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• Waste Management

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# *Industry as a partner for sustainable development*

## Waste Management

International Solid Waste Association (ISWA)



*Developed through a multi-stakeholder process  
facilitated by:*



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# *Industry as a partner for sustainable development*

## Waste Management

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In a multi-stakeholder consultation facilitated by the United Nations Environment Programme, a number of groups (including representatives from non-governmental organisations, labour unions, research institutes and national governments) provided comments on a preliminary draft of this report prepared by the International Solid Waste Association (ISWA). The report was then revised, benefiting from stakeholder perspectives and input. The views expressed in the report remain those of the authors, and do not necessarily reflect the views of the United Nations Environment Programme or the individuals and organisations that participated in the consultation.



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## Foreword

Since the 1992 World Summit in Rio de Janeiro, professional waste management has made significant technological and managerial contributions to the protection of the environment. However, we are still facing numerous and serious problems. The 1990s can be seen as a period of better understanding regarding the position and function of the waste management sector as specialist in the ecological, economic, and social framework. The new decade offers an opportunity – and at the same time shows the necessity – to proceed with the implementation and consolidation of environmental regulations. Focused action is required as soon as possible, especially in developing countries.

This document summarises contributions from a number of International Solid Waste Association (ISWA) national members. The ISWA is well aware of the fact that the overview provided is far from being complete. Nevertheless, the document clearly shows the significant change of the role of waste management from the sector's limited scope of dealing with wastes to the new task of managing our society's metabolism.

Waste management has for quite some time been understood as a key area in global environmental protection. Beyond that integrated waste management may be regarded as an interface between the production, distribution and consumption of goods on the one hand, and soil, groundwater, air and climate on the other. Thus, it is an important partner in the context of sustainable development.

Industrialised countries are currently fine-tuning their regulatory framework and waste management infrastructure. The waste management industry deals with considerably rising environmental and legal standards, best

practices, the need for increased efficiency, quality management and occupational health aspects.

The impact of waste management on the environment has been widely recognised in less developed regions, as well. Getting control of the various waste streams from households, small shops, from the industry, the healthcare sector, and numerous other sources, allows their proper handling, treatment and disposal. Furthermore, it has been recognised that very simple solutions for waste management often have tremendous effects on the health and safety standards in developing countries.

Waste collection is the basis for all subsequent managerial measures and treatment technologies. The early stages we hope to envisage comprise the establishment of a basic regulatory framework, of collection schemes, and of appropriate treatment and disposal facilities to prevent further damage to the environment. Training of operators and staff is a key element in this context. Local operators and authorities can definitely benefit considerably from international support and the transfer of know-how, so that they can run at least basic collection and recycling operations, landfills or compost plants in the best possible way under the given circumstances.

ISWA has recently entered into co-operation with UNEP and is now able to offer training courses in developing countries. Furthermore, a special training pack for hazardous waste is being developed in order to support this training programme. The tasks and challenges we face today in our business and field of research are the result of decades, if not centuries, of economic and social development.

Our behaviour as consumers, as well as our roles as managers, operators or regulators, are determined by our specific set of values, our emotions, our culture, our cognitive background, and by our personal degrees of freedom. Both education and legislation are required to change behavioural patterns. Education will create awareness and support the development of a new frame of mind in a mid-term perspective. Legislation, however, has to lay out the rules, to enforce them and to prevent violations as a short term measure.

In view of the variety and complexity of products and consequently of wastes, by-products, and residues, there is no single solution to the waste treatment demands of today. An appropriate mix of technologies is needed in order to meet the various technical, ecological and economic requirements of integrated waste management on a regional level. As long as industry and consumers produce waste, we need an infrastructure that allows for their proper treatment and detoxification and for the safe long-term disposal of residues. This system may become less extensive once we achieve good results in the fields of waste detoxification and waste minimisation.

The concept of producer's responsibility was realised by shifting the financial burden for the proper treatment or recycling of end-of-life products to manufacturers. This has established a new line of communication between the environmental sector and manufacturers. Waste managers relay information regarding the design for recycling and the design for disposal upstream to producers and manufacturers, thus advocating the cause of the environment's capacities and environmental constraints. This communication will still be developed and further improved, but it can be regarded as a first step taken by the waste management sector.

Two main challenges for the future are the task of decoupling waste generation from

economic growth by increased eco-efficiency as well as the problems caused by the trend of rapid urbanisation. Given our present production and consumption patterns, waste generation is closely tied up with population growth and economic development. Many of the most rapidly growing conurbations and mega-cities are located in developing countries where funding is still a critical issue. While the introduction of fees for waste collection and treatment services raises people's awareness, it may push consumers and businesses to illegal practices. This makes education an even more important factor in this context.

Today, the waste management industry is well aware of the importance of social aspects. These include, among others the siting of facilities and the introduction of new collection schemes, training workers and staff and educating consumers, establishing and promoting business, business relations and international dialogue, etc. Since the waste management sector of today has a wider scope, an increased potential and a sense of growing responsibility, it needs to create trust in its management approaches, business practices and technical operation. Trust as a long-term commitment will be supported by high standards, transparency, documentation, and an honest policy to fight offenders.

As part of this programme, ISWA initiated the development of a Waste Convention as a code of ethics for the waste management business worldwide to raise the level of performance in this field. ISWA extends an invitation to other international bodies to contribute to this initiative.

ISWA's practical experience gathered in more than 30 years of international co-operation of practitioners and planners, regulators and operators, scientists and researches in the field of waste management in more than 90 countries around the world proves how much developing countries and economies in transition can benefit from this transfer of



know-how. Of course, immediate support that facilitates the implementation of sound waste management strategies and practices is most valuable. In many cases, a small amount of money invested in training and education will enable local staff and regional regulators to solve the problem themselves.

If the industrialised countries are willing to donate just a minuscule fraction of the waste management industry's profits for this purpose, this sum – allocated under acknowledged international auspices – will make a tremendous difference. With its unique and balanced membership structure that represents the public and the private sector as well as the academic and scientific world, the ISWA is ready to take the lead in this effort.

