The former requires technical abilities in testing and availability of sometimes sophisticated equipment and therefore in the initial stage it may be wiser for developing countries to adopt the latter. Table 5.4-1 briefly describes both methods.

**Table 5.4-1 Methods for the Definition of Hazardous Wastes**

Methods	Analysis of hazardous characteristics	Use of lists
Direct/Indirect	Direct definition	Indirect definition
Tools of definition and their contents	Characteristics to be analyzed: <ul style="list-style-type: none"><li>• Ignitability</li><li>• Corrosivity</li><li>• Reactivity</li><li>• Toxicity</li><li>• Others</li></ul>	Lists to be used: <ul style="list-style-type: none"><li>• List of hazardous elements and chemical compounds with their maximum permissible levels, content in wastes and/or concentration in leachate (such as mercury, lead, cadmium, arsenic elements, and PCB, alkyl mercury, cyanides, organic phosphorus compounds)</li><li>• List of industries and/or processes which have high possibility of producing wastes which contain elements of chemical compounds in the above list (industries such as primary metal industry, organic chemicals, pesticides, explosives, electroplating, inorganic chemicals, etc.)</li></ul>
Conditions	This method requires: <ul style="list-style-type: none"><li>• Standard analytical procedures</li><li>• Sufficient laboratory capacity</li></ul>	This method requires: <ul style="list-style-type: none"><li>• An updated inventory of industries classified according to the types of industries and processes</li></ul>

Source: "Improvement of Solid Waste Management in Developing Countries", 1990, JICA

It is therefore necessary for Morocco to develop its lists based on a detailed study of its industries, and setting priorities for treatment and disposal of certain types of hazardous wastes taking into consideration the availability of relevant facilities and the degree of hazard.

## **5.4.2 Disposal and Collection Standards**

### **1) Disposal Standards**

The national government should determine disposal standards taking into consideration the safe disposal of industrial and hazardous wastes, and the environmental protection measures to decrease the impacts on the surroundings and living environment.

Generally, from the viewpoint of disposal, industrial waste (including hazardous waste) can be divided into three categories, as follows;

- Wastes which can be disposed of directly at the disposal site (most types of non-hazardous industrial wastes are included in this category);
- Wastes which can be disposed of at the disposal site after necessary treatment, such as harmlessness, stabilization and reduction (most types of hazardous wastes are included in this category); and
- Wastes which are prohibited at the disposal site (some types of hazardous wastes, such as waste acid, waste alkali, etc.).

Hazardous waste requires special treatment for harmlessness and stabilization before disposal at the disposal site.

#### **a. Industrial Waste**

Disposal standards for industrial waste prepared by the national government should include the following;

- Industrial wastes shall be disposed of only in sites specified as disposal sites and having the facilities that meet the technical standards for industrial waste disposal.
- Necessary measures shall be taken so as not to receive the wastes which are prohibited to be disposed of at industrial waste disposal, such as some types of hazardous waste.

#### **b. Hazardous Waste**

Disposal standards for hazardous waste prepared by the national government should include the following;

- Hazardous wastes shall be disposed of only in specified sites and having facilities that meet the technical standards for hazardous waste disposal.
- Necessary measures shall be taken so as not to discharge the wastes which are prohibited to be discharged at any kind of disposal site.
- No mixing of hazardous wastes with other waste types.

### **2) Collection and Transport**

The national government shall establish standards for the safe collection and transport

of industrial and hazardous wastes from the generation points to the intermediate treatment facilities and disposal sites.

Due to the hazardous properties of some types of industrial waste, they should be transported with no leaking or scattering, and the trucks should have proper cautionary labels.

### **3) Storage**

It may be necessary to store hazardous wastes prior to their transport at the generation point or at the intermediate treatment facility. Under such circumstances the waste should be stored in properly sealed containers and kept in a suitable place with controlled access.

## **5.4.3 Technical Standards for Landfill and Intermediate Treatment Facilities and Other Equipment**

### **1) Disposal Facilities**

Basically, facility standards for industrial waste disposal shall be the same as those for municipal waste disposal Type -4 (sanitary landfill -B). For the outline of this disposal system, see Chapter 3 of Part B of Book 2-Part 2. Hazardous waste disposal should be completely isolated from its surroundings. Therefore, special facility standards must be established for hazardous waste disposal. For detailed information on hazardous waste disposal, see 3 of this report.

Technical standards for disposal facilities and siting conditions for industrial and hazardous waste prepared by the national government should include the following.

#### **a. Industrial Waste**

##### **(1) Siting Standards**

- Proper siting of disposal sites is required to prevent the environmental effects to surrounding areas. The thickness of the impermeable layer, groundwater level, and distance from drinking water source, etc. should be taken into consideration.

