

# WASTE MANAGEMENT STRATEGY

*With special emphasis on minimisation  
and resource recovery*



**SMALL ISLAND DEVELOPING STATES**



*This IMA - SIDS Waste Management Strategies has been prepared following inter-regional consultations organised by the Indian Ocean Commission on behalf of UNEP*

*The strategies were arrived at, following national reports from respective island states and two inter-regional meetings held at the Indian Ocean Commission at the end of 1999.*

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# IMA - SIDS

Indian Ocean, Mediterranean Sea and Atlantic Ocean

## Small Island Developing States

### WASTE MANAGEMENT STRATEGY

*With special emphasis on  
minimisation and resource recovery*

Prepared by **Adrian Coad**

**December 1999**



- PART A EXECUTIVE SUMMARY
- PART B TOOLS FOR SHAPING THE STRATEGY
- PART C ACTIVITIES AT NATIONAL LEVEL
- PART D REGIONAL STRATEGY
- PART E ANNEXES - SUPPORTING MATERIAL



## PREFACE

As highlighted in the 1994 Barbados Programme of Action and the 1999 Special Session of the UN General Assembly held in September 1999, the problem of waste management is a major area of concern for Small Island Developing States (SIDS). SIDS like other developing countries, face similar waste management problems. Many SIDS, however, experience additional constraints arising from small land area, high dependence on imports and high population densities exacerbated by high tourist inflows.

This volume is part of a series of publications on waste management in SIDS prepared by the UNEP's Division of Environmental Policy Implementation. The publications were prepared as part of the UNEP project *Integrated Waste Management in SIDS in the Indian Ocean, Mediterranean and Atlantic (IMA) Regions*, which was implemented by the Indian Ocean Commission (IOC). The series consists of the following documents (i) Strategic Guidelines for Integrated Waste Management in SIDS (ii) IMA-SIDS Waste Management Strategy with special emphasis on Minimisation and Resource Recovery (iii) A Directory of Environmentally Sound Technologies for the Integrated Management of Solid, Liquids and Hazardous Wastes in the Pacific and (iv) A Directory of Environmentally Sound Technologies for the Integrated Management of Solid, Liquids and Hazardous Wastes in IMA- SIDS.

*The Strategic Guidelines for Integrated Waste Management in SIDS* were developed on the premise that, if systematic improvements are introduced at the various stages of the waste cycle, the quantity of waste to be managed at each of the subsequent stages would be reduced considerably. It is argued that there should be appropriate and adequate integration and co-operation between stakeholders at the different stages of waste management, based on the vision of achieving "zero waste" to be managed.

These guidelines were prepared using inputs from the Caribbean, Pacific and IMA regions and later reviewed at the UNEP Meeting of Experts on Waste Management in Small Island Developing States organised in London by the Islands and Small States Institute in collaboration with the Commonwealth Secretariat, from 2 to 5 November 1999. They were endorsed later that at a meeting of experts held in Mauritius from 22 to 24 November 1999 under the auspices of the Indian Ocean Commission.

The second document included in this series is the *IMA-SIDS Waste Management Strategy with special emphasis on Minimisation and Resource Recovery*. All IMA-SIDS have problems in disposing of wastes regardless of the economic status. A well-managed environment is critical for SIDS since two of their major industries; tourism and fisheries heavily depend on the state of the environment. The threat of disease outbreak will have terrible repercussions on the tourist industry and, the destruction of fisheries, can have enormous negative economic impact.

UNEP, in its programme of support for IMA-SIDS has assisted the region to develop the strategy as a follow-up of the Valetta Declaration, adopted in Malta in November 1998, and of the UNEP Meeting on Integrated Management of Wastes in SIDS in the Indian and Atlantic Ocean SIDS organised by the Indian Ocean Commission (IOC) in December 1997. The waste management strategy adopted at the UNEP/IOC meeting identified the need to adopt a regional approach to waste minimisation as one of the priority issues.

The components of the strategy were identified during the IMA-SIDS Meeting of Technical Experts on Integrated Waste Management and Waste Minimisation in Small Island Developing States held in Mauritius from 22 – 25 November 1999. The strategy was prepared by the Indian Ocean Commission, reviewed and endorsed by the IMA – SIDS High Level Meeting of On Integrated Waste Management and Waste Minimisation in Small Island Developing States from 14 to 15 December 1999 in Mauritius.



*The Directory of Environmentally Sound Technologies for Integrated Management of Solid, Liquid, and Hazardous Waste for Small Island Developing States (SIDS) in the Pacific Region* was compiled by the UNEP International Environment Exchange Centre (IETC). Many times, waste management technologies are transferred from larger and more developed countries, and as such are not always suitable for SIDS. Some SIDS have developed appropriate technologies, which have been successfully employed, but the information has not been shared with other SIDS in the same regions or in other regions. Hence the need for the Directory which compiles a list of practical technologies applicable to SIDS. The Directory is not meant as a technical manual, but as a source of information. The Directory was reviewed during the UNEP Meeting of Experts on Waste Management in Small Island Developing States Waste Management in SIDS, held in London from 2 and 5 November 1999.

The Directory for the Pacific regions was reviewed and endorsed at the IMA-SIDS Meeting of Technical Experts on Integrated Waste Management and Waste Minimisation in Small Island Developing State held in Mauritius from 22 to 25 November 1999. The Indian Ocean Commission adapted the Directory to suit the IMA-SIDS region and produced the fourth document which is *A Directory of Environmentally Sound Technologies for the Integrated Management of Solid, Liquid, and Hazardous Waste for Small Island Developing States (SIDS) in the Indian, Mediterranean and Atlantic Region*.

It is hoped that these publications will make a useful contribution to the promotion of integrated waste management in SIDS in particular those in the IMA regions, and will foster an increased awareness about the special circumstances of SIDS, especially the fact that these states face special constraints in their options for sustainable development. Additionally the material will be useful background to the GPA efforts toward the sewage conference framework and its five year review.

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# LIST OF CONTENTS

Section	Title	Page
<b>A</b>	<b>EXECUTIVE SUMMARY</b>	<b>3</b>
<b>A.1</b>	<b>OVERVIEW</b>	<b>3</b>
<b>A.2</b>	<b>INTRODUCTION TO THE STRATEGY</b>	<b>4</b>
<b>A.2.1</b>	National components	4
<b>A.2.2</b>	Regional Strategy	6
<b>B</b>	<b>TOOLS FOR SHAPING THE STRATEGY</b>	<b>8</b>
<b>B.1</b>	<b>GENERAL APPROACH</b>	<b>8</b>
<b>B.2</b>	<b>BASIC CRITERIA AND CONCEPTS</b>	<b>9</b>
<b>B.2.1</b>	Local Conditions	9
<b>B.2.2</b>	Financial criteria and feasibility studies	10
<b>B.2.3</b>	Available human resources	10
<b>B.2.4</b>	The need for a broad view of waste minimisation and recycling	11
<b>C.</b>	<b>ACTIVITIES AT NATIONAL LEVEL</b>	<b>13</b>
<b>C.1</b>	<b>Education, awareness and involvement of the public</b>	<b>13</b>
<b>C.1.1</b>	Integration of environmental and waste management issues in school curricula	13
<b>C.1.2</b>	Public awareness and involvement	14
<b>C.2</b>	<b>Capacity building</b>	<b>15</b>
<b>C.3</b>	<b>Development of a waste management policy</b>	<b>16</b>
<b>C.4</b>	<b>Waste management planning</b>	<b>18</b>
<b>C.5</b>	<b>Upgrading disposal facilities</b>	<b>19</b>
<b>C.6</b>	<b>Increasing the funds for solid waste management</b>	<b>21</b>
<b>C.7</b>	<b>Strengthening legislation, monitoring and enforcement</b>	<b>22</b>
<b>C.8</b>	<b>Hazardous and special wastes</b>	<b>23</b>
<b>C.9</b>	<b>Waste reduction</b>	<b>25</b>
<b>C.10</b>	<b>Resource recovery</b>	<b>27</b>
<b>C.11</b>	<b>Improving capacity to produce and distribute compost</b>	<b>29</b>
<b>C.12</b>	<b>Improving collection services</b>	<b>31</b>
<b>C.13</b>	<b>Management of healthcare wastes</b>	<b>32</b>



Section	Title	Page
<b>C.14</b>	<b>Management of wastewater</b>	<b>34</b>
<b>C.14.1</b>	Minimising wastewater quantities	34
<b>C.14.2</b>	Reuse of wastewater	35
<b>D</b>	<b>REGIONAL STRATEGY</b>	<b>37</b>
<b>D.1</b>	<b>Networking</b>	<b>39</b>
<b>D.2</b>	<b>Promotion of composting within the Region</b>	<b>40</b>
<b>D.3</b>	<b>Public awareness and education</b>	<b>42</b>
<b>D.4</b>	<b>Staff training and development</b>	<b>44</b>
<b>D.5</b>	<b>Formulation of laws and standards</b>	<b>46</b>
<b>D.6</b>	<b>Co-ordination of the management of hazardous and problematic wastes</b>	<b>48</b>
<b>D.7</b>	<b>Co-ordination of waste minimisation and resource recovery</b>	<b>50</b>
<b>D.8</b>	<b>Provide support to national initiatives to improve institutional arrangements</b>	<b>51</b>
<b>D.9</b>	<b>General comments</b>	<b>53</b>
<b>E</b>	<b>ANNEXES - SUPPORTING MATERIAL</b>	<b>54</b>
<b>E1</b>	<b>DEFINITIONS OF TECHNICAL TERMS</b>	<b>54</b>
<b>E2</b>	<b>SUPPLEMENTARY NOTES AND OBSERVATIONS</b>	<b>56</b>
<b>E2.1</b>	Methods of charging directly for solid waste management	56
<b>E.2.2</b>	Some aspects of legal provisions	57
<b>E.2.3</b>	Management of hazardous and special wastes	58
<b>E.2.4</b>	Resource recovery	61
<b>E.3</b>	<b>ISSUES RELATED TO REGIONAL STRATEGY COMPONENTS</b>	<b>63</b>
<b>E.4</b>	<b>THE SCOPE OF SOLID WASTE MANAGEMENT</b>	<b>65</b>
<b>E.5</b>	<b>WORKSHOP PARTICIPANTS</b>	<b>67</b>
<b>E.6</b>	<b>SOURCES OF FURTHER INFORMATION</b>	<b>68</b>

## A. EXECUTIVE SUMMARY

### A.1 OVERVIEW

This paper presents a strategy for improvements to solid waste management systems. These recommendations were formulated as a result of a UNEP/COI initiative that included a workshop comprising national consultants from seven nations in the IMA Region, and an international consultant. These experts met in Mauritius under the auspices of the Indian Ocean Commission from 22 to 24 November 1999 to discuss a regional situation report and to prepare strategy recommendations. The national consultants produced reports on the status of waste management in their countries, and these were synthesised into a regional status report.

The basic functions of this paper are

- i) to suggest actions which can form the building blocks of national strategies and
  - ii) to present a regional strategy for the IMA - SIDS Region.
- The strategy presented in this document was adopted at a second workshop, also organised by COI in Mauritius, and held on 14 and 15 December 1999.

This section (the Executive Summary) introduces the main parts of this paper, indicating the topics covered and where more details may be found.

The next section (Part B) discusses some important considerations and criteria that have been shown by experience to be vital if serious planning errors are to be avoided. They are tools and guides, which should be used to shape national strategies. The reader is urged to read Part B carefully before developing a national strategy or implementing this Regional Strategy.

Part C proposes recommendations that can be incorporated into national strategies for waste management, especially with regard to waste minimisation and resource recovery.

Part D presents the Regional Strategy for waste management, with an emphasis on waste minimisation and resource recovery.

More information about the concepts and contents of Parts C and D is given in the second part of this Executive Summary (Section A.2).

Part E comprises the Annexes, providing supporting information, including

- some definitions of technical terms and abbreviations, defining how they are used in this report, (Annex E.1);
- some supplementary notes and observations (Annex E.2)
- a section suggesting some of the issues relating to the Regional Strategy that might require further consideration (Annex E.3);
- a review of the many aspects of waste management, to act as a checklist for planners, (Annex E.4),
- a list of participants at the workshops where these strategy proposals were developed and adopted (Annex E.5), and
- a brief list of sources of further information (Annex E.6).



## **A.2 INTRODUCTION TO THE STRATEGY**

The first question to ask is Why is a strategy needed? A strategy can serve as a vital step in the preparation of plans, and without plans there can be little co-ordination, organisation and sense of direction. A strategy communicates to outsiders about objectives, resources and methods. The development of a strategy is in itself a valuable exercise because of the need to define objectives and look for implementation mechanisms, as the strategy is debated and refined.

As already mentioned, Part C contains recommendations for national activities. Each nation should develop its own strategy for waste management, and since the components for national strategies are based on the recommendations of the national consultants, it is expected that Part C will prove to be a useful resource for the national experts who will be developing the strategies for their own countries. In contrast, the Regional Strategy presented in Part D can be regarded as a finished product since it has the approval of senior representatives of four countries in the Region.

### **A.2.1 National components**

Part C provides strategy components in fourteen thematic areas. The first is concerned with public awareness and involvement, which is a vital ingredient in any successful waste management service. The second deals with capacity building and staff development, which is another vital factor, which is often overlooked. The next is to do with the preparation of a policy statement. An essential prerequisite for effective planning is agreement about the ultimate goals and the criteria that are considered to govern waste management in the particular situation. There should be clear definition of these basic goals, and agreement on them at a senior government level. They should be set forth in a short policy document that has the support of all government ministers, to minimise the risks that different ministries may later find themselves pulling on opposite directions on basic environmental issues. This is discussed further in section C.3.

Planning should involve setting objectives, and defining how the achievement of these objectives can be assessed or verified. Therefore the objectives that are used in preparing plans should be measurable and verifiable, and should be planned to be accomplished within a defined period. For this reason measurable indicators are suggested for most of the objectives, but the timings for the individual activities have not been suggested since that aspect can only be decided by national decision-makers. Other information about each suggested activity includes description, justification, responsibility for implementation, resources required and prerequisites. Using this information, and the general guidance on designing a strategy (in Part B), a national strategy can be defined.

The recommendations for national strategies have not been assigned any order of priority because it is believed that each nation should develop its own hierarchy of priorities, in accordance with the local needs and the views of all stakeholders.

The preparation of this strategy should involve representatives of all the actors and interest groups involved - including representatives of householders, commercial and industrial interests, local and national government, environmental agencies and NGOs, providers of waste collection and disposal services, labour unions, planning authorities, social scientists, and academics from related disciplines. It is important to get the right balance between the practical realities of the current situation and visions of the ultimate objectives. If this balance is achieved, the strategies that are prepared will be sufficiently realistic and practical so that they can be implemented and lead to sustainable and needed improvements. With such a balance the national strategies will also be sufficiently in tune with environmental and developmental needs that they will not perpetuate any existing failures and wastage of resources.



The following list presents the titles and objectives of the suggested components for the national strategies:

Section	Title and objective
<b>C.1</b>	<b>Education, awareness and involvement of the public</b>
C.1.1	Integration of environmental and waste management issues into educational curricula The objective is to make schoolchildren and students more aware of environmental issues so that their behaviour, and the habits of their families, are changed in a way that benefits their environment.
C.1.2	Public awareness and involvement The objective is to reduce the negative effects on public health, the environment and the costs of waste management services, that result from unacceptable behaviour of the general public related to waste management. A further objective is to encourage positive habits, especially in the field of waste minimisation and resource recovery.
<b>C.2</b>	<b>Capacity building</b> The objective is to improve the standards of solid waste management by improving the knowledge and skills of individual waste management staff and improving the effectiveness of the organisations in which they work.
<b>C.3</b>	<b>Development of a waste management policy</b> The objective is to have an agreed policy that favours waste minimisation and resource recovery.
<b>C.4</b>	<b>Waste management planning</b> The objective is develop and publish a comprehensive plan, for a ten year period, but including short- and medium-term targets, and to review and update the plan at regular intervals, so that action can be taken and services and facilities provided in a considered and efficient manner, with due regard to the needs and viewpoints of all stakeholders.
<b>C.5</b>	<b>Upgrading disposal facilities</b> The objective is to reduce the health risks, pollution and nuisance caused by solid waste disposal operations.
<b>C.6</b>	<b>Increasing the funds for solid waste management</b> The objective is to increase the funding that is available for solid waste management.
<b>C.7</b>	<b>Strengthening legislation, monitoring and enforcement</b> The objective is to develop, strengthen and apply effective legal instruments to promote waste reduction and resource recovery and to ensure satisfactory standards of management of wastes from all sources. In some cases it may be necessary to draw together and unify - or to harmonise - legislation from different Acts.
<b>C.8</b>	<b>Hazardous and special wastes</b> The objectives are to develop or strengthen the control of hazardous waste management practices, to provide improved facilities for storing and treating hazardous and special wastes, and to reduce the quantities of hazardous wastes generated by the industrial and agricultural sectors, and the associated risks.
<b>C.9</b>	<b>Waste reduction</b> The objective is to reduce the quantities and risks of waste that are presented for refuse collection by changing consumption habits and encouraging on-site resource recovery.
<b>C.10</b>	<b>Resource recovery</b> To divert more wastes away from landfilling and to obtain further economic benefit from waste materials in a sustainable way.



Section	Title and objective
C.11	<b>Improving capacity to produce and distribute compost</b> The objective is to increase the percentage of biodegradable municipal waste that is converted into compost. There may also be other objectives such as the improvement of the character of the soil, or increased vegetable yields in poor soils and situations of food shortage.
C.12	<b>Improving collection services</b> The objective is to provide a regular waste collection service to a larger proportion of the urban populations. There may also be supplementary objectives, such as to increase the frequency of the collection service, or the service level or standards.
C.13	<b>Management of healthcare wastes</b> The objective is to reduce the health risks to the staff of healthcare establishments, to contractors' staff responsible for handling, transporting and disposing of healthcare wastes, and the people who use hospitals and clinics or live near them.
C.14	<b>Management of wastewater</b>
C.14.1	<b>Minimising wastewater quantities</b> The objective is to reduce the volume of polluted water that is discharged from homes, industries and other sources, so that the requirements for treating wastewater are less, and less pollution enters natural water bodies. This objective is linked to the reduction in water consumption, which is particularly important for islands with scarce or expensive water supplies. However, it should be pointed out that the actual pollutant load (which includes organic matter and disease organisms) is not changed by water conservation measures, but is simply carried in a smaller quantity of water.
C.14.2	<b>Reuse of wastewater</b> The objectives are to gain some economic benefit from wastewater, to reduce the demand on water sources and to reduce the pollution load that enters the environment.