The more the waste management sector understands and accepts the paradigm of sustainable development, the more it becomes obvious that our traditional approaches and common tools will soon have reached their limits. Present planning and regulation in waste management still focus on micro measures. On the other hand, very high standards have been successfully achieved in many technical areas, from emission control to working conditions. This know-how, these technologies and practices have not been implemented in many parts of the world – not for technical reasons in the first place, though.

Despite all efforts, there are huge areas in which no progress can be expected in the near future due to other political priorities, to a lack of awareness or to poverty.

Yet, we have a common goal – an environmentally sound, responsible and sustainable management of wastes with a minimum of detrimental effects on human health and life, and on the eco system. And we have a common restriction – limited financial resources. So we have to ask ourselves: which are the key priorities and which are the most

efficient measures with the biggest possible benefit for the environment?

Ten years after the World Summit of Rio de Janeiro, environmental policy-makers now have tools like environmental impact assessment, or cost-benefit analysis, life cycle analysis, material flow analysis etc. for improved and scientifically based decision making. The professional waste management sector anticipates that the 2002 Johannesburg Summit will address the macro measures that will help us to overcome the stall we may face due to financial constraints in the developing world.

With this common goal in mind, we will assume our shared responsibility for the future.

I would like to thank all ISWA members, experts and staff involved in the preparation of this document and especially Helena Bergman, ISWA general secretariat, for her dedicated work.

Christoph Scharff,  
President, ISWA January 2002



## Executive summary

Waste management is an important part of the urban infrastructure as it ensures the protection of the environment and of human health. It is not only a technical environmental issue, but also a highly political one. Waste management is closely related to a number of issues such as urban lifestyles, resource consumption patterns, jobs and income levels, and other socio-economic and cultural factors.

The present report gives a brief review of the development of the waste sector since the 1992 Rio World Summit, as well as a status description of the situation of waste management today and of future challenges. The scope of the report is limited to the management of municipal solid wastes (MSW).

This report is divided into five parts. Part 2, describes the status quo in the field of waste management and presents relevant facts and figures. Part 3 takes a look at the differences in waste management in different parts of the world. Part 4 deals with the implementation of the three dimensions of sustainable development in the waste industry. Part 5 explains different means of how to implement sustainable waste management systems. Some of the instruments are widely applied whereas others mainly concern a few countries that are in the forefront of waste management. Part 6 looks into future challenges and goals for the waste industry. A number of case studies can be found in the annexes to the report.

One characteristic feature of sustainable waste management is that it is achieved by using the technical, organisational, and financial resources available in a particular locality.

The waste management situation in the countries around the world is by no means uniform. It is easy to forget that the category of countries that are now 'fine-tuning' their waste management systems is a minority. The

vast majority of countries are busy struggling with such basic issues as ensuring sufficient collection services and implementing a minimal degree of control at disposal sites at the same time as they are facing increasing waste amounts due to the trend of urbanisation. They also lack the technical and financial resources to safely manage solid wastes – which includes adequate provisions for storing the waste at the point of generation as well as efficient and sufficient collection services. Final disposal in those countries is usually a matter of transporting the collected wastes to the nearest available open space and then discharging them.

However, important progress has been made in the waste sector over the last few years. The most important improvement is the increased level of awareness among both the public and politicians. This is the first step to ensure that action is taken and resources are allocated accordingly. On the other hand, the availability of resources is closely connected to the economic situation and waste management still holds a weak position in this context compared with other public services. And since economic development is also closely linked to the generation of waste, the last couple of years with strong economic development have resulted in increasing waste quantities.

It has become more common to use different instruments to reach environmental targets. Legislation plays an important role in establishing the framework for these targets; it is complemented with a number of market based, economic and information related instruments. Their application and effectiveness depends on the situation. During the last ten years, new communication technologies and networking have played an increasingly important role in the process of sharing know-how and experience across borders.

One major drawback for the industry is the difficulty to get acceptance for the siting of new waste treatment facilities. The NIMBY-syndrome ('not in my backyard') makes the siting of facilities lengthy and costly all over the world.

The most important challenge for the industry is the prevention of waste, followed closely by the need to obtain clear, transparent and reliable data. Another task is the increased cooperation across industrial sectors to achieve the overall goal of improved resource management and to render waste less hazardous. Solutions for those two goals will have to be found in the conception, design and production phases of goods.

It seems clear that the tail (waste management) cannot wag the dog (the entire economy). The tools of material and substance flow analysis, life cycle analysis and cost-benefit analysis have to be applied more widely, since focusing on the waste end only is the wrong approach in many cases. The combined application of these methods for comprehensively defined systems will result in concrete concepts of the optimal mix of measures. The goals of dematerialisation and detoxification of all economic activities in a long-term perspective have to become more important than goals just restricted to waste management.

The resulting concept could be called 'sustainable integrated resource and waste management'. The main future challenges and goals for realising this concept are:

- National waste policies have to be made more coherent; the legal framework, its implementation and enforcement need to be improved in all parts of the world. Especially in developing countries, substantial efforts are of greatest importance in that field. Waste management plans at national and local level are needed; these can serve as the basis for the improvement of and investment in waste management systems. This is especially important in those countries where public health is adversely affected by insufficient or non-existent services.
- It is of highest priority to achieve a reduction in the amount of waste generated and to decouple the link of economic growth and waste generation. For this purpose, a uniform waste industry approach to raise public and political interest is required in all parts of the world to establish sustainable waste management systems.
- A most pressing area for future progress is the field of information and education. There needs to be a co-ordinated strategy with regard to information provision and considerable work needs to be done to change people's attitudes towards waste management as a whole and increase participation in recycling and minimisation schemes. Once the public is participating in the recycling schemes it is important to give them feedback on what happens with the recycled waste to keep up their interest in participation.
- Information and education are also needed to allay the fears that people have with regard to waste management and to encourage them to take responsibility for the waste they generate. One major goal that needs to be achieved is increasing public confidence in the waste management sector. Extensive work needs to be done to remove negative perceptions and replace emotive views with views based on sound science and agreed facts.
- Future progress is also needed in improving the markets for recyclables. Producers must be encouraged to incorporate life cycle assessments in the development stages of their products and consider waste

management issues in the design stages – something that does at present not happen as a general rule.