##### **(2) Basic Standards**

- Disposal sites shall be operated in such a way as to prevent wastes from scattering or flowing out, such as enclosing fences, retaining walls, dams and other facilities.
- Disposal sites shall be constructed so as to preserve the living environment.
- Erection of enclosures around the disposal sites, to certify the siting of the disposal site and control site access.
- Erection of notice boards indicating that the subject sites are industrial waste disposal sites.
- Erection of gates and on-site offices, to control incoming wastes/vehicles, landfill operation, and site facilities.

- Necessary measures shall be taken to prevent leachate from polluting public water bodies and groundwater.
- Conduits and other leachate collection facilities to gather leachate effectively.
- Leachate treatment facilities to conform to the quality of discharged water to standards adopted in Morocco for water pollution control.
- Necessary measures for preventing inflow of rainwater to disposal sites shall be taken.
- Closing of sites shall be made taking necessary measures for preventing scattering and outflow of wastes, contamination by leachate and occurrence of fire.

### **(3) Specific Standards subject to Location Conditions**

- Land-slide prevention measures shall be taken.
- Subsidence prevention measures shall be taken.

#### **b. Hazardous Waste**

Obviously the standards for disposal facilities of the hazardous waste should be more detailed due to the nature of the waste, and in addition to the above should include the following:

- The disposal site must be isolated from public water bodies and groundwater.
- External periphery separation facilities, such as a double liner, concrete base and wall etc., shall be installed at the disposal site to prevent outflowing of toxic substances and to prevent the contamination of public water bodies and groundwater by leachate which contains toxic substances.
- Internal facilities shall be installed to separate disposal areas for each type of hazardous waste may be required.

### **2) Intermediate Treatment Facilities**

Facility standards for intermediate treatment shall be established for each type of industrial and hazardous waste, taking into consideration harmlessness, stabilization, reduction and recycling. Generally, the following treatment systems are adopted for each type of waste, some of which will be explained in 3.

- Waste acid: alkali neutralization, incineration (in liquid), pyrolysis etc.
- Waste alkali: acid neutralization, incineration (in liquid), hydrolysis etc.
- Waste oil: incineration, clarification and recovery etc.
- Waste liquid: dehydration, solidification etc.
- Sludge: incineration, melting furnace, digestion, dehydration etc.
- Waste plastics: incineration, melting furnace etc.

Technical standards for intermediate treatment facilities should include the following;

- Intermediate treatment facilities shall be properly located, from the viewpoint of environmental protection measures.

- Adoption of standards for waste treatment systems for each type of waste at the intermediate treatment facilities.

### **3) Collection and Transport**

#### **a. Industrial Waste**

Standards for collection and transport of the industrial waste should be as follows;

- Any facilities used for the operation should not pose any risks or damages to the surrounding living environment
- Any equipment used in the operation should be of stable structure to avoid any leaking or scattering of the wastes
- Transfer station sites should be selected so as to prevent any damage to the surrounding environment

#### **b. Hazardous Waste**

Obviously the standards for facilities and equipment used in the collection and transport of the hazardous waste should be more detailed due to the nature of the waste collected and transported, and in addition to the above should include as follows;

- Collection trucks should be properly designed to completely discharge their hauled wastes
- In case of using a transfer station, the station site should be selected so as to prevent any damage to the surrounding environment and the site area should be of sufficient size to allow for the separate storage and handling of the different waste types

### **5.4.4 Technical Standards concerning Operating Facilities and Equipment**

#### **1) Disposal**

At the disposal site for industrial waste and hazardous waste, daily landfill control is indispensable for preventing environmental effects, such as diffusion of offensive odor, breeding of vectors and insects, outflowing of toxic substances, contamination to public water bodies and groundwater etc.

Technical standards for the disposal operation prepared by the national government should include the following;

#### **a. Industrial Waste**

- Necessary measures shall be taken to prevent offensive odor, noise and vibration caused by landfill siting and/or operation.
- Necessary measures shall be taken to prevent scattering and outflowing of the waste.
- Necessary measures shall be taken for preventing occurrence of fire, and sites shall be equipped with fire fighting facilities, including fire extinguishers.
- Necessary measures shall be taken to prevent the growth of rats, mosquitoes, flies or

other harmful insects at disposal sites.