Workshop participants stressed the importance of data collection as a tool in the implementation of recommendations. Efforts should be made to quantify each task and to measure the efforts made to solve problems. Information about sources of waste is vital for planning and for revenue collection, and, particularly in the case of industries, to monitor the quantities and types of waste requiring disposal. Data should always be collected with a specific purpose in mind to ensure that the appropriate level of detail is achieved and the accuracy is sufficient for the intended purpose.

## A.2.2 Regional Strategy

The main focus of this paper is the Regional Strategy, with the same emphasis on the satisfactory management of wastes, for the IMA Region as a whole. The components are discussed in Section D.

The proposed components are presented in a format similar to that used for the national activities. Some keywords are added to help the reader select components of particular interest. The list of keywords is shown at the start of Section D.

Section	Title and objective
D.1	<b>Networking</b> The objective is to create a mechanism for exchanging, data, lessons learned, plans and other information between waste management professionals in different parts of the IMA Region.
D.2	<b>Promotion of composting within the Region</b> The objective is to promote the composting of organic wastes within the Region by sharing information and expertise.
D.3	<b>Public awareness and education</b> The objective is to facilitate the sharing of experience and resource materials (such as videos, posters etc.) between nations of the Region in order to improve the public's understanding of, and involvement in, waste management.
D.4	<b>Staff training and development</b> The objective is to give managers, engineers and other professionals, inspectors and supervisors the knowledge and tools that they need to do their work as effectively as possible.
D.5	<b>Formulation of laws and standards</b> The objective is to assist national governments to introduce and/or improve legislation and regulations that deal with waste management, and to set appropriate and enforceable standards.
D.6	<b>Co-ordination of the management of hazardous and problematic wastes</b> The objective is to benefit from economies of scale by combining wastes from different countries in the Region.
D.7	<b>Co-ordination of waste minimisation and resource recovery</b> The objective is to promote components of waste minimisation and recycling schemes that are most effective at the Regional level.
D.8	<b>Provide support to national initiatives to improve institutional arrangements</b> The objective is to provide regional assistance to national efforts to develop efficient and sustainable institutional arrangements for providing services and monitoring performance.



## B. TOOLS FOR SHAPING THE STRATEGY

### B.1 GENERAL APPROACH

Parts C and D are based on a number of recommended components for national and regional strategies that were proposed during a meeting of technical experts in November 1999. Since there are considerable differences in the conditions throughout the IMA Region, there is a need to adapt the recommendations for national strategies to suit local conditions. The considerations presented in Section B.2 may be helpful in tailoring the components in Part C to ensure that national strategies are compatible with local conditions.

It may be necessary to prioritise the recommendations because of resource limitations, so that the highest priority components can be implemented at an early stage, and other components added to the strategy when possible. This prioritisation process also should take local conditions into account.

Planning may be considered in four stages: -

1. The development of, and agreement to, a **policy** statement which specifies the basic rules to be used in subsequent stages of planning, including outline objectives, basic priorities, and guiding principles.
2. The preparation of a **strategy**, defining the areas in which action will be taken, an outlining the methods used, with key features concerning these methods and approaches.
3. The preparation of **plans**, defining objectives in measurable terms, methods used to achieve these objectives, prerequisites and assumptions, time frames and required resources. These plans can be classified into three tiers:
  - a) the **strategic plan**, with a longer-term view, indicating the basic objectives. The objectives should be expressed in terms of objective and verifiable indicators and for a defined time interval (usually ten years);
  - b) the **action plan**, which goes into more detail and is reviewed at regular intervals, concerned with the actions that will be needed to achieve the objectives, and
  - c) the **operations plan**, which is for a short time frame and considers the scheduling, resource requirements, and monitoring of each component of the action plan.
4. The periodical review of plans, in the light of experience, changing situations and progress, is an important part of the planning process. It has been said that the process of planning is more important than the plan itself.

The components listed in Parts C and D include guidance relating to all three types of plan, ranging from the basic objectives of each proposed component to resource implications and monitoring indicators.

National decision-makers may use the material in Part C to develop the strategy that most suits their own country. Section D presents the recommended Regional Strategy for the IMA Region.

## B.2 BASIC CRITERIA AND CONCEPTS

This section suggests a number of important points that should be used as criteria for selection between alternatives, and as tools for shaping the proposed programmes. There are many examples of attempts to introduce waste management improvements that have ignored these criteria and concepts, and have failed as a result, so the reader is urged to consider them carefully.

### B.2.1 Local conditions

The importance of local conditions cannot be over-emphasised. Each initiative should be developed for the particular situation, and not necessarily imported or copied from elsewhere. This implies the collection of essential data, and a return to first principles, designing programmes and strategies on the basis of the fundamental objectives of waste management. These objectives could be summarised as: **reducing public health risks and environmental pollution in a sustainable way and at an affordable cost.**

Some of the factors that vary significantly from place to place and that should be considered in any planning exercise are listed below.

- The density of solid waste has a major impact on the choice of equipment that should be used for collection.
- The geology of a disposal site is all-important in terms of the spread of pollution from the site into underlying water resources.
- The importance attached by the public to environmental sanitation, and the level of household incomes affects directly the methods of collection, recycling and disposal that can be used.
- The degree of public and political concern for the environment determines the best approach for introducing waste minimisation and recycling innovations and the opportunities for enforcing legislation.
- The autonomy and expertise of the agency responsible for waste management should be carefully considered at the planning stage. Autonomy includes the capacity of the agency to plan its future expenditures, and the freedom enjoyed by the agency to make decisions according to the requirements of waste management - if decisions are made for political reasons or by leaders or managers with little understanding of environmental issues, much less can be achieved. An autonomous organisation should be staffed by specialists who are hired for specific reasons rather than transferred from other departments as a matter of routine.
- The economics of resource recovery vary greatly from place to place. Aspects that must be considered include the costs of transport, the quantity and the purity of material that can be gathered from within a reasonable distance, the markets for products, and the prices that will be paid for the products (whether the product is compost, electrical power or products made with recycled materials such as glass ornaments or carton for packaging).

These local conditions do not just vary from country to country, but also between one city and another in the same nation, and even between different parts of the same city.

Waste management advisors should take every opportunity to emphasise the importance of local conditions and the dangers of trying to import methods or systems from outside. Equipment suppliers and some consultants may advocate complete replacement of existing arrangements with a new system and equipment. This may be very expensive, and the impact may be short-lived because of problems with maintenance, operating cost, and social acceptance. Schumacher suggested a better approach:

*"Find out what the people are doing, and help them to do it better."*



This approach firstly involves studying existing methods and understanding how they operate. (This can be difficult in the case of informal sector activities, because officials may give inaccurate information and informal sector workers have learned not to trust outsiders.) Then it is necessary to determine what are the constraints that restrict growth or improvement in this activity, and to see whether some of these constraints can be reduced to allow the activity to expand in a positive direction. Adjustments and changes should be made gradually and cautiously, involving the stakeholders, allowing time for evaluation of the results. There should be a "bottom-up", demand-driven approach.

A key factor in regard to waste recycling is the environmental awareness of the population and the sustainability of the existing waste management systems. In industrialised countries the motivation for many recycling schemes is based on a public concern for the environment, compliance is supported by effective enforcement of laws, and the extra expenditures are paid by the formal waste management sector. In many low-income countries a completely different system operates, based on large numbers of informal sector workers who are driven by their need to earn a personal income, often motivating the public by small payments for materials that are separated. The two situations, and the two systems that have resulted, are completely different, and attempts to transplant systems - to places where conditions are very different - have been expensive failures, and often caused considerable damage. It is essential that any attempt to promote resource recovery or waste minimisation be based on a thorough understanding of local conditions and existing systems.

### **B.2.2 Financial criteria and feasibility studies**

Another mistake that is often made is to make decisions based on initial or capital costs, not considering the costs of operation and maintenance, or how the finance for operation and maintenance will be obtained. A typical example is incineration of healthcare waste - an incinerator may be provided by a donor, but little used because the operator does not have sufficient money to buy the fuel needed to use the incinerator.

Another, related, reason for failures of projects is basing them on concepts rather than an objective feasibility study. This is often the problem with projects that involve composting. There is no doubt that composting is the best way of dealing with food waste and other wastes that decompose readily, but this fact does not guarantee that a composting project will be technically and financially feasible. It is usually necessary to start such projects on a small pilot scale in order to develop methods of obtaining good compost and to understand the market. When the system (including the marketing) is operating satisfactorily on this small scale, it can then be scaled up in stages. In many countries of the world there are large mechanised composting plants that have failed because they were based purely on the concept rather than on pilot-scale experience and a good feasibility study.

### **B.2.3 Available human resources**

Another neglected factor is the impact of the human resources on the chances of success. Many waste management activities involve a wide range of aspects and influences, and conventional university courses do not provide all the necessary skills. Experience of operations is needed in addition to classroom instruction. This may be obtained through attachments to successful operations in other cities or countries, if the normal career structure does not provide it. The practice in many countries of moving engineers and managers between many municipal functions and administrative duties does not provide sufficient confidence and experience in any one issue (such as waste management), so it is important to develop career structures that encourage professionals to stay in waste management for most of their careers. The motivation and enthusiasm of professionals are very important factors, and much can be done to help in these areas by improving delegation, management procedures and working conditions.



The most important factor affecting the success of a sanitary landfill is the manager of the site, yet often the selection, training and motivating of the manager is an afterthought, left until the last minute. Considerable attention is (rightly) given to the selection of the site for a landfill, but none is given to the early selection of the site manager. The motivation and supervision of staff must be given careful consideration - the very low productivity of many public sector manual workers is clear testimony to this need.

#### **B.2.4 The need for a broad view of waste minimisation and recycling**

A further point that is particularly relevant to waste minimisation and resource recovery is the importance of taking a complete or integrated view of an issue, and not seeing only the implications for waste management. Environmental, public health and economic factors must also be integrated. Some examples are suggested below.

- There is a risk to health associated with the reuse of bottles for drinks. If a bottle is used for storing a household chemical or weedkiller before it is discarded, and then it is filled with a drink without being thoroughly washed, the drink may be seriously contaminated. (There is also the danger that children might drink the contents of a soft drink bottle that has been used to store another liquid, with potentially fatal results if the liquid is toxic.)
- If decomposed waste with a high content of a heavy metal (because of dry cell batteries in the waste, for example) is used as a soil conditioner, soil that is enriched with this material may also be contaminated and poisoned.
- The economics and environmental benefits of recycling are very much affected by the distance that the recyclables must be transported. If special journeys are required, the pollution from the vehicle and the cost of the journey may cancel the benefits of the recycling of the material. This may be particularly important in the case of islands where long journeys are involved in taking recyclables to markets or reprocessing facilities, but perhaps not significant if such material can be carried at a small charge in a boat that would otherwise travel empty.
- Recycling can itself cause pollution. Sometimes waste is scattered when it is being searched for items that can be recycled. Waste pickers in some countries set fire to waste dumps in their search for metals, and so cause serious air pollution. The washing of plastics and other materials may cause local water pollution, and the cleaning for reuse of containers that previously held oil or toxic chemicals can cause serious water and soil pollution. Informal recycling of car batteries can cause very serious air, water and soil pollution.
- If industrial containers are not completely clean before they are reused, there are health risks for the users.
- The reuse of used healthcare materials can be very dangerous whether performed officially or informally, if sterilisation is not complete. Some methods of chemical disinfection appear to be unsatisfactory. Sorting through healthcare wastes is clearly a very hazardous occupation because of the risk of injury, infection or poisoning to the recycling workers or to others who buy and use the items that are recovered. To safeguard against these risks certain items in healthcare waste should never be recycled.
- Food packaging is a nuisance for solid waste management, but packaging serves many purposes, and so pressure to reduce packaging should be balanced by an understanding of the important roles of some forms of packaging. Packaging can actually prevent waste - farm produce that is carefully packed before a rough journey to market arrives in better condition than produce that is just thrown into a truck. The wastage of the produce is less as a result



of the packaging, resulting in economic and environmental benefits. Food that is wrapped in clean plastic in a clean factory is less likely to be contaminated than food, which has been transported loose and wrapped in recycled newspaper under unhygienic conditions. Whilst tinned (canned) food results in discarded containers, the wastes from food processing have been taken care of at the canning factory and so do not require handling in the urban context. (For example if peas are supplied in their pods, the waste from preparing the peas is the pods; if supplied in a steel can, the only waste is the can, which may cause fewer disposal problems.)

- Whilst there are many advantages in recycling domestic wastewater (that has no industrial chemicals in it), there can be serious health impacts, from accidental direct consumption of the wastewater, from eating raw fruit and vegetables that have been contaminated, and from skin contact with the wastewater. There have been cases of epidemics from such causes in quite highly developed societies.

Notwithstanding these concerns, there are strong reasons for promoting waste minimisation and recycling. Some of the main reasons are listed below. They are not in any priority order because the ranking of priorities varies from place to place.

- ✓ If less waste is discarded, there is less for solid waste vehicles to collect and less requiring disposal, so these operations cost less and less land is required for disposal. (It is important to quantify the associated gains and costs.)
- ✓ If fewer resources are used for packaging and for manufactured items, there is a lower demand for natural resources. This is particularly important in the case of non-renewable resources.
- ✓ Reprocessing of materials after they have been used often requires less energy and causes less pollution than making the materials from virgin resources. Aluminium is a striking example.
- ✓ If materials are reused within a country there is a lower demand for imported raw materials, so there is an economic benefit.
- ✓ Recycling creates employment.
- ✓ Improvements to informal recycling methods, especially source segregation of recyclable materials, reduce the health risks to which recycling workers are exposed.
- ✓ A campaign to promote waste reduction habits makes citizens more aware of wastes and so may improve the ways in which wastes are handled.

In order to develop a waste minimisation plan that is of real benefit, all of the aspects mentioned above should be considered and integrated.

## C. ACTIVITIES AT NATIONAL LEVEL

These components for national waste management strategies were developed at a workshop by consultants and other participants from seven States in the IMA Region. (A list of the participants at that Workshop can be found in Annex E.5.1)

### C.1 EDUCATION, AWARENESS AND INVOLVEMENT OF THE PUBLIC

#### C.1.1 Integration of environmental and waste management issues into educational curricula

##### *a. Objective*

The objective is to make schoolchildren and students more aware of environmental issues so that their behaviour, and the habits of their families, are changed in a way that benefits their environment.

##### *b. Description*

Primary school curricula generally include topics related to the environment and to hygiene; such topics may provide opportunities for imaginative and participative exposure to waste management issues, such as experiments with composting, visits to waste treatment facilities, or other assignments. Children can be motivated to take part in programmes and campaigns and to promote recycling. There may also be opportunities for integration of aspects of waste management into the science curricula of secondary schools. At both levels there are possible practical projects for the classroom or laboratory, the schoolyard or to be undertaken at home.

There may be opportunities for including waste management and other environmental subjects in general science courses at university level.

##### *c. Justification*

Children of primary school age are receptive to ideas about environmental protection and able to influence the behaviour of other family members in relation to waste management. The curriculum for primary schools is usually flexible enough to allow insertion of special items of this kind, whereas more senior classes may be under too much exam pressure for the inclusion of topics that are not directly related to examinable material. Primary school children can be motivated by very small rewards to take part in recycling activities.

Environmental issues are increasingly included in secondary school and university courses, and waste management is an important aspect of environment management. It is therefore important to develop an understanding of waste management issues amongst scientists whose careers will impact the environment.

##### *d. Indicator*

The voluntary participation of children in specific programmes provides a useful indication of the impact of such a programme. Simple questions or evaluation methods can be used to determine the impact of schools programmes.



*e. Responsibility for implementation*

The waste management agency should work together with the Ministry of Education, schoolteachers and university staff to develop and implement such programmes.

*f. Resources required*

Much can be done with a small amount of finance. Teachers with an interest in environmental issues are a particularly valuable resource. Local waste treatment and recycling schemes can provide a useful focus. There is currently a pilot project, under the auspices of the Indian Ocean Commission and funded by the European Union, which is concerned with the development of pedagogic material for training teachers of children in the age range 9 to 13.

*g. Prerequisites*

Concepts and materials that are attractive to schoolchildren and students and the support of principals, teachers and lecturers.

### **C.1.2 Public awareness and involvement**

*a. Objective*

The objective is to reduce the negative effects on public health, the environment and the costs of waste management services, that result from unacceptable behaviour of the general public related to waste management. A further objective is to encourage positive habits, especially in the field of waste minimisation and resource recovery.

*b. Description*

Public awareness campaigns require continuous and organised efforts, using a range of methods and imaginative approaches. A wide range of organisations can be involved, including children's clubs, women's organisations and religious groups.

It is advisable to employ specialists in the preparation of public awareness materials. If material is taken from elsewhere it may need to be adapted to suit local conditions and culture.

Proactive use of press releases and broadcasting opportunities is effective and cost-free.

The public should be informed of progress that has been made as a result of their efforts, and successful initiatives should be widely publicised.

*c. Justification*

It has been shown repeatedly in many projects that a lack of co-operation by the public makes waste collection and drain cleaning significantly more expensive, and degrades the urban environment, with negative consequences on public health. On the other hand, where communities have been involved in decision-making, and feel some ownership of waste management systems and facilities, there have been significant improvements in the cleanliness of public spaces and reductions in waste collection costs.

The value of recyclable materials depends on their purity, and so such materials can command higher prices if they have not been mixed with wet biodegradable wastes. Such segregation of wastes requires the co-operation of residents, office workers and others, and to obtain this co-operation, extensive public awareness campaigns are usually necessary.

*d. Indicator*

Assessment of the impact of public awareness campaigns is not simple. It is possible to investigate the level of knowledge acquired by members of the public, but knowledge is not the same as a change of habit, and generally it is changes of habit that are desired. In cases where a public awareness campaign is targeted towards source segregation or the use of a telephone "hotline" for making complaints (to take two simple examples), there are obvious measurable indicators. Any analysis of the number of times waste management issues are mentioned in local media is another indication of the level of public concern regarding waste management.