- Alternatives have to be made available so that consumers are encouraged to minimise their waste or buy products that are of a comparably high standard and price but less harmful to the environment.
- Accessible and transparent data is crucial if strategies are to be successful and sustainable waste management practices achieved. The industry needs to have access to clear, transparent and replicable data and information. The availability and the quality of waste data cause difficulties already at a national level; at an international or regional level, these difficulties are even greater.
- We need to create standards for the whole waste industry that include new and emerging technologies and also the management of specific waste types such as agricultural waste. Considerable investments should be made in emerging technologies and support should be given to research and development (R&D).
- While progress has been encouraging to date, partnerships need to be developed continually, so that all stakeholders can work together towards a common goal. Participation by all parties in the decision-making process is an important issue. The waste industry has to encourage and take part in multiple stakeholder involvement.
- The waste industry must set and achieve sustainability targets.
- There needs to be access to training and education for everyone involved in waste management. An increasing awareness of networking opportunities is required to facilitate the information flow.
- The practical experience of practitioners and planners, regulators and operators, scientists and researches in waste management must be made more available to developing countries and economies in transition. Immediate support and transfer of know-how are most valuable, as they facilitate the implementation of sound waste management strategies and practices. In many cases, a small amount invested in training and education can enable local staff and regional regulators to help them effectively.
- From a global point of view, the most urgent need is to close the gap between developed and developing countries. The first priority in this context is to make sure that there are collection services available to as large a part of the world's population as possible and to raise the quality of landfills.

The key priorities and the most efficient measures with the biggest possible benefit for the environment have to be identified on the basis of the relevant facts and figures. Tools such as environmental impact assessment, material flow analysis, or macro-economic cost-benefit analysis must be applied more widely for improved and scientifically based decision-making. A broad range of stakeholders must be involved to achieve substantial progress in the minimisation and detoxification of waste.

Step by step the isolated 'end of pipe' view of waste management must be transformed into a concept of integrated resource and waste management. This will help to realise genuine sustainable development. The system definitions of analyses used in decision- and policy-making must include the global picture of waste generation and resource consumption outside national systems. This is especially important in developing countries.

To achieve the objective of integrated resource and waste management, new ways of policy-making will be needed that include a structured dialogue between numerous stakeholders. Waste management institutions will be challenged to contribute to that dialogue, the topics of which will include the whole picture and range from the supply of primary resources, production and trade, to transport and consumption. As a result of this comprehensive approach, the goals of waste minimisation and decoupling of economic growth and waste generation may finally be achieved.

## Part I: Introduction

Waste management is an important part of the urban infrastructure, as it ensures the protection of the environment and of human health. It is not only a technical environmental issue, but also a highly political one. Waste management is closely related to a number of issues such as urban lifestyle, resource consumption patterns, jobs and income levels, and other socio-economic and cultural factors. Lately there has been a trend to enlarge the scope of waste management and include it within the larger concept of resource management. Today, waste management must be seen in its full context. It cannot be solved with merely technical end-of-pipe solutions.

When we employ a long-term waste management strategy to ensure sustainable development, this will not only affect a number of different dimensions; there are also different levels of decision-making and action involved. Decision-making and action take place at various levels – nationwide, regional, local and finally in households. All aspects and all actors must be considered when we develop a waste management system and implement it in daily life.

There are also large differences in the level of proficiency in the countries of the world. It is easy to forget that the category of countries that are now ‘fine-tuning’ their waste management systems is a minority. The vast majority of countries is busy struggling with such basic issues as ensuring sufficient collection services and implementing a minimal degree of control at disposal sites at the same time as they are facing increasing waste amounts due to the trend of urbanisation. There is an interesting parallel to draw between the problems faced by the cities of today’s low-income economies and those of 19th century North America and western Europe. In both cases, the pace of population growth outstripped the capacity to manage urban services.

*‘The total lapse of more than a century from the first clear stirrings of public interest in urban waste services to the present time in high-income countries suggests that a comparable change in low-income countries, where public interest is not yet fully aroused, is not likely to be swift. Until public interest is aroused, additional public funding for improved waste service is unlikely unless accompanied by increased prosperity.’* (WHO, 1998) The organisation of efficient waste collection in western Europe and North America took around 20 years, as public and political interest in waste management ‘was delayed to the 1960s and 1970s in the wake of another period of economic growth.’ (MacFarlane, 2001).

Due to this complex situation, it is indeed a challenging task to come to a satisfying solution. On the following pages, we have prepared a general report on the components necessary to attain sustainable waste management and we have included several relevant examples. The information used in this report was provided by a number of our national members and by a large number of other sources (as referred to in the bibliography). A UNEP reference group has also contributed to this text by providing material input and giving comments. The ISWA Scientific and Technical Committee and an internal ISWA reference group have also been helpful with advice.

### 1.1 The International Solid Waste Association

The International Solid Waste Association (ISWA) is a global body concerned with professional waste management. ISWA is a non-political and non-governmental association by statutes and follows the mission statement to promote and develop professional waste management worldwide as a contribution to sustainable development.

ISWA's objective is the worldwide exchange of information and experience on all aspects of waste management. ISWA promotes the adoption of acceptable systems of professional waste management and of public cleansing through technological development and improvement of practices for the protection of human life and health and of the environment as well as the conservation of materials and energy resources.

The association is active in a variety of areas, including conferences, meetings, training programmes, information development and dissemination, and technical assistance on a global scale.

ISWA has a total of more than 1,200 members in 93 countries. Its network expands to countries with more than 80% of the world's population. ISWA has three membership categories: national members, organisation members and individual members. At present, there are 32 national members or incoming national members that represent their country on solid waste issues. ISWA's national members represent countries with 48% of the world population and 87% in terms of global GNP.

ISWA's members represent all aspects of our field and most regions worldwide: from practitioners and industry to communities, from associations, research institutes and academics to regulatory authorities. The association is the global forum for waste management, with 12 technical working groups covering all relevant aspects of sustainable waste management and with special interest in developing countries issues:

- Working Group on Biological Treatment of Wastes,
- Working Group on Collection and Transport Technology,
- Working Group on Communication and Social Issues,
- Working Group on Developing Countries Issues,
- Working Group on Economic Analyses for Sustainable Development,
- Working Group on Hazardous Wastes,
- Working Group on Healthcare Waste,
- Working Group on Legal Issues,
- Working Group on Recycling and Waste Minimisation,
- Working Group on Sanitary Landfill,
- Working Group on Sewage and Waterworks Sludge,
- Working Group on Thermal Treatment.