- Retaining walls, dams, and other facilities shall be periodically inspected, and necessary measures shall be taken if there is a fear of occurrence of damage to them
- Water leakage prevention measures shall be periodically inspected, and necessary measures shall be taken if there is a fear of occurrence of reduction of water interrupting effects
- Monitoring of the quality of the groundwater in the peripheral area shall be carried out
- Operation and maintenance of leachate treatment facilities shall be carried out so as to satisfy the effluent standards with periodical inspection of the function of facilities and periodical examinations of the effluent quality.
- Ventilating equipment shall be provided for discharging gases
- When the disposal site is closed, the surface of the wastes shall be covered by 1 m thickness of covering soil, to prevent scattering and outflowing of wastes, reducing the amount of leachate, occurrence of fire.

#### **b. Hazardous Waste**

Obviously the standards for operation of hazardous waste disposal facilities should be more detailed due to the nature of the waste, and in addition to the above should include as follows;

- Provide countermeasures against health risks to humans or the surrounding living environment during landfill operation
- No mixing of hazardous wastes with other waste types
- Clearly inform disposal operators of the types of hazardous waste discharged and the dangers involved in mishandling of the waste
- Stagnant water in the disposal site shall be discharged before commencement of landfill
- External periphery separating facilities and internal separating facilities shall be periodically inspected, and necessary measures shall be taken if there is a fear of occurrence of damage and outflow of leachate
- Disposal site shall be closed with the covering which satisfies the requirements equivalent to those for external periphery separating facilities on completion of landfill

#### **2) Intermediate Treatment Facilities**

The national government should determine the operational standards on intermediate treatment facilities for industrial and hazardous waste taking into consideration the environmental impacts on the surroundings and living environment.

Technical standards on the operation of intermediate treatment facilities prepared by the national government should include the following;

- Adoption of sufficient countermeasures to avoid waste scattering and outflowing at the intermediate treatment facilities.
- Adoption of necessary countermeasures to protect the living environment against offensive odor, noise and vibration caused by its operation.
- Provide countermeasures against health risks to humans or the surrounding living environment during operation
- No mixing of hazardous wastes with other waste types
- Clearly inform plant operators of the types of hazardous waste treated and the dangers involved in mishandling of the waste
- Notice boards should be placed to clearly indicate the nature of the plant, signs inside the plant should indicate the types of wastes accepted.

### **3) Collection and Transport**

#### **a. Industrial Waste**

The standards for collection and transport of the industrial waste should be as follows;

- No scattering, leaking or overflowing of the wastes during transport
- Provide countermeasures against emission of odor, noise or vibration or effects to the surrounding living environment
- No overloading of the collection trucks
- Periodic maintenance of the trucks
- In case of transfer station operation, the station should accept only the amount of waste its capacity allows, be aware of the next destination of the waste, not induce any changes in the characteristics of the waste unless it is licensed to do so, and not become a source of generation of rodents and other pests

#### **b. Hazardous wastes**

Obviously the standards for collection and transport of the hazardous waste should be more detailed due to the nature of the waste collected and transported, and in addition to the above should include as follows;

- Provide countermeasures against health risks to humans or the surrounding living environment during operation
- No mixing of hazardous wastes with other waste types
- Clearly inform collection crews of the types of hazardous waste transported and the dangers involved in mishandling the waste
- Strictly maintain the manifest system of recording the amount of waste transported and other conditions such as the date of transport and time, origin and destination, etc.
- Stick a warning label on the collection truck
- Types of collection truck and containers (if any) shall be selected based on the characteristics of the waste to be transported
- Carefully select transport routes to minimize damage to the surroundings in case of accident or vehicle breakdown
- Daily inspection and washing of the collection trucks
- In case of transfer station operation, a billboard should be placed to clearly indicate

the nature of the station. Signs inside the station should indicate the types of wastes accepted there, the station should be able at any time to contact the generators of the waste brought there, and there should be no mixing of different waste types when transferring the wastes into the secondary transport vehicle

#### **5.4.5 Environmental Aspects related to Disposal Facilities**

Concern for the environment is essential for disposal of industrial and hazardous wastes, especially for scattering of waste, outflowing of toxic substances, diffusion of offensive odor, breeding of vectors and insects, self-burning of the waste, and contamination to public water bodies and drinking water sources by leachate.

Standards on introduction of the daily cover soil, and liners leachate collection and treatment facilities can be the proper countermeasures to eliminate environmental effects for non-hazardous industrial waste. Meanwhile, structurally isolated disposal sites shall be required for hazardous waste disposal, to prevent environmental impacts caused by toxic substances. In addition, proper siting conditions for the disposal site can sometimes overcome these environmental affects.