*e. Responsibility for implementation*

The implementation of a public awareness campaign must be closely co-ordinated with waste management operations. In cases where contractors are involved in collecting wastes, educating the public may be included in the contractual responsibilities.

*f. Resources required*

The preparation of concepts and materials can be expensive, unless posters and other publicity from other programmes and locations can be obtained and adopted. Television and radio time can often be obtained at low (or no) cost because of the public service nature of the message or by using news and magazine programmes.

*g. Prerequisites*

It is important to identify the objectives and message of any campaign in a precise way, and to ensure that services are being provided that will allow and encourage the public to participate as they are requested. For example, there is no point in encouraging the public to put their waste in communal containers if there are no containers available or if the containers are overflowing because they are not emptied satisfactorily. If residents are asked to segregate their waste, but then see the different streams being mixed in the collection vehicle because the collection system has not been set up effectively, they will quickly lose their motivation to segregate wastes. It will subsequently be very difficult to motivate them to segregate their wastes at a later date because of this experience.

**C.2 CAPACITY BUILDING***a. Objective*

The objective is to improve the standards of solid waste management by improving the knowledge and skills of individual waste management staff and improving the effectiveness of the organisations in which they work.

*b. Description*

Staff development should include not only classroom training, but also visits and attachments to organisations and facilities in other countries. There may also be opportunities for staff development by requiring attachments to consultant teams or foreign/national joint ventures when consultants are engaged for waste management studies and projects. Distance learning (correspondence courses and Open University courses) provides another possible method.



In-house training should be provided for all manual and semi-skilled staff, particularly in the areas of health and safety and customer relations. There should be a mechanism for briefing and training all levels of new staff whenever they join, not forgetting contract staff who are employed only for short periods.

Codes of practice are a useful tool for improving operational standards. They should be developed for the local needs, taking into account local conditions and resources.

*c. Justification*

The people that manage and run waste management services and facilities are perhaps the most important part of the systems, having the greatest impact on the quality of the service delivered. It is vital that they are given effective and relevant training and exposure, and that their work situations are such that they can put into practice what they have learned.

*d. Indicator*

It is difficult to measure the impact of professional training, but it is appropriate to investigate whether the available training is relevant to the needs of the individual and whether improvements are identified and implemented as a result of various kinds of training. The number of person.weeks devoted to training is a simple indicator, provided that the courses have been carefully screened to ensure that they are relevant and at the right level. Reports related to training activities, and assessment of performance before and after the training are subjective indicators, but nevertheless useful in certain situations.

*e. Responsibility for implementation*

Each organisation should have a senior manager who is responsible for the professional development of the staff of the organisation, and who seeks to develop a training plan for each individual, and to be aware of all relevant training opportunities.

*f. Resources required*

Travel and tuition costs in conventional training programmes are significant expenditures, so it is important to ensure that the programmes that are selected are relevant and that the right staff attend. The need to cover for senior staff when they are away on training programmes is a significant resource constraint in many organisations. The University of the Indian Ocean provides relevant programmes in countries that do not have universities of their own.

*g. Prerequisites*

There is a long list of important prerequisites for effective training including the matching of the course content to the local needs, and the trainee to the level and language of the training programme. It is helpful if there is a way of encouraging trainees to continue in the field for which they have been trained, and preventing their transfer to another department (where the training is not relevant) by the employer.

### **C.3 DEVELOPMENT OF A WASTE MANAGEMENT POLICY**

*a. Objective*

The objective is to have an agreed policy that favours waste minimisation and resource recovery.

### b. Description

This task involves the adoption by government of a statement, perhaps only one page, which states that the government is committed to the principle of sustainable development, and that it will undertake to conserve resources, to minimise the impacts on public health and pollution that are caused by solid wastes, and to develop a system of solid waste management that can be sustained, being based on an agreed plan, having a reliable source of funding, and with the broad agreement and support of the stakeholders. It should endorse the concept of integrated waste management, and the objectives of waste minimisation and resource recovery. The policy statement should refer to important international agreements, such as Agenda 21, to support the thrust of the policy. Policy concepts that have been adopted in industrialised countries include the following:

- *Responsibility* - Generator responsibility means that the person or organisation that discards any material retains responsibility for the management of that waste through to ] the final disposal stage - also known as the duty of care. Producer responsibility means that the manufacturer of the item or material is responsible for it when it becomes waste - this is used to encourage the recycling of packaging.
- *Proximity* - if possible, wastes should be treated and disposed close to the place where they are generated - to avoid long journeys and reduce opportunities for losing control of the waste.
- *The polluter pays* - The generator should pay all management costs for the waste that is generated. (This concept may not always be appropriate, as discussed in Annex E.2.1.)
- *The waste management hierarchy* - There are various formulations, but typically it states that reduction of wastes is better than reuse, reuse is better than recycling, recycling is better than energy recovery, and energy recovery is better than land disposal.
- *BATNEEC* - Best available technology not entailing excessive cost. The principle argues for careful selection of technology to minimise health and environmental impacts, provided that it is not disproportionately expensive.
- *Proportionality* - This means that in deciding on priorities one should assess the risk or seriousness of the problem one is trying to avoid. (For example, very small quantities of waste are not as great a threat as large quantities.) It argues for a reasonable approach, based on understanding.

It must be emphasised that the policy should be tailored to suit the local situation, with the overall objectives of protecting public health and the environment. For example, it would not be wise to invest money and time in a sophisticated recycling project for a particular city if the waste is not being collected from most of the city, and there are piles of waste in the streets and blocking drains. The policy should be a working tool, not a showpiece. It should be a garment that fits, that is the right size.

### c. Justification

It will not be possible to take actions that promote good waste management unless there is agreement about the aims for waste management, which will generally include reducing the quantity of waste that needs disposal, and reducing the environmental pollution that comes from waste. These requirements will entail expenditure and place some responsibilities on certain industries, and so they may not be popular in some quarters. It is therefore important to have the agreement and understanding of the government for the objectives.



*d. Indicator*

The existence of a document, which has the support and authority of the government.

*e. Responsibility for implementation*

The preparation of document should be the responsibility of the ministry responsible for the environment, but senior government leaders should be closely involved at every stage, so that all will be able to endorse the final policy document.

*f. Resources required*

Similar policy statements from other countries would provide useful guidance and encouragement.

*g. Prerequisites*

The statement cannot be prepared until there is general support for the concept among senior political leaders. Examples or endorsements from friendly countries and donors may be helpful.

#### **C.4 WASTE MANAGEMENT PLANNING**

*a. Objective*

The objective is develop and publish a comprehensive plan, for a ten year period, but including short- and medium-term targets, and to review and update the plan at regular intervals, so that action can be taken and services and facilities provided in a considered and efficient manner, with due regard to the needs and viewpoints of all stakeholders.

*b. Description*

The plan should include the needs for facilities such as transfer stations and sanitary landfills, and allow sufficient time for the selection and acquisition of land and for obtaining the necessary planning and operational consents, including public meetings.

Two key elements of the plans should always be cost recovery and human resources development.

Plans should be based on data that have been collected with due regard for the required degree of accuracy and scope, and on the results of pilot tests and investigations.

*c. Justification*

In many situations where waste management is not planned, there are problems such as

- a lack of integration between collection, transport and disposal operations, resulting in low efficiencies and extra cost;
- the use of unsatisfactory disposal sites (unsatisfactory in terms of location, geology or size), because sufficient time and resources have not been allowed for identifying and assessing a number of potential sites;
- the adoption of technologies and management systems for collection, treatment and disposal that have not been investigated and improved in pilot tests, and which prove to be ineffective or inefficient;

- insufficient funding for major capital expenditures, and
- a mis-match between the requirement for technical skills and the available skills, because training needs have not been foreseen and provided for.

To avoid these problems and others, it is essential to plan (for the coming ten years), and to update plans at regular intervals.

*d. Indicator*

The existence of a written plan is itself an indicator, but proof of regular revision, and of the application of the plan in management decisions, is also important.

*e. Responsibility for implementation*

It is, unfortunately, common for senior managers to be too busy with routine administrative matters so that they do not have time to set long-term goals and to plan the way to achieving these goals. Overseas consultants may then be called in to prepare a master plan, but if this is done without extensive participation of local managers, the plan may be left on a bookshelf because local managers do not feel it is applicable and do not have a sense of ownership towards the plan.

*f. Resources required*

The primary requirement is for the time of professional waste management staff and stakeholders. The preparation of the plan may require a considerable investment of time and resources to collect data.

*g. Prerequisites*

The main prerequisite is that senior managers and decision-makers should believe that the planning is essential. Another requirement is reliable information about existing operations and resources so that the starting point of the "journey" is known.

## **C.5 UPGRADING DISPOSAL FACILITIES**



*a. Objective*

The objective is to reduce the health risks, pollution and nuisance caused by solid waste disposal operations.

*b. Description*

The upgrading task depends very much on the condition of the existing disposal sites. In some cases the first step in upgrading may be to improve the road that leads to the site, and to stop the practice of burning the waste. In landfills that are operated in a much better way, there may be a need to improve the way in which the polluted water (or leachate) is managed, or to add vents for releasing the gas that is generated within the mass of the deposited waste. Upgrading must often be achieved by a step-by-step approach - gradually improving operational standards and site infrastructure, so it is necessary to evaluate the current situation at the disposal site to determine what the next step should be.



*b. Description*

The upgrading task depends very much on the condition of the existing disposal sites. In some cases the first step in upgrading may be to improve the road that leads to the site, and to stop the practice of burning the waste. In landfills that are operated in a much better way, there may be a need to improve the way in which the polluted water (or leachate) is managed, or to add vents for releasing the gas that is generated within the mass of the deposited waste. Upgrading must often be achieved by a step-by-step approach - gradually improving operational standards and site infrastructure, so it is necessary to evaluate the current situation at the disposal site to determine what the next step should be.

*c. Justification*

Poorly designed or managed solid waste disposal sites are breeding grounds for insects and rodents that transmit disease. Waste pickers at such sites are exposed to illness and injury. Air, water and soil can be polluted if a site has been poorly designed or is poorly managed. It is normal for the public to protest if a disposal site is to be located near their homes, but if the site is well run, the offence and nuisance of waste disposal are much less than for an uncontrolled dump.

Some nations are planning to compost all their biodegradable waste, so that the pollution caused by landfilling this type of waste is avoided. However, it is unlikely that all compostable waste will be diverted from landfills in the medium term, and there are always rejects that require landfilling, so there will be a need for good sanitary landfills for some time to come.

*d. Indicator*

Indicators should be defined in terms of reduction of pollution and operational standards that are achieved. More information on this issue is available in the recent World Bank/SDC/WHO Decision-makers' Guide (Thurgood, 1999).

*e. Responsibility for implementation*

Waste disposal sites may be operated by private companies or by local government, but the responsibility for the standards of operation rests with the appropriate government agency, whether as operator, client or inspection authority.

*f. Resources required*

The cost of improvements depends on the type of work that needs to be done and the local conditions. A key resource in any landfill improvement is the site manager - the value and impact of any upgrading measure depends very much on the knowledge, leadership and effort of this manager.

*g. Prerequisites*

Since the action is tailored according to the current situation, the only general prerequisite is the legal right to use the existing site.

## C.6 INCREASING THE FUNDS FOR SOLID WASTE MANAGEMENT

### a. Objective

The objective is to increase the funding that is available for solid waste management.

### b. Description

It may be possible to win a guarantee of a significant and enduring increase of financial support from local or national government, but very often the only way of increasing revenue is by direct collection of a waste management charge, provided that this revenue can be retained for exclusive use in waste management.

This could involve reviewing mechanisms that are used in the Region and elsewhere in the world for collecting payments from waste generators for the service they receive. Funding should be

- sufficient to cover the costs of the collection and disposal services (including the long-term costs of managing sanitary landfills after they have been closed to incoming waste);
- easy to collect without involving repeated visits or mailings;
- enforceable, having an effective sanction to discourage non-payment, and
- (in some situations), related to the quantity of waste that is generated at the particular source, so that there is an incentive for reducing waste quantities.

Further points relating to this issue can be found in Annex E.2.1

### c. Justification

One of the major reasons for failures of solid waste management systems in many places appears to be the lack of sufficient funding for operations, or the unpredictability of funding so that managers cannot plan their operations and capital expenditures, because they never know what money will be available in the future. Organisations that collect their own revenue usually have more autonomy to plan their expenditures. Charging directly can have beneficial side effects, such as increasing the accountability of the service provider to the generators who pay the fee, and increasing the involvement of generators in the service and in maintaining standards. Charges may also have some impact on initiatives to reduce the quantities of waste that are generated.

### d. Indicator

There are various possible indicators, including the percentage of the sum billed that is actually received; the percentage of recurrent expenditure that is paid from the revenue that is collected, and the money that is set aside each year for replacement of vehicles when this becomes necessary.

### e. Responsibility for implementation

National governments may be required to provide guidelines and amend legislation. National or local bodies could be involved in investigating possible revenue generation mechanisms.

### f. Resources required

A multidisciplinary team may be needed. This team might comprise a social scientist for identifying the public perception of the most appropriate method for revenue generation, a legal expert for drafting any necessary changes in legislation, a financial specialist and an expert in local government administration.



*g. Prerequisites*

The political will to risk unpopularity with the electorate at the introduction of a new or increased fee.

A new system of waste collection, or an improved standard of service, so that waste generators feel that they are receiving something in return for the extra fee that they are being asked to pay. Willingness to pay may be boosted by a public awareness campaign. There should also be effective enforcement of prohibitions on illegal dumping, if the extra charges are likely to cause this problem.

**C.7 STRENGTHENING LEGISLATION, MONITORING AND ENFORCEMENT**

*a. Objective*

The objective is to develop, strengthen and apply effective legal instruments to promote waste reduction and resource recovery and to ensure satisfactory standards of management of wastes from all sources. In some cases it may be necessary to draw together and unify - or to harmonise - legislation from different Acts.

*b. Description*

Whilst it is recognised that laws by themselves are not sufficient to ensure that satisfactory standards of waste management are achieved, they are a vital component of any strategy for promoting waste minimisation and resource recovery, particularly if accompanied by effective enforcement and financial instruments. (These issues and other aspects of legislation are discussed in more detail in Annex E.2.2). Legislation may also require generators to collect and make available operational data, which may be subject to spot checks.

*c. Justification*

Whilst laws are essential for promoting waste management practices that minimise environmental degradation and protect against illness and accident, they are also important in providing a framework for waste minimisation and resource recovery, particularly in terms of defining responsibilities and authorising financial aspects.

Revision or unifying of existing laws may be needed because new requirements may have arisen since the last legislation on the subject was enacted. Apart from the need to review fines and other penalties, new situations (such as the involvement of the private sector, the promotion of waste minimisation and resource recovery, and new standards for sanitary landfilling) may require new laws.

*d. Indicator*

When a law is first introduced, its impact can be monitored in terms of the numbers of warnings that are given to offenders. Later the numbers of prosecutions, convictions and repeat offences can give an idea of the impact of the legislation. In some cases it may be possible to measure the degree of compliance.

*e. Responsibility for implementation*

Government agencies responsible for waste management and environmental protection, working together with local authorities and the office of the Attorney General.

*f. Resources required*

Effective laws take time and expertise to formulate. Legislation that has been enacted in other Small Island Developing States, and experience in applying this legislation may provide useful guidance. Expertise in the application of international conventions and the legal frameworks of other countries may also be needed

*g. Prerequisites*

The political will to improve the situation.

Before the legislation is drafted there should be a thorough review of the needs of the waste management sector, including inputs from the general public, waste management professionals, environmental protection officers, lawyers who specialise in environmental issues and individuals or organisations involved in resource recovery.

Before a law is enforced, it is essential to check that compliance with the law is possible and reasonable. To quote a simple example, the public should not be required to put segregated biodegradable waste into a green bin if no such bins have yet been provided. Requirements for industry and hospitals should allow a reasonable length of time for facilities to be installed, and should not require unrealistic standards.

## C.8 HAZARDOUS AND SPECIAL WASTES

*a. Objective*

The objectives are to develop or strengthen the control of hazardous waste management practices, to provide improved facilities for storing and treating hazardous and special wastes, and to reduce the quantities of hazardous wastes generated by the industrial and agricultural sectors, and the associated risks.

*b. Description*

The main aspects to be considered are discussed in Annex E.2.3. In summary these aspects include

- providing secure storage for any hazardous or unidentified wastes of which the authorities are already aware;
- collecting data on industries and other sources which are likely to generate hazardous wastes;
- developing legislation which defines which wastes are hazardous, how the movements of these wastes are to be logged, procedures, responsibilities and duties, and penalties for breaking the law;
- identification of satisfactory disposal routes for hazardous wastes arising within the country;
- training of inspectors and equipping of laboratories;
- links with the control of importation of hazardous chemicals;
- public awareness;
- developing and implementing measures to reduce the quantities of waste that are being generated and to reuse hazardous wastes where this can be done in a safe and environmentally acceptable way.



*c. Justification*

Some wastes have the potential for causing serious impacts on public health and the environment. In some countries (such as USA and UK) little action was taken until there had been a disaster, or until a disaster was narrowly averted, and public concern became irresistible. It is clearly preferable to prevent a disaster than to react to one.

The high cost of the treatment and disposal of such wastes encourages unscrupulous operators outside (and perhaps inside) the country to find ways of disposing of hazardous wastes at low cost and with no consideration of the welfare of people living and working near the place of disposal. It is therefore of great environmental - and significant financial - benefit if ways can be found of avoiding or minimising such wastes.

*d. Indicator*

It may take some time to make an accurate assessment of the total quantities of various kinds of hazardous wastes that require special disposal. In the meantime a record of the quantities of waste handed in to the temporary facility would show the extent to which this issue is taken seriously and whether public education campaigns were having an effect. The development of a detailed inventory of hazardous wastes would also be a clear testimony to progress.

*e. Responsibility for implementation*

It is likely that the ministries with responsibility for industry and the environment would both be heavily involved, together with the Attorney General's office and the Ministry of Foreign Affairs (which would have an important function in linking up with other countries with similar problems and in organising shipment and disposal). If another ministry is responsible for customs, and licensing and inspection of imports, it should also be included. In most cases it would be appropriate for the environmental ministry to take the leading role.