## 1.2 Scope of the report

The scope of this report is limited to the management of municipal solid waste (MSW). Hazardous waste will only be touched upon in general terms. The delimitation of the scope corresponds to Chapter 21 of Agenda 21 excluding sewage sludge issues. The definition of MSW as referred to in Chapter 21.3 of Agenda 21, is as follows:

*'Solid wastes, as defined in this chapter, include all domestic refuse and non-hazardous wastes such as commercial and institutional wastes, street sweepings and construction debris. In some countries, the solid wastes management system also handles human wastes such as night-soil, ashes from incinerators, septic tank sludge and sludge from sewage treatment plants. If these wastes manifest hazardous characteristics they should be treated as hazardous wastes.'*

The general descriptions of individual sectors reflect the state-of-the-art standards characteristic of the most advanced countries even if this is not representative of standards common on a global scale. Certainly, the disparities between developed and developing countries are much more obvious than those between countries of the industrialised world. A large number of people around the world are without adequate waste collection and disposal services.



It remains an important goal for all countries to adopt general waste management policies, to allocate sufficient funds to ensure the setting up of collection systems and waste treatment facilities under controlled health and environmental conditions. It also remains a major challenge for the waste management sector to ensure the transfer of information, technology and experience to developing countries. In this report, consideration will be given to the different aspects and problems encountered in the field of waste management in developing countries.



## Part 2: Implementing the three dimensions of sustainable development

### 2.1 Environmentally sound management of solid wastes

Environmentally sound waste management is recognised by most countries as an issue of major concern. For both developing and developed countries, waste management is an important factor in ensuring both human health and environmental protection. Article 21.4 of Agenda 21 states that 'Environmentally sound waste management must go beyond the mere safe disposal or recovery of wastes that are generated and seek to address the root cause of the problem by attempting to change unsustainable patterns of production and consumption.'

Sustainable waste management is realised by using the technical, organisational and financial resources available in a particular locality.

Definitions of sustainable waste management will differ depending on the circumstances. The following components are indispensable for the purpose of guidelineing the implementation of a system that will be able to achieve the overall environmental objectives of countries and/or regions:

- waste policy, including a waste hierarchy;
- waste planning;
- regulatory framework;
- enforcement of the law.

Waste management is usually regulated by a national and/or regional waste policy. The following hierarchy is generally accepted in this context:

- waste prevention and minimisation;
- reuse and recycling;
- environmentally safe waste treatment including disposal.

Another important component is waste planning and the co-ordination of other policies on a national, regional and local level. Waste planning makes it possible to take into consideration the large number of different factors that have an impact on the waste management system.

The overall policy is linked by the objectives and targets that form the regulatory framework for the industry. The complexity of the framework differs from one country to another, but it sets the scene for the industry. In most developed countries, the industry is strictly regulated with regard to licensing, authorisation and compliance with the law of the different waste treatment facilities. Waste planning is also often subject to legislation: the general contents of a plan and the procedure of how to realise it are established by the law.

Enforcement of the law and the powers of the regulatory authorities to ensure that the regulatory framework is respected are necessary tools for efficient legislation. This is a weak point in most countries. Non-compliance with environmental legislation is not always deliberate. But there is still a tendency in society to consider this kind of violation less serious than the violation of other laws. The lack of efficient enforcement of such laws is often due to the lack of financial and human resources.

In the last few years, the concept of integrated waste management has evolved. In such a system, the technical solution of disposing of waste is not the only focal point. Instead, it relies on a number of different means to manage waste. It aims at a holistic approach to the chain of waste management from generation to disposal and all stages in between. All actors participating in and

affected by the waste management system are considered as well as cultural, social and economic factors.

Since the Rio summit in 1992, the focal point of waste management has shifted from raising the level of public awareness to taking action. In most developed countries, the development has gone from improving the technical solutions of waste management to understanding the importance of an integrated waste management system. The fine-tuning of the system will continue and technical solutions are going to be complemented by increased activities on social and communication aspects.

## 2.2 Description of the waste industry

Over the years, the waste industry has developed into three main groups depending on the type of waste dealt with:

- municipal solid waste: this group often includes commercial and institutional wastes,
- industrial waste: industry-specific waste depending upon the industrial activity concerned,
- hazardous waste.

Household hazardous waste is usually included in MSW. In developing countries there is often no distinction made between the different sources of waste; it is simply all mixed.

Healthcare waste is a small, but highly significant waste stream with a highly rated perception of risk. It contains a wide range of hazardous materials, as well as infectious materials. In this field, there is a significant potential for improvement in all countries regarding waste prevention, segregation and recycling. This is especially true in developing countries where there is a lack of special management and an urgent need for training

and support programmes. In those countries, separating and treating waste with intermediate technology is a truly sustainable alternative to doing nothing at all. But since healthcare waste goes well beyond the scope of this report, there will be no further specific consideration of this waste stream. That does not mean that the issue is not of a high priority in the achievement of sustainable waste management.

The individual steps in the waste management chain can be divided into the following:

- waste prevention, waste minimisation and waste detoxification;
- collection, transfer, transport and storage;
- reuse and recycling;
- waste treatment including waste disposal.

Waste can be treated and recycled using a large number of different technologies. But the following categories specify the main groups of treatments:

- biological treatment, for example composting and anaerobic digestion;
- incineration with or without energy recovery;
- landfilling.

Apart from those controlled treatment methods one cannot ignore the fact that a considerable amount of waste is still done away with in an unacceptable way. Waste is still disposed of by dumping it in the open or into the ocean, or by burning it on-site. Such ways of disposal have irreversible and potentially harmful effects on both human health and the environment. These are clearly not methods that belong to sustainable waste management. Nevertheless, such disposal methods are frequently employed in an estimated 175 sovereign nations and territories (Rushbrook, 1999).

As mentioned earlier, there are a number of different actors within the industry. These

range from policy-makers and legislators on a national level, to citizens taking part in the waste collection schemes. The role of the local authorities is to deliver sustainable waste management to the citizens. Many of those who work in the field of waste management are elected and appointed for a limited period of time. This is another factor that has an impact on the decisions taken and on long-term planning.