### **5.5 Technical Standards for Infectious Waste Disposal**

#### **1) Judgment Criteria for Infectious Waste**

There must be criteria for defining infectious waste. Infectious waste is waste whose pathogenic contents may cause infection. Definition of the waste should be made in detail by decree. The criteria must be of practical use. For example, as far as potentially infectious waste is concerned, even the blood of a healthy person should be classified as infectious. Should this rule be applied to any materials stained with blood? More strictly, should definition of infectious waste cover the blood of infected patients whose disease will not be infectious through blood contact? Concrete criteria in this sense should be presented.

There must be criteria for infectious waste generated by infected patients or test animals. In case some waste hovers vaguely on the line where criteria is determined, so doctors eventually must judge whether or not waste is infectious or not.

The national government should discuss these matters to prepare criteria regarding infectious waste.

#### **2) Standards for Disposal and Collection**

##### **a. Disposal Standards**

The government should prepare disposal standards that rule out landfilling of waste that has not been sterilized or neutralized.

Methods should be defined for sterilization and neutralization such as high-pressured steam sterilization, chemical disinfection, and heated inactivation. Pathogenic waste



in particular should only be treated by incineration.

Standards for infectious waste that remains even after sterilization or neutralization should be defined. For example, sterilized blood can be discharged into sewage respecting regulations of waste effluent, or treated waste can be disposed of at authorized controlled landfills.

#### **b. Collection and Transport**

The government should create standards for collection and transport of infectious waste from medical institutions to treatment facilities.

It should be made clear that infectious waste must be separated from other waste and kept in specific containers during collection and transport. Containers should have labels clearly indicating the infectious waste that they contain.

#### **c. Storage**

When storing infectious waste for transport, it should be kept in storage that satisfies safety conditions regarding spillage of waste so that accidental contact with people will not take place. There should be standards for the period of storage.

### **3) Technical Standards concerning Landfills, Intermediate Treatment Facilities, and Other Equipment**

#### **a. Disposal Facilities**

Technical standards concerning treatment facilities should be prepared in accordance with the types of facilities that require permission for their location.

When defining treatment facilities for infectious waste, it will be a problem whether or not the definition covers autoclave and facilities for chemical disinfection. This is because such equipment can be regarded as medical equipment. Generally, treatment facilities represent incineration or landfilling facilities. Size of facilities must be taken into consideration as well. Although small facilities may not have to be authorized, they are not recommended for this purpose.

Technical standards for locating treatment facilities include the following criteria:

1. Avoid any damage to the surrounding area
2. Waste should not be scattered.
3. Proper measures are taken to prevent emission gas and waste effluent.
4. Peripherals are prepared for proper operation of treatment facilities.
5. Treatment facilities have adequate specification.

Technical standards for landfilling are mentioned in prior section 5. 3.3

## **b. Collection, Transport and Storage of Infectious Waste**

There must be technical standards for transport vehicles and containers. Vehicles for transporting infectious waste should have equipment to prevent containers from falling. Safe containers for infectious waste should be specified in accordance with their contents.

Technical standards for storing infectious waste include the following.

1. Admission to storage should be restricted to only authorized personnel.
2. If waste that becomes rotten easily must be stored, it should be kept in refrigerated storage.
3. Infectious waste should be stored separately from other waste.
4. Signs clearly indicating that infectious waste is kept should be placed outside of storage containers

## **4) Technical Standards Concerning Operation of Facilities**

Locating proper treatment facilities does not necessarily achieve proper treatment. Proper treatment can be achieved only when the facilities are operated properly.

The following caution should be taken when operating incineration facilities.

1. Infectious waste should be treated when the temperature of incineration chamber reaches the designated point.
2. Excessive amounts of infectious waste should not be treated at one time.
3. The temperature of incineration chamber should be controlled during operation.

It is necessary to set up operation standards for autoclave, sterilization by boiling, and chemical disinfection. Items to be defined will be how to load infectious waste into autoclave, steam temperature, adequate operation period, density of sodium hypochlorite for chemical disinfection, processing period of disinfection, etc. In Japan, these operational standards are presented in detail to medical institutions in referential guidelines, which are attached to the manual for infectious waste management.

## **5) Environmental Aspects related to Disposal Facilities**

When disposing of infectious waste, consideration must be paid to the environment. Plastic waste in the form of disposable medical equipment is becoming a more common problem, which will have to be addressed. Emission gas from incineration also requires particular consideration. Dust and HCl are serious problems in emission gas pollution. There is a possibility that emission gas contains chemical materials such as SO<sub>x</sub>, NO<sub>x</sub>, and Dioxin, and metals. Extra consideration must be given to the environment in which large incineration facilities are located. It is therefore necessary to set up emission standards for air pollutants related to incineration of infectious waste.

Liquid waste will be generated in the process of sterilizing blood waste, and its

generation is generally small at one time. After confirming that it is properly treated, it can be watered down and discharged into sewerage system.