Government may provide some help to industries in terms of consultancy advice regarding the management and minimisation of hazardous wastes, or the industries themselves may be required to engage consultants at their own expense.

*f. Resources required*

Initially, apart from the construction and staffing of the storage facility, there would be the need for the services of a laboratory capable of analysing the wastes and evaluating possible disposal methods (such as burning of waste oil), and the human and financial resources needed for the public education component.

Making an inventory involving industries that generate hazardous wastes would involve a survey team to visit and inspect industrial premises. Inspectors with a good understanding of industrial chemistry and with a strong motivation to reduce environmental pollution are required to monitor the use and disposal of hazardous substances. There might be a considerable need for training for the survey team and for inspectors.

Framing the legislation would require legal expertise and contacts with, and visits to, other neighbouring countries to learn from their experiences, become familiar with their facilities, and develop arrangements for co-ordination.

Expertise is needed to advise industries regarding methods of waste minimisation, which are appropriate. A network or co-ordination system between industries - both within each nation and on a regional basis - could promote waste exchanges and the sharing of experience.

### *g. Prerequisites*

An important prerequisite is a legal definition of the terms hazardous and/or toxic, so that it is clear which wastes need special attention. In order to persuade decision-makers that action is necessary, it would be helpful to conduct a preliminary survey to assess approximately the quantities and nature of the hazardous wastes that require disposal. In order to develop public concern and support, it might also be helpful to assemble case study information concerning disasters and emergencies that have been caused by hazardous wastes (such as the Love Canal episode in northern USA), or, if information is available, incidents closer to the Region. A clear differential between the costs of treating and disposing of hazardous wastes, and the costs for other wastes would help to motivate industrialists to minimise the quantities of hazardous material that they generate.

## **C.9 WASTE REDUCTION**

### *a. Objective*

The objective is to reduce the quantities and risks of waste that are presented for refuse collection by changing consumption habits and encouraging on-site resource recovery.

### *b. Description*

Domestic wastes can be reduced by

- making products available that result in less waste, and banning alternatives that cause significant environmental problems
- changing shopping habits so that less packaging is used,
- encouraging on-site processing of waste (such as back yard composting)
- promoting the use of scrap dealers and bring centres so that material can be recycled without it entering the waste stream or being contaminated.

By changing their habits, consumers can reduce the quantities of waste they generate by refusing unnecessary packaging (such as plastic bags), by selecting items that have less packaging, or by buying items in containers that are reused, and returning the containers before they enter the waste stream.

Financial instruments, such as a refundable deposit that must be paid for each drinks can or bottle, can encourage consumers to return containers to retailers instead of discarding them. A deposit system can also be used to encourage the return of batteries, car tyres and other wastes to retailers.

Charges can be levied on items that cause particular problems in disposal and for which less troublesome alternatives exist. In this way it may be possible to motivate industries to operate more efficiently so that they generate less waste, or they may find other raw materials that are safer or simpler to handle and dispose of. (This is discussed more in the context of hazardous wastes in Annex E.2.3.) The income generated in this way should be devoted to waste management.

If there is already some concern for environmental issues, the "Eco-labelling" system could be introduced, so that shoppers would be able to select products that cause less harm to the environment, as determined by life cycle analysis.

Retailers can be obliged to accept packaging back from customers, and arrange for it to be recycled.



Control of the quality and probable life of imports is another way to reduce waste generation. If controls are placed on the importation of old cars or used tyres, and on goods that are of such a low quality that they will quickly be discarded, there will be a reduction in the quantities of associated waste.

Waste minimisation is also understood to mean minimising the problems caused by wastes. It may therefore be helpful to investigate options for banning certain substances or packaging products that are causing environmental problems (Clearly there are limits to the extent to which small nations can influence the methods of packaging used by large international producers; but there are opportunities which should be exploited.)

Public awareness campaigns, legislation, and financial incentives or penalties can all be used to promote such changes in consumption habits.

*c. Justification*

If quantities of solid wastes that require collection and disposal are reduced, the costs of these operations are correspondingly reduced. The space required at landfills is reduced, so land fill sites have longer lives, and less land is needed for disposal. If wastes that are particularly polluting are reduced, pollution is less.

*d. Indicator*

The amounts of wastes generated by large sources - such as industries - may be estimated or measured for charging purposes, so the weight or volume of wastes generated per ton of production would indicate the success of waste reduction measures.

If domestic wastes arriving at transfer or disposal sites are weighed, it would be possible to plot the monthly average weight collected divided by the population. Without waste minimisation initiatives, the per capita weight would be expected to rise. If this figure shows a long-term trend (allowing for seasonal effects) of a reducing increase, or even a decrease, this is a clear indication that the waste reduction programme is having an effect.

*e. Responsibility for implementation*

Legislation should be promoted by either the ministry responsible for the environment or the ministry responsible for local government. Public education campaigns might be directed by an interministerial group or entrusted to an NGO if it had the necessary experience and resources.

*f. Resources required*

Changing the habits of consumers is a major task, requiring repeated reminders and probably using a variety of media. Setting up an eco-labelling scheme would require considerable research into the environmental impacts of a wide range of products and packaging, unless information from a similar scheme relating to the same products were available.

*g. Prerequisites*

The political will to improve the situation, and some degree of public concern for environmental issues.

## C.10 RESOURCE RECOVERY

### a. Objective

To divert more wastes away from landfilling and to obtain further economic benefit from waste materials in a sustainable way.

### b. Description

This may involve starting new recycling routes, modifying tax systems so that secondary materials are not penalised, or easing the constraints on existing practices. This is discussed in more detail in Annex E.2.4.

### c. Justification

Resource recovery can reduce the costs of disposal by reducing quantities that go to landfill, provide employment for those who collect and process the recyclable materials, and reduce the demand for virgin materials.

In some situations it is cheaper to landfill all wastes in an environmentally acceptable way than to return some components to the economy, so extra taxes on landfill may be needed to make resource recovery more attractive financially. Sometimes tax concessions favour the use of virgin materials and penalise the use of secondary materials; such an arrangement clearly does not favour waste minimisation and resource recovery.

By preventing the importation of items and materials that have a negative environmental impact and by taking a variety of measures to encourage resource recovery, the quantities of wastes requiring disposal can be minimised, and the impacts on the environment can be reduced.

If a recycling operation is functioning well it is advisable not to require many changes, but rather to determine if there are any barriers that are preventing the operation from expanding or developing, and to find ways to remove or reduce these barriers. If major changes are required but the effects of any changes are not well understood, there could be unexpected repercussions, which might damage or destroy the operation.

Some of the suggested actions would require the development of collection systems for particular types of recyclable materials. One way of increasing the supply in some situations would be to announce an increase in the price paid for particular materials, so that children and informal sector waste pickers increase their efforts to collect this material. However, because of the health risks associated with looking for recyclable materials in mixed waste, it would be preferable to develop source segregation of wastes by generators themselves. In general it is not recommended that government become directly involved in the supply of recyclable materials to the recycling industry, because government's expenses tend to be high, and the productivity of government labourers tends to be lower than those in the private and informal sectors.

### d. Indicator

The most important indicator for the purposes of this project is the amount of waste that is diverted to recycling operations. If all the waste that is generated is always collected, then the reduction in the quantity of waste going to the disposal site would be a useful indicator, but in many cases a reduction might be caused by shortcomings in the collection system, or it could be related to waste reduction measures rather than recycling.

If it is possible to collect information on the tonnage of materials that is diverted each year from the waste stream into recycling, this would provide a useful indicator of developments in



this field. In most cases the recycling industry is scattered in many small units, making data collection difficult. It might be more feasible to collect information on the value of recycled goods that are sold each year. Otherwise indirect indicators, such as the number of reprocessing facilities that are set up, or the number of drop-off centres that are established, could be used.

*e. Responsibility for implementation*

Many waste management authorities are struggling to collect all of the solid waste from urban areas and dispose of it in a satisfactory way, and so are not able to undertake extra work to develop waste minimisation and resource recovery. In such cases NGOs and industrial associations may be able to participate in the implementation of this work, and the private and informal sectors may be attracted if the operation is likely to prove financially rewarding.

*f. Resources required*

The resource requirement depends greatly on the type of work to be carried out. A thorough audit of a large industry could require many days of a consultant's time, but other questions might be answered from simple pilot trials and reference to the Internet (remembering that information obtained on the Internet should be checked for relevance to the particular situation, and for accuracy).

One or more recycling officers at national and local level could have a useful and continuing role in developing such initiatives. Finance for small research projects to be undertaken by NGOs or a local university might be cost-effective. Implementation of bring or drop-off centres would require land, containers and a collection service.

*g. Prerequisites*

Many options would require one or more entrepreneurs who are willing to take a commercial risk and set up a plant, labourers who are willing to work with waste, separating or collecting material for recycling processes, for a relatively low wage, and a sufficient local market for the goods that are to be produced.

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<sup>3</sup> In some countries there are associations of manufacturers, which are dedicated to developing resource recovery of their products for a variety of reasons (such as a concern for the environment, public relations, or to discourage other measures which would be unpopular with the industry.)

## C.11 IMPROVING CAPACITY TO PRODUCE AND DISTRIBUTE COMPOST

### a. Objective

The objective is to increase the percentage of biodegradable municipal waste that is converted into compost. There may also be other objectives such as the improvement of the character of the soil, or increased vegetable yields in poor soils and situations of food shortage.

### b. Description

There are several ways of utilising biodegradable waste to improve the quality of agricultural soils

- Raw waste may be spread on or dug into the soil, but if the waste is contaminated with glass or plastic, long-term pollution of the soil may result. This practice may also take nitrogen away from plants (as the bacteria responsible for the degradation process take nitrogen from the soil to compensate for the lack of nitrogen in the waste).
- If waste is buried and there is sufficient moisture, the waste undergoes anaerobic decomposition. This can be done at the household level as well as by communities. Decomposed waste from landfills is sometimes dug up, screened and used as a soil conditioner; this practice can be satisfactory if the concentration of heavy metals in the material is low.
- For many years biogas has been produced from the anaerobic digestion of biodegradable waste. The feed material is usually mostly animal manure, but human excreta and vegetable wastes can be added. There are some experimental plants that are being used to apply this technique on a large scale to municipal solid wastes, but the process is not yet well established, and there may be little demand for the wet, partially digested organic material resulting from the process. (See also Section C.14.2 for comments about the use of this process for treating wastewater sludge.)
- Aerobic composting requires careful control of the amount of moisture in the waste and the replenishment of the oxygen that is used by bacteria. It can be done by manual or mechanical methods, at any scale, from the household level to large factories. This process is quicker than anaerobic composting, but requires more effort and supervision.
- Vermicomposting uses worms to produce a very good quality of product. It is usually done on a small scale. Careful control of the moisture level and temperature are needed to maintain conditions that are suitable for the worms.

A key feature of successful composting schemes is that it is seen as a production process, not a disposal process. (Whilst it is true that composting is the most environmentally-friendly method of disposal, the costs and the need for operational control are such that it is unlikely to be feasible without a sufficient demand for the product.)

The activities required to achieve this objective vary from country to country. There are many possible approaches in terms of the scale of operations and the agent responsible. The smallest level is the flowerpot in which earthworms are fed with cut vegetable wastes, and the largest is a mechanised factory processing hundreds of tons per day. Composting may be undertaken by a farmer or an urban family, by a



community, an NGO, an institution such as a school or hospital, by an industry, by a contractor or by a governmental agency. In some cases there may be a need to train operators in methods of composting and in how to produce a better quality product. In other situations the need may be to find ways of increasing the demand for compost from the agricultural and horticultural sectors, or to determine the size and type of operation that can be supported by local resources and demand. In other countries the need may be to develop segregation of wastes from houses or markets so that contamination levels of the product are low. Another need might be to raise the extra revenue needed to divert waste from landfills to composting operations.

*c. Justification*

Since a large part of the solid waste in most countries represented consists of biodegradable organic matter, composting of this fraction can be a very effective way of reducing the quantities of waste that need to be landfilled. Composting is the most environmentally satisfactory method of disposing of biodegradable solid waste, but financial difficulties have often caused composting operations to close, and low demand for the product has constrained the size of many operations. Investigations are needed to resolve these issues if quantities of waste going to landfill are to be significantly reduced.

*d. Indicator*

A simple indicator that reflects success in achieving this objective is the increase in weight or volume of product compost that is sold. An alternative, which would be more appropriate where there are many small-scale composting operations, would be the reduction in the percentage of biodegradable matter in the waste (though measurements would need careful and laborious assessment and compensation for seasonal variations in fruit, vegetable and yard waste, and should concentrate on loads coming from areas where small composting operations are known to exist).

*e. Responsibility for implementation*

It is important that the agricultural sector - including the ministry or government department that is responsible for agriculture - should be heavily involved in this activity, since the key to success often lies in persuading local farmers to use the compost in their fields. In the case of household operations, community-based organisations, local government and interested individuals could play a decisive role.

*f. Resources required*

The resource requirements depend upon the nature of the problem that needs to be solved.

- Household composting could be promoted by a cadre of trained volunteers or local government employees, with the possibility of free or subsidised containers in which the composting could be done.
- Farmers - whether they produce the compost themselves or are encouraged to use material produced elsewhere - would need support from agricultural extension workers, and there should be demonstration plots to show improved yields with compost.
- Generators of waste (whether homes, restaurants and hotels, or markets) would need intensive awareness and educational inputs to persuade them to keep biodegradable waste separate from other solid wastes.

- Local government, entrepreneurs and contractors should have access to an advisory service so that they can obtain advice about initial steps, process problems, marketing strategies, and other aspects of this work. (This advice could be provided free of charge, or for a fee or subscription.)
- In some cases entrepreneurs are provided with government land, rent-free for a certain period, on which large-scale operations can be located.
- Financial arrangements regarding the supply of waste vary greatly. In some cases compost plant operators have actually paid local government for the waste. However, it seems reasonable that local government should pay to the compost operator for each ton of waste that is accepted, a sum equal to the cost that local government pays for disposal of one ton of the rest of the waste - in other words the money saved or the avoided cost.

*g. Prerequisites*

There must be a regular supply of suitable biodegradable waste - implying a regular solid waste collection service and a means of separating unsuitable material from the biodegradable waste that is to be composted.

## C.12 IMPROVING COLLECTION SERVICES

*a. Objective*

The objective is to provide a regular waste collection service to a larger proportion of the urban populations. There may also be supplementary objectives, such as to increase the frequency of the collection service, or the service level or standards.

*b. Description*

This is a very important objective. To make a significant long-term improvement there needs to be a careful evaluation of the causes of the deficiencies in the existing service. Often the causes are linked to insufficient cost recovery, lack of technical capacity and managerial leadership, and excessive political interference. Because the possible causes are many, the first step is to investigate the current situation in order to diagnose the reasons for inadequate performance. Simply providing trucks may provide only short-term relief, and can make the situation worse.

Involving the private sector in waste collection has improved performance in many cases, but an improvement is not guaranteed, and careful supervision and monitoring are needed to ensure value for money and an effective service.

*c. Justification*

There are strong public health and environmental reasons why it is important to prevent the accumulation and retention of waste within urban areas, so removal - usually by motor vehicle - is a necessity in dense urban areas.

*d. Indicator*

The best indicator is to monitor the weight of waste that is brought to the disposal site. If no weighbridge is available, the total volume of waste transported can be estimated. Other indicators might include the effectiveness of revenue collection or the number of vehicles that



are ready for service each day, depending on the common causes of the failure of the collection and transport service. Another indicator would be the number of informal piles of waste in a particular urban area, and the length of time that these piles are left uncollected - such piles could be monitored by municipal supervisors or by community members.

*e. Responsibility for implementation*

It would be helpful to set up an oversight committee to monitor and guide efforts to improve collection services. This committee should include representatives of the residents and businesses that are served.

In many cases it may be necessary to engage outside experts who report to senior municipal administrators.

Managers and engineers working in the organisation responsible for day-to-day operations should play as large a part as possible in the design and implementation of improvements, because of what they can learn from the exercise, and to maximise the sense of ownership for the proposed improvement plan.

*f. Resources required*

It is important to understand the reasons for the inadequacy of the collection service. A common problem with municipal workforces is low productivity, and if a contractor provides the service problems may lie in the contractual arrangements and the methods of monitoring performance. Often the solution to such problems is assumed to be the need for new trucks, but this may not solve the underlying problems. It may, therefore, be helpful to engage a specialist consultant to identify the reasons for inadequate service, provided that the consultant has experience in improving operations (rather than recommending completely new systems). The opinions and preferences of the generators (residents and commercial generators) should be surveyed and considered. The expenditures involved in waste collection and transportation are large, so significant financial resources may be needed to fund purchases and to provide for operational expenditures.

*g. Prerequisites*

There must be a strong desire in both politicians and people to make and support lasting improvements, even if they are painful.

## C.13 MANAGEMENT OF HEALTHCARE WASTES

*a. Objective*

The objective is to reduce the health risks to the staff of healthcare establishments, to contractors' staff responsible for handling, transporting and disposing of healthcare wastes, and the people who use hospitals and clinics or live near them.

*b. Description*

Improvements to healthcare wastes management systems must not only consider the method of final disposal, but also the storage, handling, transport and treatment of the waste - that is all stages from generation to disposal. Particular local conditions, including the involvement of informal sector waste recyclers, the awareness of the associated health risks and the provisions for collection of general wastes, must all be considered in the preparation of the plan.

Often only a small percentage of wastes generated by hospitals are significantly more dangerous than domestic wastes, so a vital component of most systems should be the segregation of hazardous wastes from others so that the quantities of waste that receive special treatment are as small as possible. The hazardous wastes should be kept separate from other wastes at all stages from initial storage to final disposal.

Improvements may be piloted in larger or more advanced hospitals, but the aim should be to extend the improvements to all healthcare establishments, large and small, since even small quantities of hazardous wastes mixed with domestic wastes can contaminate the whole load and put collection labourers at risk.

There are distinct advantages in minimising the quantities of waste that are generated, provided that the general level of hygiene is not compromised by internal reuse of items without complete sterilisation.

Informal sector recycling of hazardous healthcare wastes (such as syringes and outdated medicines) can be a serious danger to the recycling workers and to the general public, and so it is important to ensure that such recycling does not take place.