The fact that the industry is dealing with the public, influences the way industry works. Changing and directing public behaviour in a certain direction takes a long time and a large information campaign. Once a system is set up, it is difficult and costly to make changes to it. Furthermore, if citizens are required to behave in a certain way, they want to be informed on and assured of the environmental benefit of their efforts. The public willingness and capacity to pay for waste management are other factors that limit the scope of waste management services.

## 2.3 Facts and figures on the municipal waste industry

We can only comprehend the current situation, assess future trends, set targets, and determine the means to reach those targets efficiently, if we have precise information on waste amounts and on its composition. A common terminology is also an important element in the waste industry. However, the waste industry is still characterised by inconsistent and non-comparable data and the absence of a common terminology, of parameters and monitoring standards.

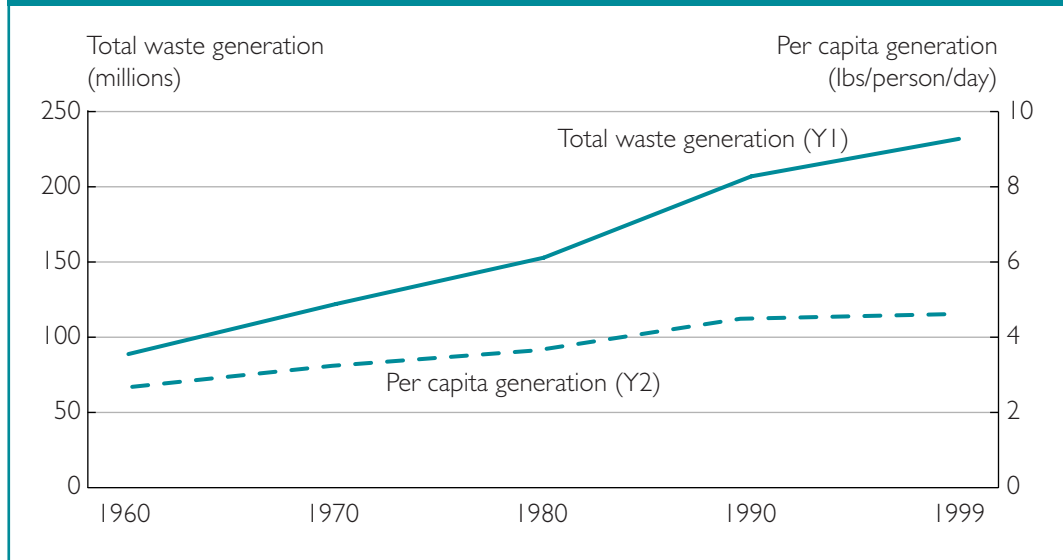
Municipal waste includes domestic refuse and non-hazardous waste from commercial activities and the public sector. But as mentioned earlier, this is not true for developing countries where different kinds of waste are usually mixed. The organisation of the collection and treatment systems for

municipal waste is normally within the responsibility of the respective public authority. The system is set up according to the demands of an overall waste policy and its targets. The amount of freedom to achieve set targets varies from one regulatory framework to another.

A number of different factors such as environmental, cultural, social, economic, and technical aspects must be taken into consideration in the setting up of a sustainable waste management system. That is why waste management schemes vary substantially from one country to another and also from one region/city to another.

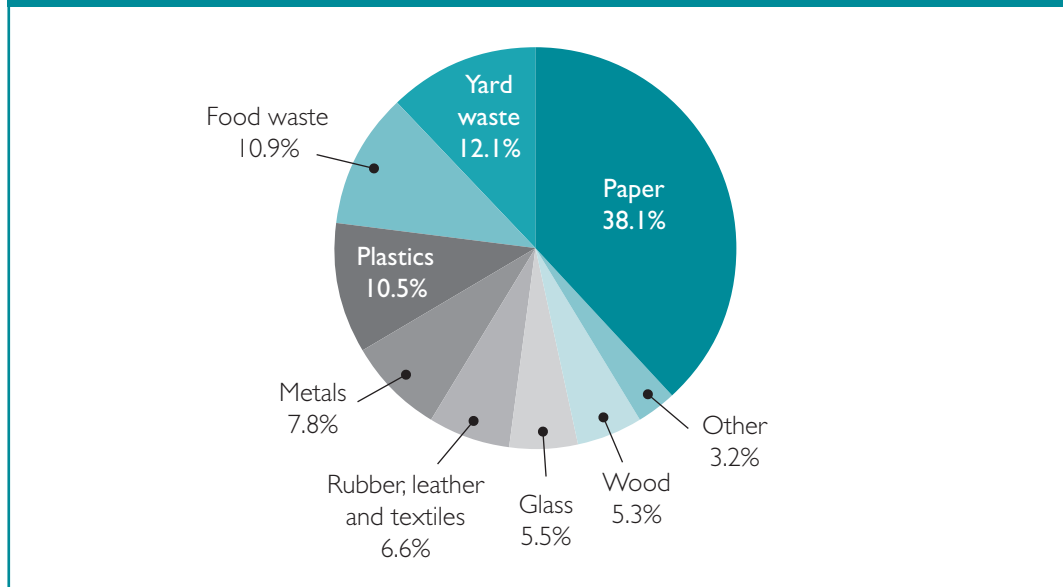
The patterns of waste generation, its composition and treatment are highly diverse in the different regions, countries and parts of the world. We have put together some statistical information illustrating those differences in the figures on pages 20 to 22.