#### *c. Justification*

Staff in hospitals and related establishments have died as a result of infections contracted through unsatisfactory handling of healthcare wastes. Waste collection workers, recycling workers, patients and nearby residents may also be put at risk. Air and water pollution can result from unsatisfactory management of solid and liquid healthcare wastes. The public reaction to poor management of healthcare wastes, particularly needles and recognisable body parts, is often very strong. The costs of good healthcare waste management can be high, so quantities should be minimised by careful segregation.

#### *d. Indicator*

Accidents relating to the management of hazardous healthcare wastes and incidents of lapses should be recorded scrupulously to indicate any improvement in practices. The proportion of hospitals that practice source segregation of hazardous wastes and that have satisfactory handling and disposal systems can also be used as an indicator of progress.

#### *e. Responsibility for implementation*

One of the most important steps in the improvement of healthcare waste management is the identification of responsibility, both at the operational level and regarding supervision and planning. Some senior hospital doctors and administrators are surprisingly unconcerned about this problem, so it may be necessary to set up a task group including representatives of the municipal waste collection and disposal service, representatives of medical establishments, labour union leaders to represent staff, and a representative of the government's environmental agency.

#### *f. Resources required*

The most important resource is the person within the hospital who is responsible for the management of the wastes. If that person is trained, motivated and supported, much can be done to reduce risks, even with small capital inputs. On the other hand, without effective leadership, even expensive equipment may have little effect on risks and operational standards. Some important and effective measures, such as providing training for staff



and the introduction of a colour-coded two-bin system for waste segregation, are not particularly expensive. If hazardous wastes are to be transported outside the premises of the generating establishment, a special vehicle is necessary. Some treatment methods are expensive both to set up and to operate.

*g. Prerequisites*

The main prerequisite is the readiness of healthcare administrators to do something to reduce the risks posed by hazardous wastes.

## **C.14 MANAGEMENT OF WASTEWATER**

### **C.14.1 Minimising wastewater quantities**

*a. Objective*

The objective is to reduce the volume of polluted water that is discharged from homes, industries and other sources, so that the requirements for treating wastewater are less, and less pollution enters natural water bodies.

This objective is linked to the reduction in water consumption, which is particularly important for islands with scarce or expensive water supplies. However, it should be pointed out that the actual pollutant load (which includes organic matter and disease organisms) is not changed by water conservation measures, but is simply carried in a smaller quantity of water.

*b. Description*

Water consumption in homes can be reduced by public education programmes, by control of the pressure in the water supply mains, and by water saving devices (such as toilet pans that can be flushed with less water, water meters and fittings that restrict the flow of water).

It is commonly believed that water-borne sewerage systems are preferable to on-site disposal systems, but the disadvantage of these conventional systems is that they use large quantities of water to flush toilets and move wastes along the pipes. An increase in the number of connections to sewer systems is therefore likely to result in an increase in water consumption.

There have been many cases of industries that have made dramatic reductions in water consumption and wastewater generation when they have been obliged to by rationing of water supplies or increased water charges. Financial motivation to make reductions can be very effective and simple to apply, if backed up by the necessary political will. Industries may be able to use relatively clean wastewaters for purposes that do not require a high purity (such as cooling water or preliminary washing) or they may treat their wastewater until it is of a sufficient standard to be reused for some applications. The effectiveness of treatment may be enhanced by changes in some of the processes or chemicals (for example, the use of biodegradable dyes).

By finding ways of reducing wastage and promoting the internal reuse of some forms of wastewater, industries may save on water charges and be better able to cope with droughts and water shortages.

*c. Justification*

Smaller quantities of wastewater result in lower pumping costs, and may allow a delay in the construction of extensions to wastewater treatment plants. The resulting conservation of water resources can be a major benefit in water-scarce islands.

*d. Indicator*

If a wastewater treatment plant or pumping station has a facility for measuring the flowrate, such measurements can be used to indicate success by showing reduction in per capita wastewater generation.

*e. Responsibility for implementation*

Both water supply and wastewater undertakings should be represented in the body that works for reductions in wastewater generation.

*f. Resources required*

Since the variety of possible programmes is very broad, no general statement can be made about the resource requirements. A public education programme to encourage the repair of leaking taps may be possible at very low cost, whereas a programme to install water meters in every home could be very expensive.

*g. Prerequisites*

The main prerequisite is a concern to reduce both pollution and the costs associated with high wastewater volumes.

## X C.14.2 Reuse of wastewater

*a. Objective*

The objectives are to gain some economic benefit from wastewater, to reduce the demand on water sources and to reduce the pollution load that enters the environment.

*b. Description*

The quality of the wastewater has a strong influence on how it can be used. For example, untreated wastewater should never be used to irrigate crops of vegetables that are eaten raw, but it may be used for irrigating pasturelands. Careful attention must be paid to health aspects, particularly the survival of parasitic worms, especially where shoes are not always worn. The cultural beliefs of the people involved should also be carefully considered.

If municipal wastewater is to be reused for irrigation, it is important to control the discharges from industry into the sewers, or to use wastewater that has come from networks where there are no industries, in order to ensure that there are no toxic chemicals in the wastewater. As with other forms of resource recovery, it is important to consult possible users to determine whether they wish to use the treated wastewater, and to evaluate if they are likely to use it in a safe manner. The motivation for using it must also be considered - if a plentiful and dependable supply of fresh water is already available at a low cost, there is probably no reason why a farmer should be interested in using treated wastewater on his fields. (The treatment of wastewater to a high standard needs significant land areas, or relatively high expenditure on energy and chemicals, and so the costs of providing treated wastewater may be more than an underpriced borehole source.)

Wastewater can be separated into grey water from washing and laundry, and black water from toilets. Wastewater from kitchens is sometimes classed as grey water, and sometimes as black water. Grey water needs less treatment before it can be reused, in comparison with black water. Options for reuse of wastewater depend to a considerable extent of the design approval procedures for new buildings. After relatively simple treatment, grey water can be reused on-site for irrigation. (On-site use avoids the need for a duplicate drainage system.)



Sludge from wastewater treatment can be treated by anaerobic digestion and spread on fields to provide nutrients, moisture and organic matter, provided that it does not contain significant concentrations of heavy metals from industrial discharges. The anaerobic treatment itself produces methane, which can be used as a fuel. Sludge can also be composted with municipal solid waste or with other materials such as straw and woodchips.

*c. Justification*

The main reason why wastewater reuse is important is to reduce the demand for higher quality water. In some cases the organic matter in wastewater is seen as a valuable resource because it can enrich the soil and provide crop nutrients.

Islands have proportionately large coastlines, and often coastal zones are very vulnerable. There are often important environmental and economic reasons for protecting the coasts against any form of pollution. It is therefore of considerable benefit if wastewaters, even after treatment, are not discharged to the sea, but are reused on land.

*d. Indicator*

The best indicator is the volume of wastewater that is put to productive use in a given time period, either in absolute terms or as a percentage of the total wastewater volume.

*e. Responsibility for implementation*

Such reuse schemes could be operated by the owners of private property, or by agencies that are responsible for agricultural development or wastewater disposal. Government agencies that are responsible for protecting public health should have an effective input at the design stage and in monitoring the operations.

*f. Resources required*

Apart from the costs of implementation, and operation of treatment plants, pumps and sewer networks, the needs for monitoring should be provided for. Consultants with major experience in wastewater reuse might be retained to assist in implementing and provide backstopping support for monitoring.

*g. Prerequisites*

The obvious prerequisites are a wastewater collection (sewerage) system that collects waste water that meets the required quality requirements (such as not having a high content of toxic chemicals from industry, or not having a high salinity concentration that would prevent agricultural use). Another fundamental prerequisite is that there should be no cultural taboos to prevent the intended method of reuse.

## D. REGIONAL STRATEGY

The following components have been adopted by the High Level Meeting held in Mauritius on 14 and 15 December 1999 as the regional strategy for the IMA-SIDS Region to promote higher standards of waste management, including waste minimisation and resource recovery. (The list of participants can be found in Annex E.5.2.) These are recommended actions that are to support all of the countries in the Region, though it may be that some are of more relevance to the programmes of some countries, than of others, at a particular time.

As has been discussed in Parts A and B, a strategy is based on a policy, though sometimes the developers of strategies do not explicitly define the policies - priority rankings, principles and overall objectives - that they are using (perhaps subconsciously) to make decisions and proposals.

The policy that is behind the development of the Regional Strategy can be summarised as follows:

- One key objective is to minimise the impact of wastes on public health.
- The other main objective is to minimise the impacts of wastes on the environment, and to manage the wastes in a sustainable way, so that current waste management practices do not cause long-term damage to the natural environment.
- Waste minimisation and resource recovery are not objectives in themselves, but should be pursued whenever there is a social, environmental or economic benefit, provided that levels of public health and environmental protection are not compromised. The waste management hierarchy (reduction above reuse above recycling above energy recovery above landfilling) should be implemented whenever it will not divert resources from - and therefore adversely affect - the fundamental functions of collecting waste and safe disposal.
- As much as possible, the opinions and ideas of stakeholders should be sought during planning, and integrated into plans and decisions. Whilst all concerned government agencies should be involved in planning and evaluation activities, there should be a clear definition of the lead or co-ordinating agency in each case.
- Public awareness and education are a fundamental part of waste management initiatives. It is important to increase the responsibility of generators for the management of their waste, and the principle that "The polluter pays" should be implemented if there is sufficient monitoring and enforcement to prevent illegal dumping (or "fly tipping").
- The most efficient combination of the public, private and informal and community sectors is desirable. The public sector must retain ultimate responsibility for service provision and upholding environmental standards.
- New approaches and new technologies should not be implemented without successful demonstrations at the pilot scale and thorough feasibility studies.

The titles and objectives have been listed in Section A.2. The titles are listed again here for convenience, together with the list of keywords, to help the reader find particular topics of interest.



Section	Title	Page
D.1	Networking	38
D.2	Promotion of composting within the Region	40
D.3	Public awareness and education	42
D.4	Staff training and development	44
D.5	Formulation of laws and standards	46
D.6	Co-ordination of the management of hazardous and problematic wastes	47
D.7	Co-ordination of waste minimisation and resource recovery	49
D.8	Provide support to national initiatives to improve institutional arrangements	51

### Keywords

Keyword	Subsection	Keyword	Subsection
aerobic	D.2	management information	
anaerobic	D.2	systems	D.8
attachments	D.4	manufacturing with	
biodegradable fraction	D.2	recycled materials	D.7
car wrecks	D.7	markets	D.7
career structure	D.4	on-site experience	D.4
community participation	D.3	pollution monitoring	D.6
composting	D.2	private sector participation	D.8
contracts	D.8	problematic wastes	D.6
definitions	D.5	processing	D.7
deposits for bottles	D.7	public awareness	D.3
directory of local expertise	D.1	regulations	D.5
discarded tyres	D.7	resource centre	D.2
disposal	D.6	scrap metal	D.7
electronic mail	D.1	soil conditioner	D.2
enforcement	D.5	standards	D.5
guidance notes	D.2	storage	D.6
hazardous wastes	D.6	training	D.4, 6
informal sector	D.7	transport	D.6
information exchange	D.1	travel scholarship	D.2
Internet	D.1	treatment	D.6
landfill mining	D.2	vermicomposting	D.2
laws	D.5	waste exchange	D.7
legislation	D.5		

## D.1 NETWORKING

### a. Objective

The objective is to create a mechanism for exchanging data, lessons learned, plans and other information between waste management professionals in different parts of the IMA region.

### b. Description

Since electronic mail and the Internet are already widely used, it would be appropriate to use this medium for exchanging information.

There has already been a proposal (at the UNEP Expert Meeting on waste management, held in London, November 1999) for such a network, based on a web site, which has been proposed to serve the needs of waste management in the small island developing states around the world. This proposal is awaiting funding. This is a very welcome and timely initiative and deserves the full support of all waste management professionals in the Region. Progress on the development of this site should be followed, and when it is made operational, full use of it should be made to share information, information sources, lessons from experience, questions and news about relevant events. There should also be a directory of expertise in the Region, comprising a list of all professionals who are active in the waste management sector, together with information on their expertise and experience (such as composting, developing source segregation programmes, development of legislation, or revenue collection systems).

It would be beneficial to link up with other networks, such as the Clean Technology Centres, the Regional Centres for the Basel Convention, and the UNEP Industry and Environment Centre in Paris.

Until the time when the web site is ready, an informal e-mail list should be developed and used to circulate information and news. The web site SIDSnet ([www.sidsnet.org](http://www.sidsnet.org)) should also be used for disseminating information - this operates like a noticeboard where users may post whatever they wish. If the use of these two options clearly indicates that the sharing of information on waste management within the IMA - SIDS Region is having a useful impact, this will add weight to the request for funding for a waste management website for small islands.

One person in the Region should be designated and funded to act as the regional co-ordinator for this activity, receiving messages from individuals and sending them out to all on the list. If no one is designated, and the responsibility is left to each individual to send information to all the others, it is likely that very little will be done.

Each country should designate a focal point who would make information from the particular country available to the network, and would relay information by post to individuals in the country who do not have access to the Internet.

Such networks are only successful if each member plays an active part.

### c. Justification

Results of research, trials, data collection and pilot tests conducted in one state would be of interest and benefit to other states. Co-ordinated approaches, including the shared use of facilities could be encouraged. Training opportunities, meetings and other events could be publicised. Documents could be shared, and the network could also be used as a forum for discussion of current issues.

It will be seen that many of the other recommendations listed (as D.2 to D.8) below involve communication between professionals in the Region, so the networking outlined here can be described as the backbone of the whole Regional Strategy.



*d. Indicator*

The first indicator of progress would be the establishment of a web site or the designation and support of a person to operate and promote the information exchange. Other important indicators would be the number of people using the network and the number of SIDS represented, and the number of new items of information that are added each quarter. Another valuable method of assessment would be to ask a sample of target users for their opinions about the way the network is being operated.

*e. Responsibility for implementation*

The success of a network depends to a large extent on every person involved, but it is unlikely that much will happen unless an individual is appointed to manage the early stages.

*f. Resources required*

Relatively small amounts of time and money are required to set up an informal e-mail network, but the settling up and maintenance of a web site requires much more time and effort. In the case of an informal e-mail network, the person charged with establishing the network would need to be able to devote several hours per week to it, and be free to send large numbers of e-mail messages.

*g. Prerequisites*

A mailing list could be set up on the basis of contacts made at the workshop and extended to others with similar interests in the Region.

*h. Keywords:*

Directory of local expertise; electronic mail; information exchange; Internet, web site.

## **D.2/ PROMOTION OF COMPOSTING WITHIN THE REGION**

*a. Objective*

The objective is to promote the composting of organic wastes and the utilisation of compost within the Region by sharing information and expertise.

*b. Description*

Whilst some sharing of knowledge takes place informally and without outside facilitation, more could be done with some specific support and direction.

The first step would be to prepare an inventory of all composting initiatives within the Region, including schemes that have failed, or closed down for other reasons, current operations (whether bench-scale or pilot scale trials or full-scale operations), and plans for initiating composting activities in the future. This inventory should include a brief description of each initiative, including information on the size and process, the operating organisation and the markets for the product.

It would also be useful to prepare a list of people with expertise in this field, covering all associated aspects including

- the social aspects of organising source segregation and operating a community scheme,
- the scientific aspects of the various processes,

- the marketing of the product (including demonstration projects),
- the institutional and administrative arrangements and financial aspects, and
- engineering and management issues associated with any machinery.

The list should include experts in the agricultural sector. These experts should primarily be within the Region, but it would also be useful to include information about potential consultants from outside the Region, particularly if they have experience in the Region and can be recommended by an expert within the Region.

These two lists should be widely circulated within the Region.

It would also be helpful if there were a fund to allow visits to schemes within the Region. The visits might be for short periods to collect information, or might be longer attachments to gain experience in handling operational problems. The fund should be operated as a travel scholarship. Individuals (whether at the planning level, concerned with social and community aspects, or currently or potentially involved in composting operations) should be invited to apply for the scholarship if they feel it would help them develop their schemes. Applications should include a description of the local situation and needs regarding composting, a proposal for the programme of the visit, a description of the expected benefits of the visit, and letters supporting the visit from both the sending and receiving locations. Applications should be reviewed and decided upon by a panel representing several of the nations within the Region. Reports on these visits and attachments should be prepared and made available on request, together with evaluations from senior managers at sending and receiving locations.

A further component would be the preparation and publication of some guidance notes on particular aspects of composting. The first step would be to identify the gaps in readily available literature in English, French and Portuguese, so that efforts can be targeted to areas of greatest need. Examples of possible topics would be

- setting up and running pilot trials,
- developing demand using demonstration trials,
- encouraging source segregation schemes, and
- troubleshooting operational problems.

The scope of the subject area could include the various methods of aerobic composting, anaerobic composting (including landfill mining - that is the excavation and sieving of decomposed waste from disposal sites) and vermicomposting, and the range of scales from household level to large central composting plants.

If there is sufficient demand courses and workshops could be arranged on this theme. A resource centre could be set up to collect and make available literature, videos, posters and other training materials related to composting. As much as possible, literature should be sent in electronic format by e-mail, but it might be possible to set up a system for lending books if a membership arrangement were developed.

### *c. Justification*

Composting is an important issue within the Region for the following reasons:

- Some national waste management strategies restrict the use of sanitary landfills to wastes that are not biodegradable. Methods of treatment or reuse of the large quantities of biodegradable waste are therefore required, and the various forms of composting are the only methods with proven success.



- In some of the islands the space available for disposal of waste is limited, and since biodegradable wastes form a large part of the wastes in some islands, the limited space could be used most effectively if an alternative destination could be found for this fraction of the wastes.
- The decomposition of biodegradable wastes in landfills and dumps is a major cause of water pollution related to solid wastes, and so if the wastes can be stabilised under controlled conditions, environmental pollution is greatly reduced.
- Compost is of considerable benefit to the soil, improving fertility, reducing soil erosion and conserving precious irrigation water. There are therefore wider environmental and economic benefits of composting.
- There is already considerable expertise and experience in the field of composting within the Region. This experience includes collection systems for the raw material, and operation of composting processes.

*d. Indicator*

The existence of the lists and guidance notes are obvious indicators, but a more useful indicator would be to ask individuals who are involved in developing composting operations to evaluate the usefulness of these tools in their own experience. Such an evaluation could be conducted each year.

*e. Responsibility for implementation*

This should be decided by the planning workshop. Options would include a university with a track record in composting, or a committee formed by representatives from the nations of the Region. It is important that the leadership of this component should not have purely a narrow scientific interest, but be also concerned with the social and marketing aspects.

*f. Resources required*

Much information about initiatives and experts could be provided at no cost, but the work involved in co-ordination and compilation would require payment. The guidance notes, travel fund and the resource centre would be larger items of expenditure. It would not be necessary to employ an individual full time or to have a dedicated office.

*g. Prerequisites*

Work on some parts of this component could start as soon as agreement is reached. Some activities could not be started until funding is available.

*h. Keywords:*

aerobic; anaerobic; biodegradable fraction; composting; guidance notes; landfill mining; resource centre; soil conditioner; travel scholarship; vermicomposting

### **D.3 PUBLIC AWARENESS AND EDUCATION**

*a. Objective*

The objective is to facilitate the sharing of experience and resource materials (such as videos, posters etc.) between nations of the Region in order to improve the public's understanding of, and involvement in, solid waste management.

*b. Description*

Improved public awareness and participation are needed in many states to improve co-operation with waste collection operations. The actions that may be required include putting out waste for collection in the correct way and at the right time, and keeping biodegradable waste segregated from other wastes to assist in composting operations and to reduce the contamination of other recyclable materials. Public education might also be needed to encourage payment for waste management services. Littering of streets and open spaces is another area in which public behaviour may need to be changed. Some social groups in some countries might be ready for a campaign to encourage them to avoid wastes by choosing products that have less packaging, and refusing plastic bags for their shopping, but this may be more than can reasonably be expected from many groups at this stage. In some situations, residents and commercial waste generators become more involved, because they work together to provide their own waste collection service, taking waste to a transfer point from where it is removed by the official service, or even recycling and disposing of their waste themselves. The public can also take on a supervisory role, informing the responsible authorities if services are not provided, as they should be, and reporting any illegal dumping of wastes by industries and transport contractors.

The first step may be to use the resources already existing in the region. Some managers already have considerable experience in bringing waste management issues to the attention of the public, and there are cases of community-based action, which can also provide useful information. So it is recommended that each nation provide a summary of the efforts that have been made to improve links with the public, and a list of the videos, posters, leaflets and other materials that have been used. Useful material may be obtained from UN organisations (particularly WHO and UNEP - which has a large collection of visual material) and NGOs that are involved in waste management.

Each country may have items and expertise that it can contribute. (For example, in Mauritius some videos on waste management issues have been produced by the Mauritius College of the Air).

With regard to programmes in schools, it may be that the project for the preparation of materials for schools (Section C.1.1) and funded by the European Union could be extended to help other nations.

As a next step, it is recommended that each nation convene a working group to develop proposals for developing public awareness and informing the public of good practice, health and environmental risks, and providing other information that is considered necessary. This working group should preferably include interested participants from a wide range of backgrounds, but certainly including managers responsible for waste collection services and social scientists with experience of public education campaigns (whether in waste management or other fields). The proposals should be concrete and for the short and medium time frame (up to three years). These proposals should then be reviewed to determine whether there are common features that could usefully be developed into a regional programme. (It might seem that the preparation of posters might be a useful field for regional action, but since collection systems and language vary from country to country, it might be difficult to design one poster or booklet that would suit all countries in the Region.) Concepts and approaches that have been successfully tried in one place could be applied on a regional basis.

A simple networking mechanism would allow the sharing of topical suggestions, such as how to use events as a pretext for waste management announcements. Examples are World Environment Day and the start of the new Millennium.



It is important that public awareness campaigns are closely linked to waste collection operations. For instance, a campaign to promote source segregation of wastes should never be conducted until there is a working system of separate collection of the different waste streams, because nothing kills public co-operation as effectively as seeing wastes that have been carefully segregated in the home or hospital ward being mixed in the collection vehicle. Programmes for schools have been discussed in Section C.1.1. It would be useful to build on the national initiatives within the Region that are already under way.

*c. Justification*

Gaining the co-operation of the public is fundamental to effective and efficient waste management. The experience of government agencies, contractors, NGOs, managers and social scientists within the Region should be tapped in order to gain the greatest possible input from the resources and knowledge in the Region.

*d. Indicator*

The best method of assessing the impact of this action would be to review public awareness activities in the region each year, and ask whether information and materials from other countries had played a significant part in the formulation and execution of the campaigns.

*e. Responsibility for implementation*

It is likely that the investigation of past and present awareness creation programmes will indicate who is most involved in this type of work, and this person, or the institute that (s)he works for, may be prepared to steer this regional action in its early years.

*f. Resources required*

In the early stages the resource requirements would be low, being confined to networking and the collection of information. If, at a later stage, it is decided to publish material or make video programmes, specific funding may be required.

*g. Prerequisites*

The main prerequisite at the early stage is a person or existing institution to begin to co-ordinate activities in this field, to collect information and establish contacts with representatives from the islands in the Region.

*h. Keywords:*

Community participation; public awareness

## **D.4 STAFF TRAINING AND DEVELOPMENT**

*a. Objective*

The objective is to give managers, engineers and other professionals, inspectors and supervisors the knowledge and tools that they need to do their work as effectively as possible.

## b. Description

- ① As a first step, a survey should be undertaken to establish the training needs in waste management, based on the evaluations of senior managers and engineers. Informants who have received training in waste management could be invited to comment on the value of the training that they received in terms of the way that the training has helped them in their work. In this way a picture of training needs and opportunities can be synthesised. Some external help in this work might be helpful to some countries.

Some training needs for supervisors and above can be met within the Region, by attachments to particular operations for periods of up to a month, and by courses conducted in regional institutions. Training in sanitary landfill operations is likely to be a major need, for government inspectors and for site supervisors and their operators. The University of Mauritius and the University of the Indian Ocean have experience in providing targeted courses, and the Universities of the West Indies and the South Pacific may also be sources of useful information and materials. Training courses should be practical and relevant, drawing on the experience of professionals with recent operations experience. Distance learning (for example, with the Open University, Leicester University and WEDC, Loughborough, all in UK) may meet some needs.

Trainers should be familiar with recent developments in the Region.

- ! Training for lower grades of staff should be provided by their superior officers. It is likely that training in health and safety aspects would be appropriate for collection labourers, together with information on dealing with the public and basic issues of the employer's policy. Materials that could be used, such as booklets and videos, may be available somewhere within the Region. It may be appropriate to develop some programmes for training of trainers.

More specific training for senior managers and engineers may be undertaken outside the Region, and since it is likely to be for a small number of specific cases, this should be regarded as a national, rather than a regional issue.

## c. Justification

It is likely that many people who have responsibilities related to solid waste management feel the need for more knowledge and confidence in connection with their work. Some are likely to have attended short courses in waste management, but such courses cannot meet all the training needs of waste management specialists in many different situations. Some aspects of solid waste management are very site specific, and so training should be, at least partly, in the context of local conditions, and courses should be carefully designed so that they are relevant to local conditions and challenges.

## d. Indicator

It is difficult to identify useful objective indicators for training. An evaluation sheet should be prepared for all courses involving supervisors, inspectors and above, to determine the relevance and quality of each training event. It should be filled in by the trainee just after the training event, and by the trainee and his/her supervisor four months later in order to assess the impact of the training on work performance.

## e. Responsibility for implementation

It would be helpful if one person could be designated as training co-ordinator for the Region. This would be a part-time responsibility, and would include collecting information on the training needs in waste management at different levels throughout the Region. The position also would include investigating the training resources and opportunities within the Region, such as: -



- formal training courses,
- disposal sites and other operations that are well run and that would provide useful practical experience for staff on attachment, and
- individuals with special experience of particular topics and the ability to pass on information and enthusiasm, who could act as trainers and resource persons.

This person would also be responsible for evaluating the training provided and keeping informed of training opportunities outside the Region.

The person selected for this work should have a practical approach to waste management and be familiar with day-to-day operational issues.

*f Resources required*

If a part-time training officer is appointed, (s)he would perhaps need to work for two weeks continuously to start the job, and then work for two to three days per month on this task.

Whilst it would be reasonable to ask organisations to fund the training of their own staff, it is likely that the organisations that are in greatest need do not have a budget line for training, and so external support would be essential to fund training and attachments for individuals from some organisations.

It is not possible to forecast the need for training materials until a survey is carried out.

*g. Prerequisites*

Perhaps the most important prerequisite is a more realistic expectation of the impact of short training courses. It is often assumed that someone who has been on a training course has absorbed and integrated all the knowledge that is necessary; whereas the reality is that there must usually be practical reinforcement and continuing guidance to supplement classroom training.

*h. Keywords:*

attachments; career structure; on-site experience; training

## **D.5 FORMULATION OF LAWS AND STANDARDS**

*a. Objective*

The objective is to assist national governments to introduce and/or improve legislation and regulations that deal with waste management, and to set appropriate and enforceable standards.

*b. Description*

The first step would be to assemble small working groups in each country to review waste management legislation and enforcement. Some countries have made more progress in developing specific legislation than others; those that have more detailed legislation might find it profitable to review the effectiveness of enforcement mechanisms to understand their strong and weak points.

Regarding regulations that are promulgated to implement legislation, it is likely that the needs of each country will be different. Regulations should be achievable, and so the requirements of regulations should be tailored to the situation that applies in each nation. However, it would be helpful if each country were to publish its laws and regulations on the Internet. Experiences with the use and implementation of laws would also be useful so that it is possible to avoid the pitfalls that other countries have experienced. The expertise of UNEP in the field of environmental law is a useful resource.

After this review is completed each country's group will be in a position to decide whether further work is necessary with regard to laws, regulations, standards and enforcement. A compilation of the reports of the country groups would provide useful information regarding the strengths and weaknesses of each system and the potential benefit of a regional workshop.

Another issue that may need to be examined is the movement of hazardous to other countries where there are satisfactory means of disposal. Legal and administrative instruments for implementing the Basel Convention should be put in place, and it may be necessary to modify laws so that they harmonise with other international agreements.

It is recommended that countries within the Region keep each other informed about new legislation, regulations and enforcement methods.

*c. Justification*

Legislation is fundamental to good waste management. As greater stress is laid on prevention of environmental pollution and the involvement of the private sector and community groups, there is a need to modify and strengthen laws and regulations. Growing concern with the management of industrial wastes (particularly the hazardous fraction) and hazardous healthcare wastes, and new experience with methods of monitoring and controlling these wastes, require new legal measures. Some legislation in the region is demanding big leaps forward in the systems for the separation and composting of biodegradable wastes; it will be useful to compare the effectiveness of this legislation with a more measured, step-by-step approach.

*d. Indicator*

Since the legislative and enforcement systems of the different nations are at very different stages, it is difficult to specify a universal target. The simplest indicator of the impact of this activity would be whether country-working groups are formed and a regional workshop held. Another indicator would be the compliance with laws and regulations - for example the tonnage of waste that is managed under the appropriate regulations, or the compliance of facilities (such as healthcare establishments) with regulatory requirements. Such indicators would be measured on a country basis.

*e. Responsibility for implementation*

Each nation should appoint a contact or liaison person, who together would form a Regional Working Group. Then there should be a regional initiative (perhaps from IMA-SIDS) for a regional workshop, at which the role and method of operation of the group could be discussed and a co-ordinator appointed.

*f. Resources required*

It may be necessary to hire legal advisors with experience in environmental legislation in each country, and this could be a large expense unless there are legal experts in universities or working with NGOs who would assist voluntarily.



*g. Prerequisites*

The essential prerequisite is the interest and motivation at the national level. If, after an initial meeting, there were no conviction that much can be achieved by a regional initiative of this sort, there would be no justification for continuing except on an informal level through networking.

*h. Keywords:*

definitions; enforcement; laws; legislation; regulations; standards;

## **D.6 CO-ORDINATION OF THE MANAGEMENT OF HAZARDOUS AND PROBLEMATIC WASTES**

*a. Objective*

The objective is to benefit from economies of scale by combining wastes from different countries in the Region.

*b. Description*

This objective can be achieved by co-ordinating treatment and shipments of wastes that cannot be recycled or disposed of in a satisfactory way within any particular country. If wastes from several countries were combined, the cost per ton would be expected to be less. The first step in achieving such co-ordination would be for all the nations in the Region to agree on a unified definition of the term "hazardous" in this context.

The next step would be to prepare, for the whole Region, an inventory of all hazardous wastes that cannot be satisfactorily treated and disposed in the country of origin.

There is also a need to co-ordinate when seeking expert advice and in arranging shipments and treatment.

Consideration should be given to undertaking a feasibility study for a facility for treating or disposal of the most common types of hazardous waste within the Region, particularly considering the quantities of waste arising and the transport costs.

Radioactive wastes can be classified into three groups - low level wastes which can be landfilled, materials with a short half-life that should be stored until they have decayed sufficiently to be no longer hazardous, and other sources which are generally sent back to the supplier for disposal. It may be possible to develop a similar arrangement - sending hazardous materials back to the supplier - for other types of hazardous wastes, so that the suppliers take responsibility for disposing of the wastes resulting from the products that they sell. There is more chance of making such an agreement if a number of countries are co-operating in this issue.

Tyres and slaughterhouse wastes may be classed as problematic rather than hazardous. Used oil and batteries are particular problems that require improved collections systems as well as satisfactory disposal routes.

There may be a need to raise the profile of these issues amongst politicians and other decision-makers as well as among the general public. The sharing of approaches and visual materials within the Region could support such campaigns.

Further comments on this subject can be found in Annex E.2.3.

*c. Justification*

It is expected that the unit costs of transporting, treating and disposing of hazardous wastes from the Region are reduced if the quantities of such waste are larger. For this reason some countries have specially designed storage facilities so that larger quantities can be accumulated before they are shipped away for disposal.

Co-ordination can also assist in terms of expertise. If there is good co-ordination, one expert can provide the necessary guidance for the whole Region, instead of each country hiring or training its own expert.

When regulations concerning wastewater result in industries installing effluent treatment plants, these plants will produce sludges, some of which may be classified as hazardous wastes, so the quantities of hazardous wastes can be expected to increase.

*d. Indicator*

The best indicator of success would be the percentage of the waste that is exported for disposal that is shipped and treated under this co-ordinated scheme. Since it might take several years for a sufficient quantity to accumulate, more immediate indicators would be helpful. One would be the agreement of a legal definition of the term "hazardous waste" and another would be agreement of a method of co-ordination and a mechanism for sharing of expenses.

*e. Responsibility for implementation*

Each nation should appoint a representative with responsibility for the disposal of the hazardous wastes arising within that country. A co-ordinating body (such as IMA-SIDS or UNEP) should explore with each representative (using e-mail) the particular needs of each country and the need for support in this sector, including the need for a co-ordination work shop and the need to appoint a regional co-ordinator or secretariat.

*f. Resources required*

The requirements for outside funding and expertise depend on the consensus achieved by the representatives. If the general view were that informal contacts are sufficient and there is no need for concerted action, the resource requirements would be very small. At the other extreme, requests for funding might include the need for a co-ordination workshop, for training, for consultant expertise or even for assistance with the costs of transporting and disposal of difficult wastes.

*g. Prerequisites*

The primary prerequisite is the political will that the problem of hazardous wastes will not be ignored. It may be necessary to raise the profile of this issue by informing the people who are most affected by the risks that could result from poor management of hazardous wastes in their neighbourhood.

*h. Keywords:*

disposal; hazardous wastes, pollution monitoring; problematic wastes, storage; training; transport; treatment



## D.7 CO-ORDINATION OF WASTE MINIMISATION AND RESOURCE RECOVERY

### a. Objective

The objective is to promote components of waste minimisation and recycling schemes that are most effective at the Regional level.

### b. Description

Regional initiatives in waste minimisation could be directed towards modifying the packaging that is used for food and drink products and for other consumer items, so that the amount of packaging per item is reduced, the packaging can be reused, or the material used is biodegradable or recyclable and so causes less impact on the environment. This could be achieved by passing a law banning certain types of packaging, or adding a surcharge so that other, more acceptable alternatives are used.

**Waste exchanges** Some wastes from one industrial process can be used as a raw material for another process. Industries could be invited to describe their waste streams (in quantitative and qualitative terms) and advertise its availability in the hope that another industry could use it and either provide some income by buying the material, or at least save disposal costs. (See also Section C.2.1 in the national lists.) Some industries may be reluctant to disclose information about their wastes, fearing passing on confidential information about manufacturing processes to a competitor. Transport costs may prohibit the transfer of materials from one country to another.

If recycled (or secondary) materials are to be attractive to reprocessing industries there must be a guaranteed supply of a minimum quantity. Supplying such reprocessing industries from small islands is difficult because the quantities are small, and transport may be irregular. The best way of reducing these problems is to co-ordinate the flow of secondary materials to the reprocessing industries or dealers.

Some reprocessing technologies can be operated at a small scale, and so such facilities could be set up on each of the larger islands. (The manufacture of handmade glass items, the fabrication of household items from tinplate and some plastics processing can be done on a small scale.) Co-ordination between the entrepreneurs would help in selection of technology, in overcoming production and maintenance difficulties, and in developing the product range.

Some technologies are only effective on a larger scale, and so co-ordination between islands states and nearby mainland nations would ensure that there is no inefficient duplication of facilities, with only one plant serving a large region. The processing of scrap metal including car wrecks and car tyres are examples of technologies that should operate on a reasonably large scale.

### c. Justification

Certain materials and forms of packaging are easier to recycle or dispose of than others, but bottling and food-processing industries may not take environmental considerations into account unless obliged to by law or encouraged by financial penalties. There may be some benefit in concerted regional action to encourage food and drink companies to adopt a preferred form of packaging.

Waste exchanges can reduce the quantities of wastes requiring disposal and also provide an economic benefit.

Entrepreneurs involved in small-scale recycling industries would benefit from the sharing of expertise and ideas without threatening competition (since each market would be restricted by transport costs to nearby islands.)

Recycling industries that operate at a larger scale need to co-operate to ensure both the sizes and the timing of supplies of secondary materials.