Figure 1: Waste generation rates from 1960 to 1999 in the United States



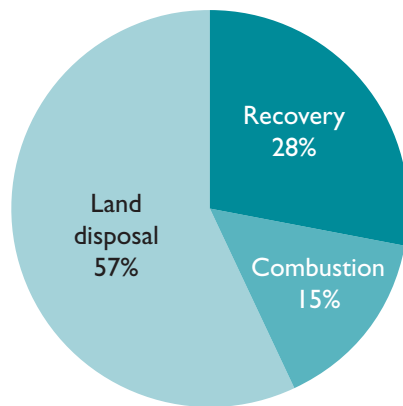
Source: US EPA, 2000

Figure 2: 1999 total waste generation in the United States - 230 million tonnes



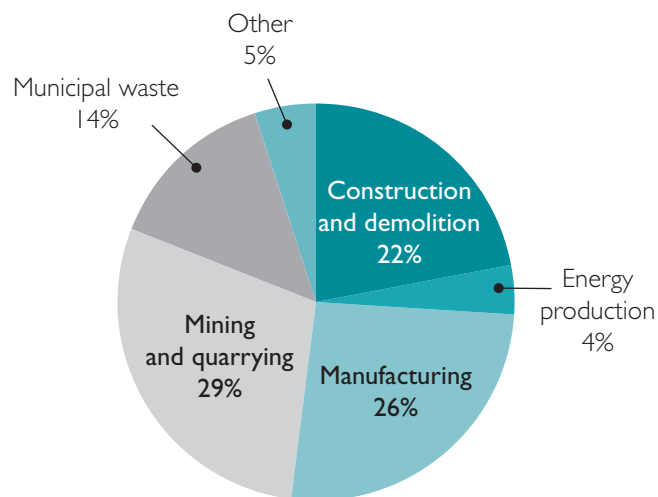
Source: US EPA, 2000

Figure 3: Management of MSW in the United States



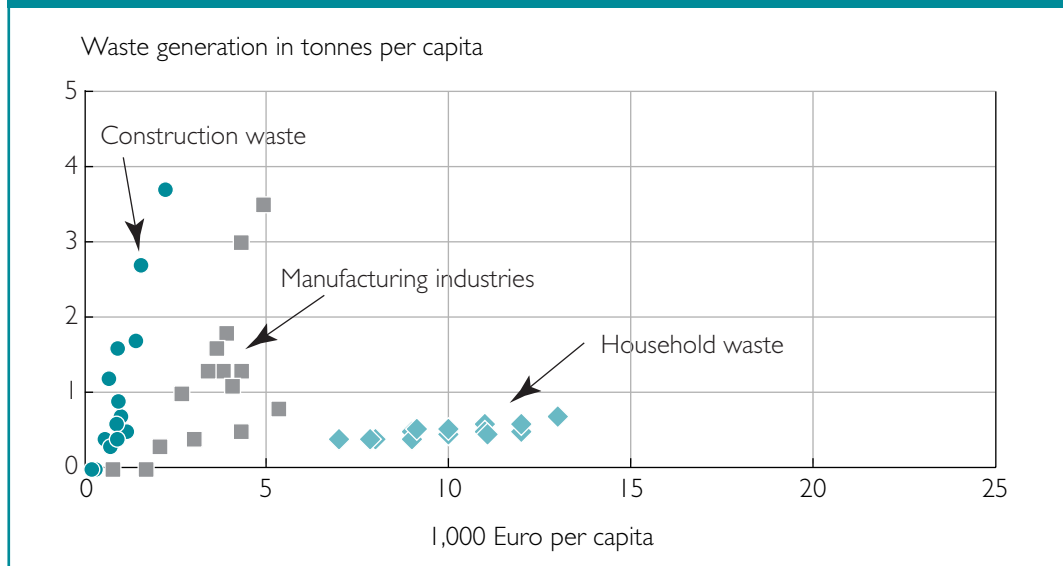
Source: US EPA, 2000

Figure 4: Total waste generation by sector - EEA countries 1992 to 1997



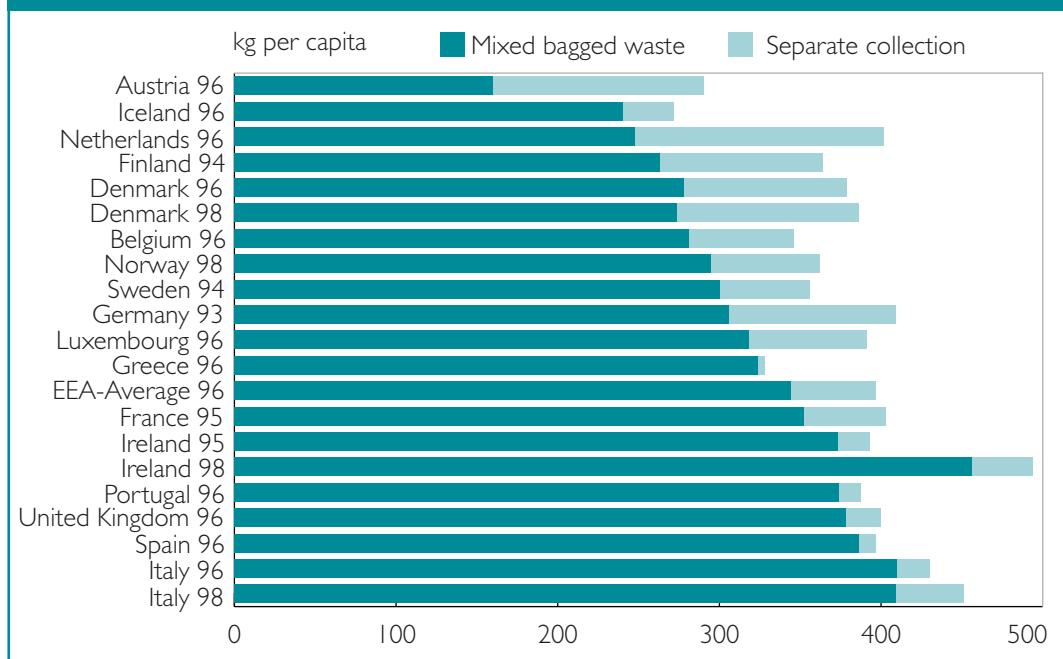
Note: Sewage sludge is included under other waste. EEA countries are the 15 member states of the EU and Norway, Iceland and Liechtenstein.  
Source: US EPA, 2000

Figure 5: Is there still a correlation between economic growth and waste generation?