*d. Indicator*

Production figures for types of packaging that are regarded, as undesirable would show a reduction if this action were successful. Statistics on the return of reusable bottles would be another indicator of the impact of this initiative.

One indicator of success in reprocessing would be the number of recycling enterprises that are working together. A more general indicator would be the total amount of secondary materials that are recycled (though this would reflect success in a range of initiatives - many being national rather than regional - and it can be difficult to get information about quantities from small enterprises).

*e. Responsibility for implementation*

The national liaison persons mentioned in activity D.5 would be involved in developing a co-ordinated approach on packaging. There would be advantages in harmonising the legislation on this issue.

The possibilities for waste exchanges could be publicised on the e-mail or Internet network. The promotion of small processing industries and the co-ordination of dealers is an activity that is largely outside the government sector, since these are mostly small private enterprises. It is possible that an NGO concerned with employment generation, or organisations such as chambers of commerce might become involved.

*f. Resources required*

The modification of legal frameworks could be linked with other legislation aspects discussed in Section D.5. Government resources might be used to promote small recycling businesses, chiefly by supporting them in applications for loans, waiving some taxation burdens in the early years and facilitating some training in management skills such as business planning and bookkeeping. Direct financial involvement by government in these small enterprises is not recommended, because they should be independent and financially viable.

*g. Prerequisites*

Before dealers and processors of secondary materials can be co-ordinated and supported, they must be identified and motivated to seek to extend their operations and work with others. Some of these entrepreneurs may be reluctant to trust others and be open about their work.

*h. Keywords:*

car wrecks; deposits for bottles, discarded tyres; informal sector; manufacturing with recycled materials; markets; processing; scrap metal; waste exchange

## **D.8 PROVIDE SUPPORT TO NATIONAL INITIATIVES TO IMPROVE INSTITUTIONAL ARRANGEMENTS**

*a. Objective*

The objective is to provide regional assistance to national efforts to develop efficient and sustainable institutional arrangements for providing services and monitoring performance.



*b. Description*

The purpose is not to impose a regional view or system, but to have materials available that may be used at the request of individual nations.

There is already considerable involvement of the private sector in the provision of solid waste management services. There may be ways in which the contractual and supervision arrangements could be improved to provide improved competition, transparency and accountability. The sharing of ideas and experiences at meetings and by electronic networking could help in the improvement of existing systems. It is often not appreciated that involving the private sector usually necessitates capacity building in the public sector so that officials are able to set and enforce standards. Visits by managers to other countries in the Region could provide useful insights and avoid the duplication of mistakes and the "reinvention of the wheel".

Traditional systems of accounting within municipal authorities often do not provide the cost information that is needed by managers. Management information systems and accounting procedures may need to be reformed and developed to improve the efficiency of operations and the selection of equipment. Regional actions that could improve the use of operations information include the sharing of expertise and the combination of consultant missions with regional seminars.

The costs and expertise required for operating a sanitary landfill support the option of inter-municipal facilities (serving several urban areas) or even national landfills. Experiences of sharing costs and responsibilities could be shared to help nations that are considering this approach.

*c. Justification*

Involving the private sector does not always lead to better value and higher standards. Much depends on the way contractual agreements are written and administered, and on the degree of competition and transparency. Sharing experiences and insights, and visits that allow observations of systems in operation, could lead to improved working relationships with the private sector, better services and more effective management.

*d. Indicator*

The cost of collecting, recycling or disposing of one ton of waste is a useful indicator in a particular situation. A downward trend with a satisfactory service standard is an indication of improvement, but it is difficult to compare costs for different cities and different service levels. The fact that a cost per ton can be determined is in itself an indication of success, because often the information is not available to allow this cost to be calculated, or no one is motivated to calculate it. Other indicators could be the level of complaints concerning a collection service, or the number of warnings or default notices given to a disposal contractor.

*e. Responsibility for implementation*

Senior executives of municipal authorities should agree on joint action in this field, and a method of operation. This issue could be raised at a meeting of such executives, or a central body (such as the COI) could promote the idea on the network.

*f. Resources required*

If there is support for this action, there should be a workshop on the subject, with an external resource person who has extensive international experience of private sector participation in solid waste management. Following such a workshop, participants should be able to share documents and ideas at minimal cost on the network.

*g. Prerequisites*

The essential prerequisites are the desire to improve on existing arrangements and a readiness to share experiences with colleagues from other nations, including an honest presentation of lessons learned from mistakes. The existence of a formal or informal regional network is another basic requirement.

*h. Keywords:*

contracts; management information systems; private sector participation

## **D.9 GENERAL COMMENTS**

This Strategy acknowledges the importance of using the skills and knowledge that are already in the Region, and the need of a system of networking that is easy to use and accessible to all waste management professionals in the Region.

In many cases effective networking could be kick started by a workshop or seminar, so that basic objectives can be agreed and personal contact made. In many cases it would be helpful to have the input of a resource person at such meetings.

Some of the recommendations need financial support in only relatively small amounts. It would be very useful to have a system that could provide small grants to fund pilot-scale trials, the preparation of reports and short consultancy visits within the Region.



## E. ANNEXES - SUPPORTING MATERIAL

### E.1 DEFINITIONS OF TECHNICAL TERMS and ABBREVIATIONS

Some of the specialised terms in waste management are used in different ways by different writers. The list below explains how some technical terms are used in this report.

#### E.1.1 Terminology

aerobic	In the presence of oxygen - aerobic composting involves one of several methods for providing oxygen to the bacteria.
anaerobic	In the absence of oxygen - no oxygen is provided in the anaerobic composting and digestion processes.
bring	"Bring" centres are used to collect bulky waste, segregated recyclable items and hazardous domestic wastes. The generator is required to bring these items to the centre or bin location. Civic amenity sites are an example of "bring" facilities. Also known as "drop-off points". "Bring" facilities for collecting recyclable materials such as glass, paper and metals may be located in shopping areas.
calorific value	This is a measure of the energy that is released when waste burns. There are two values, higher and lower, but it is the lower value that is of more significance because it takes into account the moisture that is in the waste. If the waste has a small calorific value, it is particularly expensive to incinerate because large quantities of oil or gas are needed to ensure that the waste burns at a sufficient temperature so that smoke and gaseous pollutants in the exhaust gases are at a manageable level.
compost	Soil conditioner - the main benefit is to improve the properties of the soil. Compost is not classed as a fertiliser, though most composts also provide some of the main plants nutrients and micronutrients.
disposal	The final process in solid waste management, in which the solid waste is put in its final place. If waste is treated by incineration or composting, it is only residues that require disposal. The best method of disposal is sanitary landfilling.
generator	A generator is any person or organisation that discards material as waste. (This is not the same as a producer of waste, which is a manufacturer of items that become waste).
informal sector	Individuals and organisations working for financial gain without being registered as an enterprise or being licensed or taxed as an enterprise.
waste minimisation	Any action which reduces the amount of waste generated - that is, reducing the amount of material that is, at any time, classed as waste. It includes waste avoidance and waste reduction, but does not include recycling.

recycling	Returning material discarded as waste to the economy - the concept of a cycle or circle. This usually involves some form of sorting and processing, but in this report the term is also used to cover items that are taken from the waste stream and reused without processing.
resource recovery	This is a wider term than recycling, because it also includes the recovery of energy from waste, by burning it or making a gas, which is used as a fuel.
secondary	Secondary materials are materials that have at one time been discarded as waste, but have since been separated from the waste. Secondary is in contrast to virgin.
segregation	Segregation means keeping separate, so that the items that are segregated are never mixed at any stage.
separate	When used as an adjective (as in <i>separate collection</i> ) this refers to segregation so that the two or more streams are never mixed at any time. When used as a verb it has the same sense as <i>sorting</i> , that is extracting one type of material from a mixture.
separation	Generally used to mean sorting.
sorting	Sorting means selecting certain categories of materials from mixed waste, so that items that are removed may have been contaminated by unwanted materials.
vermicomposting	Using worms to process biodegradable waste to make a soil conditioner. Also known as <i>vermiculture</i> .

### E.1.2 Abbreviations

COI	See IOC
IMA	A region including the Indian Ocean, the Mediterranean Sea and the Atlantic Ocean. IMA-SIDS means the SIDS islands in the IMA region. There is a co-ordinating IMA-SIDS secretariat in Malta
IOC	Indian Ocean Commission, based in Quatre Bornes; Mauritius, focussing on Seychelles, Comores, France (Réunion), Mauritius and Madagascar
SIDS	Small island developing states
UNEP	United Nations Environment Programme
WEDC	Water, Engineering and Development Centre, Loughborough University, UK
WHO	World Health Organisation



## **E.2 SUPPLEMENTARY NOTES AND OBSERVATIONS**

### **E.2.1 Methods of charging directly for solid waste management**

There are various obstacles to overcome in designing and implementing an effective system for charging for solid waste collection and disposal.

- ◆ Generators may resist any idea of paying because they have been accustomed to receiving the service in the past without paying for it directly.
- ◆ Their experiences of waste collection services may be negative so that they are unwilling to pay. For this reason it may be helpful to link the introduction of a charge or an increase in the amount to an improvement in service.
- ◆ If a generator does not pay the fee, it is likely that the sanction of denying the service will have little effect - the waste may simply be dumped in front of another house or business.

If property taxes are collected effectively, the waste management fee could be added to this bill, provided that it is possible to obtain the money that is earmarked for waste management. This may not be possible in local government administrations where the allocation to a range of local services is made on an ad hoc or "firefighting" basis.

One of the main issues with payment for solid waste management is how to encourage households to pay the charge. One essential prerequisite is that the collection service is satisfactory. Sometimes community structures can be used to encourage payment. If local community leaders are involved in collecting fees, they may be able to exert social pressure on each household to pay its share of the community's fee. If a small enterprise with roots in the community is collecting waste, residents may wish to support their neighbours by paying the fee for their services.

If consumers are billed for water and electricity, it may be possible to add a surcharge to one of these bills. If either the utility bill or the waste management component is not paid, the supply of water or electricity is cut off. In some countries it is not politically acceptable to cut off a water supply, so in such situations the waste management fee should be collected with the electricity bills. The electricity supplier is often paid a commission for the collection of this charge. This system has an indirect link between the amount payable and the amount of waste generated in the sense that electricity bills are likely to be higher for large families and for higher income households that have more appliances and that take less care to minimise electricity use, and large households and higher income families are likely to generate more waste. This system has been used successfully in Ecuador and Gaza, but may require changes in legislation in some countries.

These methods have a conceptual disadvantage in that the charge paid is not directly proportional to the quantity of solid waste handed over for collection. It seems more rational if each generator is charged according to the amount of waste to be disposed of, and this also provides an incentive for generators to reduce the amount of material that they discard. This is in line with the widely accepted polluter pays principle. Some of the systems that have been tried, for which the payment is proportional to the quantity of waste generated, are listed below.

- ◆ A small payment can be required for each bucket load of waste brought to a communal collection point. This requires the continual presence of someone to receive the money at the storage point.



- ◆ Waste may only be accepted for collection if it is contained in a special plastic bag or has a special tag tied to it. The prices of these tags or bags include a charge for the collection and disposal of the associated waste.
- ◆ There are sophisticated systems that weigh the contents of each bin as it is loaded mechanically into the collection truck.
- ◆ A manual count can be made by the collection crew of the number of sacks or bins that are emptied. The actual number may become a matter of dispute, and neighbouring properties may put their waste in front of a neighbour's door.
- ◆ Generators of large quantities of waste may use large containers which are hauled directly to a transfer station or disposal site, and in such situations payment may be according to the number of containers that are emptied, or according to weights registered on a weighbridge at the entrance to the disposal site.

Some of these systems are complicated or expensive to operate, and may encourage generators to dump some of their waste in public places (such as in the street, on open ground or in drains) so that they do not pay for it. Collecting waste that has been illegally dumped in this way is expensive. Whilst it is true that in some cities in industrialised countries the collection and disposal of domestic waste is charged according to quantity, it must be remembered that in these countries there has been a long period of public education and there are strong popular movements and major NGOs that constantly bring environmental issues to the public attention. In such circumstances fees that are charged according to waste quantity may not lead to widespread illegal dumping (though there are certainly some who dump their waste in the wrong place in order to avoid charges). In societies where the environment is lower on the agenda, it may be better to avoid penalties in waste charges, and concentrate on persuasion and positive benefits. We talk about motivating a donkey with a carrot and a stick - using this analogy it is better to rely on the carrot, because if we use the stick the donkey may go in another direction! It is more important to have a robust revenue collection system than to have a financial instrument to encourage waste minimisation.

### E.2.2 Some aspects of legal provisions

Methods of enforcement can include fines, applications of contractual sanctions (financial sanctions and termination), prison sentences for serious and repeated offences, and refusal to grant or renew trading licenses. Penalties should be reviewed at regular intervals to ensure that they are effective. (This regular review can be made a legal obligation.)

The situation of inspectors (including their salary level) should be realistically assessed and support should be provided to enable them to resist the pressures associated with their work, particularly from industries.

The public can be involved in enforcing environmental laws by means of well publicised telephone numbers ("Green lines") which can be used by the general public to inform the responsible agency of illegal actions such as unauthorised disposal of trade or construction and demolition wastes.

Financial instruments, such as a refundable deposit that must be paid for each drinks can or bottle, are easier to enforce and can be very effective.

A further measure that may be appropriate is the banning of the importation of certain materials or products, such as steel drinks cans, or refrigerants containing chlorine (which damage the ozone layer).



An important legislative provision is to enforce a "Duty of Care" on non-domestic generators, which makes them legally responsible for the way the wastes generated on their premises are handled and disposed of, whether they are managing the wastes themselves or another party (such as a contractor) is doing it for them. Such generators should also be made responsible for collecting and keeping information on the quantities and nature of the wastes that they generate. Another important provision is to require large generators to make data regarding their wastes available to the public. (It may be possible to introduce these particular measures in the short term.)

It is advantageous to enact a framework environmental law that sets out general environmental and financial objectives for waste management, but which allows the appropriate minister to promulgate regulations without the need to have them passed by the legislative body (e.g. parliament). Passing laws through the normal legislative process takes a long time, especially if environmental matters are given a low priority by lawmakers, so this arrangement allows regulations to be introduced as and when they are needed. The framework law may also define responsibilities and methods of working - for example that the Ministry of Environment take the role of co-ordination and leadership in the development of laws and plans that concern several ministries, and that all affected and interested agencies be involved in such processes. The role of the Ministry of the Environment may be defined in more detail. (For example, in Mauritius, the Ministry for the Environment does not implement or even enforce, but is to co-ordinate and facilitate the roles of other ministries in implementation and monitoring.) It may be necessary for a new law to open the way for the private sector to become more involved, and to define responsibilities for exercising the different functions of regulation, client and service provider.

Another issue to be considered is the registration and licensing of individuals, companies and facilities. Site managers of disposal facilities may be required to be registered to indicate their technical competence and their lack of criminal record in the environmental field. Companies involved in collection and transport may need to be licensed for similar reasons, and to indicate their financial soundness and probity. A supplementary level of licensing may be needed for anyone dealing with hazardous wastes. Transfer, treatment and disposal facilities may be required to have a permit which indicates that they have been designed and constructed in accordance with all relevant standards, and to define the ways that the facility may be operated, including the types of waste that it may accept.

Further provisions, relating only to hazardous wastes, are mentioned in the next section, Annex E.2.3.

### **E.2.3 Management of hazardous and special wastes**

#### Control

It is important that effective laws and enforcement mechanisms are developed in all States for the management of hazardous wastes. Until such instruments are in place, it is necessary to provide a means of handling any such wastes that are presented, both to reduce threats to public health and the environment and to show that government takes this issue seriously.

Hazardous and special wastes are generated by certain chemical industries, but also from demolition and renovation, in scrap yards (especially if electrical equipment is involved) and from some maintenance functions such as ship repair and vehicle maintenance. Small quantities of hazardous wastes are generated in households. Hazardous wastes are also generated at hospitals and other healthcare facilities, and these are discussed in Section C.13.

It is important to have an effective legal definition of which wastes require special management under hazardous waste law. The system of definition used by the European Union may be adopted or modified.



Provisions relating to hazardous wastes should be incorporated into planning and licensing procedures, including those relating to export processing zones that are outside the normal customs regulations.

The Rotterdam Convention controls the movement of hazardous chemicals and the Basel Convention governs the movement of hazardous wastes.

The needs for data collection and training should be evaluated and accommodated at regular intervals. Whilst the generators of the waste should be required by law to keep records of the quantities and characteristics of the hazardous wastes that they generate, it is also important that the controlling authority makes unannounced and effective spot checks to confirm the accuracy of the data provided by the generator. Some form of consignment note system should be developed for tracking wastes from the generator via transport and treatment to the final disposal.

Consideration should be given to methods of recovering costs from generators and also to bonds or bank guarantees that can be used to encourage compliance and pay for clean-up work if it is needed.

### Minimisation

Hazardous wastes (as defined by national legislation) are particularly expensive to treat and dispose of. As a result, the quantities that require disposal should be kept as low as possible. Every effort should be made to prevent the importation of substances that are classed as hazardous wastes, and chemicals and medicines that will soon be beyond their useful life and so will soon be regarded as hazardous wastes.

Chemical industries may be able to reduce the quantities of hazardous wastes requiring disposal by adopting one or more of the following methods:

- ◆ The existence of excessive or outdated stocks may be due to overestimation of needs, deterioration because of poor storage conditions, or poor management of stocks (such as using more recent deliveries first so that older stock is expired before it is discovered). Therefore a review of storage methods and stock management may help to reduce wastage.
- ◆ Substitution of a hazardous chemical that is currently employed, by a chemical that is not classed as hazardous. Industries may be able to effect such substitutions with relatively small changes to their processes. If there is an extra cost involved, the difference in disposal costs may help to persuade the industrialist to change. Clean Technology Centres (for example in Malta and Zimbabwe) may be able to provide advice on suitable options.
- ◆ Modification of processes so that there is less wastage. For example, it may be possible to change the steps in a washing or cleaning process so that less acid or solvent is contaminated. Again, the Clean Technology Centres may provide a useful input.
- ◆ Processing the waste to recover useful chemicals. It may be possible to recover solvents by distillation or recover oil by cracking emulsions.
- ◆ Waste exchanges: sending a material that is a waste of one industry to another industry that can use it as a raw material. (If the receiving company is paid to take the waste there is a strong possibility that they may be dumping or storing the waste illegally, so vigilant inspection is necessary.)



The importation of hazardous chemicals should be carefully controlled, with thorough and unannounced inspections of companies that are registered users of hazardous chemicals, or suspected users. Consideration should be given to linking the management of hazardous wastes with the control of hazardous chemicals, which are being imported or produced as raw materials for industrial or commercial processes. The expertise involved is similar, and records of imports of hazardous chemicals would provide useful information about the identity of sources of chemical wastes and the likely quantities. The control of incoming wastes allows the minimisation of such wastes, since substances, which can be replaced by a less hazardous chemical, could be banned. The expiry dates of incoming chemicals should be scrutinised and excessive deliveries (such as from donors) could be refused or reduced if it were likely that significant amounts of the material would pass its expiry date before being used.

Similarly, control of imports may help to reduce problematic or special wastes. Some countries in the Region import used tyres, and many of these tyres may quickly become wastes. Other items may be imported when they are near the end of their lives, or there may be imported items are of such poor quality that they will soon be discarded. Quality control of imports or the imposition of import duties on such items, may help to reduce waste management problems. The heavy metal contents of batteries differ considerably, and so it may be advisable to ban certain types on the basis of their composition.

Financial incentives for reduction of industrial wastes in general have already been mentioned in Annex E.2.1.

### Treatment

Whilst it may not be possible, in the short term, to enact and enforce legislation on the management of hazardous wastes, it is possible to provide a temporary facility for the storage and shipping of hazardous wastes that are brought for disposal by responsible citizens and organisations. Wastes requiring such attention might include used solvents, unwanted pesticides batteries of various kinds and waste oil.

Based on knowledge of the types and quantities of hazardous and special wastes that arise within the country and the Region, the feasibility of pre-treatment methods should be established. Such methods might include chemical pre-treatment of certain hazardous wastes to make them less reactive, less mobile (soluble) or less corrosive, so that risks in storage and shipping are reduced. The need for a small incinerator for treating special wastes (such as animal carcasses, condemned food, confiscated drugs, and port and airport wastes) might also require investigation.

Proposals should be prepared taking into account the existence of facilities in neighbouring states, and legal provisions may be required to allow the shipping of hazardous wastes to locations within the Region where there are satisfactory arrangements for disposal. (For example there is a facility in Réunion for burning waste oil, and there may be a cement factory, which could accept certain hazardous wastes that need high-temperature incineration.) When a system for managing hazardous wastes is in place, a public education campaign could be used to focus attention on this issue, encouraging the public to bring hazardous wastes for safe disposal and to be vigilant concerning unsafe practices by others.

In the initial stages this might involve simply a secure storage facility and the capacity to determine the nature of the wastes, while contacts are made within or outside the Region to identify economical and satisfactory disposal routes.



## E.2.4 Resource recovery

### New activities

If it is planned to start a new recycling activity, all parts of the chain must be considered - from identifying the best sources of the material to be recycled, through estimating the quantity that may be available, the method of separating this material from the other wastes, the network needed to assemble sort, clean and provide the material, the reprocessing method and equipment, and the product design, to the marketing and distributing of the product. Other issues, such as the financial feasibility, the availability of a workforce ready to do the required work at the salary that can be paid, regulations (commercial, health and safety, and environmental), the location of the operation, and the impacts on all stakeholders, must be considered, among others.

Some wastes can be reprocessed so that they can be used again for the same purpose (e.g. paper recycling) or made into new types of products (as with plastic, aluminium and steel cans). Large industries, offices and large shops may be useful sources of materials because they may generate large quantities of particular wastes in an uncontaminated condition. Data collection and pilot projects may be needed to determine how usable materials can be obtained, and in what quantities. Research may be needed to determine the size of recycling operation that can be supported by the available supply of material or sufficient quality. The demand and the financial prospects may indicate that it is not feasible to have certain facilities in each country, but that one facility should be shared by two or more nations.

Resource recovery can include energy recovery from waste. Energy is recovered by incineration, by collecting gas from large sanitary landfills, and by producing fuel from solid waste in more sophisticated ways. If incineration is being considered, it is essential to undertake very detailed studies of the calorific value of the waste at different times of the year, considering the composition and moisture content of the waste, as it would be received at an incinerator. The costs of incineration including measures to minimise air pollution, and the public acceptability must also be considered. Methane gas can be collected from sludge digesters, and at large wastewater treatment plants some of it can be used to generate electricity or provide a limited amount of fuel for vehicles.

### Taxation and incentives

In some situations it has been found that secondary materials are taxed more heavily than virgin materials. If any such situations are discovered, they should be amended so that secondary materials can compete fairly with virgin materials. It is generally considered advisable not to subsidise recycling operations, but in some countries a tax on landfilling makes recycling more competitive if the recycler is paid the appropriate disposal fee for each ton of waste recycled. A tax on landfilling is not recommended where arrangements for inspection and enforcement are such that it would lead to an increase of illegal dumping at unauthorised sites.

The linking of collection charges to waste quantities is discussed in Annex D.2.1. In some situations this approach is suitable for reducing waste quantities and encouraging resource recovery, but such systems may also lead to illegal dumping, and they can be costly to administer.



### Easing constraints on existing recycling operations

This involves a number of activities including:

- ♦ Investigating the constraints of particular resource recovery streams - the constraints may relate to the quantity or quality of secondary feed material, the purchase of recycled material or the market for the products made with recycled material. If material such as scrap iron is imported, it may depress local prices and demand because the supply is greater than the demand, or it may add sufficient material to merit a local reprocessing plant.
- ♦ Providing information and assistance to entrepreneurs with interests in resource recovery, including information on costs and other implications of reprocessing technology and the requirements of local industrial hygiene and pollution control legislation, and possibly assistance in obtaining finance for this equipment. In some cases government might consider guaranteeing to purchase a specific quantity of the output of recycling industries that it is seeking to promote, but in general the financial involvement of government is not advocated, since the recycling industries should be self-sufficient and financially viable. However government purchasing policies should set the lead in specifying products made from recycled material if their quality and price are acceptable.
- ♦ Investigating possibility of extending deposit schemes that encourage the return of items such as drinks bottles and cans, in order to increase the supply of clean secondary material;
- ♦ Extending "bring" systems (or "drop-off" centres) for recycling materials, both by providing more convenient container locations and by adding to the materials that are collected in this way for resource recovery.

It is important that public sector organisations take the lead and set a good example by implementing relevant laws quickly and thoroughly. (For example, government offices should set an example by segregating and recycling waste paper and there should be a rigorous policy for government offices and services that recycled products will be preferred when it is possible to use them.)

### E.3 ISSUES RELATED TO REGIONAL STRATEGY COMPONENTS

For each strategy component in Section D, some questions or issues were identified. They are listed below, under the appropriate section number and title.

#### D.1 Networking

- ? Should an interim, informal e-mail network be set up until the web site is fully operational?
- ? If so, who should operate the e-mail network, how would this work be funded, and would it be restricted mainly to the IMA Region, or would efforts be made to involve SIDS in other regions?
- ? Are there people in the Region who have important contributions to make and who do not have access to e-mail and the Internet, and if so, how can they participate in this information exchange?
- ? When a web site is set up, how will the ongoing operation of the site be staffed and funded?

#### D.2 Promotion of composting within the Region

- ? Which components (inventory of initiatives, list of experts, travel scholarship, guidance notes, resource centre) should be included in the strategy?
- ? How can funding be obtained for these activities, and how should the funding be administered?
- ? How should information about initiatives and experts be collected and collated - national consultants, a regional consultant...?
- ? Should there be any restrictions on eligibility for the travel scholarships - should individuals in the private sector and students be included?
- ? On which topics should guidance notes be prepared? How would prospective authors be selected and remunerated? Into which languages should they be translated?
- ? Where should the resource centre be located? Should there be a membership arrangement?

#### D.3 Public awareness and education

- ? To what extent to the countries in the Region have enough in common to enable them to share experiences and materials in a useful way?
- ? Who should be asked to start the process of investigating past and present efforts in this field? What support (in terms of remuneration and resources) would this person need in the first year?
- ? What resources are required, and how could these resources be financed?

#### D.4 Staff training and development

- ? What evidence is there that more training is needed? What particular topics and what levels of staff represent the greatest needs?
- ? How can training be co-ordinated and promoted on a regional level? What are the alternatives to the appointing of a part-time training officer?
- ? What are the training needs for junior staff and manual workers? Why has sufficient training not been given to these employees by senior staff?



#### D.5 Formulation of laws and standards

- ? To what extent can the SIDS in the Region assist each other in the development of legislative frameworks? To what extent do differences in basic law and language prevent the transference of experience and useful information? How could any regional activity be co-ordinated?
- ? What are the benefits of setting standards that cannot be enforced? What can be done to improve the enforcement of standards and regulations, particularly on commercial and industrial generators? What are the main constraints to improving the effectiveness of enforcement?
- ? What are the needs for further agreements and conventions regarding the movements of hazardous wastes and recyclable materials?

#### D.6 Co-ordination of hazardous waste management

- ? Which types of waste cannot be disposed of satisfactorily within the country?
- ? What are the benefits of a unified definition of which wastes are hazardous and an agreed approach to the management of these wastes? What are the constraints that make it difficult to achieve this type of agreed approach?
- ? What questions need to be resolved before it is possible to work together to combine wastes that are sent abroad for disposal?
- ? How could suppliers of chemicals be involved in ensuring safe disposal of associated wastes?

#### D.7 Co-ordination of waste minimisation and resource recovery

- ? Many recycling enterprises may operate informally, without a business licence and outside some trading and environmental laws. To what extent can government work with them if they operate in this way? Under what circumstances might an informal recycling business not be financially viable if it operated in accordance with all government regulations?
- ? What are the materials that most need inducements to encourage recycling, either because of their quantity or because of their impact on the environment?
- ? Which initiatives in this field should be regional, and which national?

#### D.8 Development of national institutional arrangements

- ? What resources are available to guide and support initiatives that make greater use of the private sector? How can regional experiences be integrated to provide most benefit? What would be the advantages and disadvantages of developing a standard contract to be used as a basis for contractual agreements throughout the Region?
- ? To what extent could a regional initiative concerning financial records and revenue generation be of benefit to municipal authorities within the Region?
- ? What are the operational, administrative and legal issues associated with a disposal facility that serves a number of municipal authorities? How can agreements for such facilities be enforced?

## E.4 THE SCOPE OF SOLID WASTE MANAGEMENT

The following list of topics can act as a checklist. It indicates some of the main aspects of solid waste management, and so can be used to review current waste management strategies to check that all aspects are given sufficient consideration. The list is not exhaustive and should be developed to suit local requirements.

### PLANNING

- ◆ Long-term - strategic planning
- ◆ Medium-term - action planning
- ◆ Short-term - operational planning

**DATA NEEDS.** Almost every proposed activity requires the collection of some form of data. Some typical requirements are listed below, but the purpose of any data collection exercise should be clearly understood in order to collect the data in the required form.

- ◆ Sources of waste - population distribution, locations and sizes of shops, markets, abattoirs, offices, institutions, industries, construction projects and other sources, types and quantities of waste produced by the various sources;
- ◆ Waste characteristics - density, composition, moisture content, calorific value
- ◆ Composting - input and product weights, chemical analyses, financial data, market demand
- ◆ Recycling - specifications and prices of recyclable items and materials, operation costs, costs of reprocessing equipment, volume of demand.
- ◆ Collection and disposal operations, capacities, costs, weights and productivities of collection systems, capital and operating costs of disposal systems

### ADMINISTRATION ARRANGEMENTS

- ◆ Functions - monitoring, client, operations
- ◆ National and local responsibilities
- ◆ Co-ordination and information exchange
- ◆ Types of agency and arrangement

**LEGISLATION** - including supporting regulations, fines, enforcement

### REVENUE COLLECTION

- ◆ Collection methods
- ◆ Sanctions, incentives and penalties

### PUBLIC EDUCATION AND AWARENESS

- ◆ General environmental and public health concepts, economic aspects
- ◆ Promotion of waste minimisation, source segregation and recycling
- ◆ Preparation for community action and involvement in collection systems.

### HUMAN RESOURCES DEVELOPMENT

- ◆ Technical and management training
- ◆ Career structure and employment conditions



#### CO-OPERATION AND CO-ORDINATION - information, standards and facilities

- ◆ between municipalities and ministries
- ◆ between nations
- ◆ co-ordination with donors

#### PRIMARY COLLECTION OF SOLID WASTES

- ◆ Service provider - public, community or private enterprise
- ◆ Method of collection of payment
- ◆ Interface with downstream transporter - transfer of waste and payment

#### COMPOSTING

- ◆ Raw material - mixed waste, segregated waste, agricultural and industrial wastes, sludge
- ◆ Process - spreading raw waste, anaerobic and aerobic composting, vermiculture
- ◆ Equipment and methods - manual, semi-mechanical, fully mechanised
- ◆ Marketing - demand, demonstration, quality, packaging, price, promotion
- ◆ Institutional arrangements - private and public sectors, role of agricultural sector

#### WASTE MINIMISATION METHODS

- ◆ Influencing behaviour and preferences
- ◆ Modifying products and packaging, legal and economic instruments
- ◆ Industrial processes - housekeeping, process, input and product modifications

#### RECYCLING

- ◆ Materials - aluminium, ferrous metals, plastic (PET, PE, PVC, other), glass, paper, animal feed etc.
- ◆ Capture - sorting, segregation, importation, collection, transport
- ◆ Processing - baling and size reduction, cleaning, physical and chemical transformations, manufacture
- ◆ Financial aspects - purchase of material, dealer networks, financial feasibility
- ◆ Legal aspects - requirements of generators (segregation, deposits, product design, labelling), status of dealers and reprocessors, pollution control, product quality, working conditions (health and safety), participation of children

#### HAZARDOUS WASTES - pesticides, industrial chemicals, liquids from scrapped electrical goods, used oil, batteries, solvents, radioactive wastes,

- ◆ Legislation - definitions, responsibilities, access to premises and information, penalties, corporate and individual liabilities, prior notification and approval, tracking, international movements, enforcement, licences of waste management contractors
- ◆ Inventories - sources, quantities, composition
- ◆ Inspection and enforcement, public education, training of transport and disposal workforce
- ◆ Technical aspects - analytical services, storage and transportation, treatment and disposal

#### HEALTHCARE WASTES

- ◆ Legislation and regulations - definitions, responsibility, provision of facilities, colour coding, tracking
- ◆ Equipment - storage, handling, treatment, transport and disposal
- ◆ Training and awareness - segregation, methods, accident

**E.5.1 PARTICIPANTS AT FIRST (NATIONAL CONSULTANTS) WORKSHOP****National Consultants**

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Dr Adrian Coad	SKAT (Swiss Centre for Development Co-operation in Technology and Management)	Switzerland
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**E.5.2 PARTICIPANTS AT SECOND (DECISION-MAKERS') WORKSHOP****14 and 15 December 1999**

Mr. Abdou Soimadou Ali	Secretary General, Ministry of Rural Development, Fisheries and the Environment	Comores
Mr. Lourenço Monteiro de Jesus	Advisor, Ministry of Infrastructure, Natural Resources and Environment	Sao Tomé
Mr. Prakash Kowlessar	Environment Officer, Environment Department, Ministry for the Environment, and Urban and Rural Development	Mauritius
Ms R. Chinnien Economist,	Ministry of Economic Development, Productivity and Regional Development	Mauritius
Dr. Adrian Coad	Resource person from SKAT	Switzerland
Ms. Elizabeth Khaka	UNEP representative	Kenya
Mr. Raj H Prayag	Co-ordinator, COI	Mauritius



## E.6 SOURCES OF FURTHER INFORMATION

### D.5.1 National Reports

**Cape Verde** *Report on Waste Minimisation Strategy - Cape Verde Islands*; by Ant nio Barbosa, October 1999

**Comores** *Rapport Nationale des Comores; Strategie R gionale de Gestion des D chets dans L'Oc an Indien et les R gions de L'Atlantique*; by Mme Bicarima Ali, October 1999

**Madagascar** *Rapport sur L'Etat de la Gestion des D chets   Madagascar* by Mme Faramalala Raveloharifera, with contributions from Mme Pierrette Ramasiarisoa, Mr Roger Rejo, Mr Jean Pierre Randrianasolo and Mr Hery Rajaomanana, with the collaboration of the National Committee for the Management of Chemical Products and the VOARISOA Project. November 1999

**Malta** *Waste Management in the Maltese Islands*, by Marie Briguglio, Joseph Gauci, Adrian Mallia and Kevin Mercieca, November 1999

**Mauritius** *National Waste Minimisation Strategy; National Report, Mauritius*, by Prakash Kowlessar; November 1999

**Sao Tom ** *Rapport Nationale de Sao Tom  sur la Strategie R gionale de Gestion de D chets dans L'Oc an Indien et les R gions de l'Atlantique*, by Arnaldo Fernandes Cavalho; November 1999

**Seychelles** *Integrated Waste Management in Indian and Atlantic Ocean SIDS Region; Country Paper - The Republic of Seychelles*, by Marlon Montano and Mary A Stravens, November 1999

### OTHER REPORTS

**Mano Kumarasuriyar**, 1999; *Strategic Guidelines for Integrated Waste Management in Small Island Developing States*, for UNEP Meeting of Experts on Waste Management in Small Island Developing States, Marlborough House, London; 2 - 5 November 1999.

**Lino Briguglio**, 1999; *The Sustainable Development of Small Island Developing States in the Indian Ocean, Mediterranean and Atlantic Regions (IMA-SIDS)*; Islands and Small Islands Institute of the University of Malta, Ministry of Foreign Affairs, Malta and United Nations Environment Programme.

**Thurgood**, Maggie, 1998; *Decision-Makers' Guide to Solid Waste Landfills*; World Bank, WHO, SDC, SKAT

**UNEP and COI**, 1997; *Waste Management in Small Island Developing States in the Indian Ocean Region - Report of a Regional Workshop, Quatre Bornes, Mauritius, 16 - 19 December 1997*

**UNEP**; *A Directory of environmentally sound technologies for the integrated management of solid, liquid and hazardous wastes for SIDS.*