Source: EEA, 2000

Figure 6: Waste generation from daily household and commercial activities



Note: The variations in waste generated from daily household and commercial activities between member countries are limited, except for Austria and Iceland, which have slightly lower generation rates. The increase in Ireland can be related to such themes as improved collection of waste and a more firm registration of waste or in changes in some of the household activities. Such as, the number of single households and the lifestyle change towards pre-prepared food and take-away restaurants. Source: EEA, 2000



Table I: Generation and transport of MSW in China

Year	Actual number of cities	Statistical number of cities	Urban population (million)	Area of road swept (million m <sup>2</sup> )	Quantity of refuse transported (million tonnes)	Quantity of faeces transported (million tonnes)	Per capita refuse generation (kg/capita.day)	Total refuse generation (million tonnes)
1986	353	348	122.34	445.07	50.09	27.10	1.12	136
1987	381	371	128.93	511.41	53.98	24.22	1.15	147
1988	434	424	139.70	588.76	57.51	23.53	1.12	156
1989	450	441	143.78	64.71	62.91	26.03	1.21	174
1990	467	455	147.52	691.98	67.67	23.85	1.26	186
1991	479	473	149.21	782.51	76.36	27.64	1.40	209
1993	570	552	165.50	924.10	87.91	31.68	1.45	240
1995	640	633	184.90	1110.40	106.71	30.66	1.59	294
1996				1227.88	108.25	29.31		

Source: UNEP-Infoterra China National Focal Point

From the few examples given, one can draw the conclusion that worldwide waste production is still growing. That goes for EU countries as well, despite the fact that a waste reduction policy was adopted and despite a relatively low growth in economic activity and a balanced population growth. Part of this increase in waste quantities is due to an improvement in statistical data collection and monitoring, part of it is real growth.

The examples above may also be regarded as an indicator of the difficulty to obtain reliable and comparable data on waste generation and treatment methods.

## 2.4 Hazardous waste management<sup>(1)</sup>

All countries generate hazardous waste. The quantities generated and their potential impacts depend on many factors, including the level of industrial development, the way in which wastes are managed, the existing state of the local environment and the capacity of the receiving media. While many developed countries now have effective hazardous waste

management systems in place, other countries with a long-term industrial base have not yet developed hazardous waste management systems to the same extent.

In the developed world, hazardous waste management programmes were started around 30 years ago. They were prompted by a number of pollution incidents. Some of those early mistakes turned out very costly, and the task of cleaning up old pollution can be a very long one. In the United States of today, more money is spent on dealing with past pollution than on managing the current disposal of hazardous wastes, even though the quantities of newly generated waste are greater.

While each country's hazardous waste management system is different, the national systems have some common features. Perhaps the most important of those are the staged introduction of controls and the gradual development of facilities. While the proper controls and facilities are put in place, interim solutions are employed. Some environmentally developing countries have already started to develop a comprehensive system for the

(1) The source of the information in this chapter is the ISWA Training Resource Pack for Hazardous Waste Management in Environmentally Developing Countries.

environmentally sound management of hazardous wastes. Many are considering how to start, while others have not yet realised the necessity to begin at all.

There is a number of lessons to be learned from the experiences and the mistakes made in developed countries during the implementation phases of their hazardous waste management systems. These include:

- wide-ranging hazardous waste management control cannot be introduced overnight, it must be introduced in stages;
- legislative and enforcement measures must be developed at the same time as facilities and support services are established;
- as controls on emissions to air, land and water are gradually tightened, specific areas of pollution can be identified and taken care of;
- waste minimisation should be addressed at an early stage, as any reduction in the quantity or toxicity of the waste will affect the number and size of treatment facilities needed as well as the economics of the waste management system.

Since the development of legislation and establishment of long-term treatment and disposal facilities will take ten to 15 years, it is important to develop interim or transitional facilities in the short-term to allow the rapid phasing out of uncontrolled dumping. Industrialising countries cannot wait until they have detailed waste data and an infrastructure in place before taking action. It is better for them to do something now than to investigate for too long. Transitional technologies offer that short-term solution.

There are three main objectives, which need to be addressed if environmentally developing countries are to improve their control and management systems for hazardous wastes.

1. Controlling transboundary shipments – particularly controlling exports from the developed world to the developing world (viz. the Basle Convention).
2. Controlling trans-national companies – controlling the behaviour and operating standards of trans-national corporations to ensure that they employ the same standards worldwide and do not lower their environmental standards where regulations may be more lax. Under some circumstances, relatively small quantities of hazardous wastes produced may make the best available technology uneconomic.
3. Helping environmentally developing countries to control their own wastes – the use of shared expertise and technology transfer to assist developing countries in the management of their own hazardous wastes.

## Part 3: Different approaches to waste management in different parts of the world

The current status of waste management is by no means uniform in different parts of the world. For the purpose of showing these differences, it seems sensible to divide the globe into the following four geo-political areas:

- the European Union,
- the United States,
- other high and medium income countries,
- economically developing countries.

### 3.1 The European Union

The member states of the European Union (EU) have reached the most advanced state in waste management in the world. Extensive source separation and material and energy recovery from wastes have led to a constant decrease of landfilled material. The landfill directive in force will reduce the landfilled amounts to a minimum and at the same time reduce the content of organic carbon. An important part of waste legislation is based on the concept of priority waste streams.<sup>(2)</sup> Individual directives set concrete targets for reduction, recycling, recovery and detoxification. The gap between more and less advanced member states is getting smaller.

In the EU, policy-making in the field of waste management is primarily driven by environmental objectives. Economic considerations are mostly restricted to statements like 'economically reasonable' without concrete valuation. The resulting high-tech solutions are rather expensive. The final goal is reducing landfilling to a minimum. The question of whether or not the environmental benefits outweigh the financial costs is hardly ever asked.

Waste management policies in the EU are currently subject to remarkable changes. In the Commission's proposal for a 6th

Environmental Action Programme (EAP), the waste issue is being incorporated into the management of natural resources. In the communication for the 6th EAP, drafted by the Commission, the waste issue is part of a chapter called 'The sustainable Use of Natural Resources and Management of Waste'. The Commission has also announced that it will launch a resource and recycling strategy during this year, which will be the framework for future waste regulation within the EU. Furthermore, it became clear that the integrated product policy (IPP) is the cornerstone of the 6th EAP. This will set the agenda for European environmental legislation.

The fact that the waste management unit in DG Environment no longer exists may be regarded as a visible sign for this reorientation. A new unit called 'Sustainable Resources – Consumption and Waste' was established in its place. This change demonstrates that a more integrated approach is taken that considers entire life cycles of products. Furthermore, the general objective of attaining sustainable development shall be the guideline to widen the perspective from a mainly environmental focus to the inclusion of economic and social aspects.

Maybe this change will also lead to a new way of applying the European waste management hierarchy (minimisation – material recycling – energy recovery – disposal) in a more comprehensive way to find the optimal combination of options. The concept of priority waste streams will probably remain, but this new approach (which is more life cycle oriented) could lead to the revision of existing regulations. The increasing consideration of economic aspects will probably lead to more cost-effective solutions for existing and new regulations.

(2) Packaging waste, end-of-life vehicles, electric and electronic equipment, batteries

It is obvious, however, that the tail (waste management) cannot wag the dog (the entire economy). Since focusing on the waste end alone is certainly the wrong approach in many cases, material and substance flow analyses will be more widely applied. The goals of dematerialisation and 'detoxification' of all economic activities in a long-term perspective will become more important than goals in the field of waste management.

Thus, new ways of policy-making are needed. These may result from a structured dialogue between a broad range of stakeholders. Waste management institutions will be challenged to contribute to that dialogue, the topics of which will be the whole picture and issues like supply of primary resources, production, trade, transport and consumption. As a result of this comprehensive approach, the goals of waste minimisation and decoupling economic growth and waste generation may finally be achieved.

Within the next ten years, several accession candidates will become member states of the EU. They will have to fulfil the EU's legal framework for waste (and resource) management, probably with specified extended deadlines.

## 3.2 The United States

Compared with the EU, a more pragmatic approach is used in the United States. Economic considerations based on cost-benefit analyses play an important role in policy-making. Due to this approach, landfilling continues to be the most common solution in the United States. Two factors play an important role in this context: a relatively low population density, and incomplete cost accounting on waste management alternatives.

## 3.3 Other high and medium income countries

Some high- and medium-income countries obviously follow the approach of the EU, some follow that of the United States. Limited availability of land normally leads to more 'European' solutions (for example, Hong Kong, Singapore, Japan). Countries where this limitation does not exist tend to follow the pragmatic course of the United States (for example, Australia).

## 3.4 Economically developing countries

### 3.4.1 General overview

Economically developing countries generally lack policies aimed at the management of solid wastes. In addition, most countries do not have modern regulations; existing regulations are antiquated and rarely enforced.

However, solid waste management has become an issue of concern for public health and environmental protection agencies in many developing countries. There are large differences in the waste management standards of developed countries. This gap is even greater between developed and developing countries. The waste produced by human settlements and the resulting problems are mainly the same – but there are differences between regions and locations due to variables such as climatic, cultural, industrial, geological, legal and environmental factors. The waste management systems in different developing countries vary substantially and are in some cases virtually non-existent.

Most developing countries do not have the technical and financial resources to manage solid wastes safely. This means that storage at the point of waste generation is often inadequate and collection services are inefficient and insufficient. Final disposal in those countries is usually a matter of

transporting the collected wastes to the nearest available open space and then discharging them. In some cases, the waste is set on fire in order to reduce its volume and to minimise the attraction of animals and vermin.

Developing countries in the process of industrialisation have to cope with larger quantities of more diverse materials. They are often hosting industries which are hazardous waste-intensive such as oil-refining, petrochemicals, pharmaceuticals manufacture and metal production. But the method for waste disposal is still the same as mentioned earlier – uncontrolled dumping. The challenge in those cases is to get from 'no control' to a managed situation, and the first step towards that is through so-called transitional technologies.

In many developing countries, the rapid population growth and the increasing economic activity combined with a lack of training in modern solid waste management practices complicate the effort to improve the solid waste service. Some improvements have been made or are under planning, for example extending the waste collection system and storing the wastes under improved conditions. Table 2 (page 28) illustrates the problems posed by the rapid growth of urban areas in China.

### 3.4.2 Resource recovery in developing countries<sup>(3)</sup>

Most developing countries have various processes aimed at the recovery of materials from the solid waste stream. Studies have shown that local industries are, in some cases, strongly dependent on the availability of secondary materials for re-processing. Some of these materials include: cardboard, various paper products, different types of plastics and metals.

Unfortunately, the methods used to recover secondary materials are inefficient, disregard

the basic principles of occupational health and in some instances cause significant environmental problems such as the recovery and reprocessing of automobile batteries at the 'home level'. Resource recovery or scavenging, as it is commonly called, takes place in most urban areas in developing countries. The process is carried out at various stages of the waste management system and in different manners. Some of the most common methods are briefly described in the following sections.

In large urban areas with an active and well-defined commercial area or an area with a large number of apartment buildings occupied by people earning a high income, scavengers typically sort through the waste before the authorised collection vehicle arrives. The most common materials that are recovered include various types of paper products (cardboard, newspaper, and office papers), some plastics and aluminium containers. In most cases, the scavengers use carts or similar units for the storage and transport of the recovered materials. In areas where there is a relatively high generation of recyclable materials, the scavengers store the materials in specific locations for their eventual collection by commercial trucks. There are isolated cases where scavengers travel from house to house buying secondary materials.

Another method of scavenging takes place during the collection process. In this particular method, the collectors themselves and/or helpers conduct a certain amount of segregation during the loading of the waste into the collection vehicles. The segregation process is facilitated in the situations where open trucks are used which allows for some of the collectors to be stationed inside the vehicle. The recyclable materials are stored either inside the truck or on the sides of the vehicle.

The last and the certainly the most onerous type of scavenging is the one that takes place at the disposal site. Disposal sites, particularly

(3) This chapter is an input by L. F. Diaz, G. M. Savage and L. L. Eggerth, CalRecovery, Inc., Concord, California, USA.

**Table 2: Statistics of municipal solid waste generation and transport in 11 large cities in China**

Cities	Year	Area of road that should be swept (million m <sup>2</sup> )	Area of road actually swept (million m <sup>2</sup> )	Quantity of refuse transported (million tonnes)	Quantity of faeces transported (million tonnes)	Urban population (million)	Per capita refuse generation (kg/capita.day)
Beijing	1990	35.26	32.44	3.45	2.05	5.54	1.70
	1993		36.30	4.10	2.08	5.75	1.95
	1995		39.14	4.40	2.42	5.94	2.03
Tianjin	1990	42.98	42.98	2.17	0.25	4.54	1.32
	1993		46.37	2.03	0.22	4.58	1.21
	1995		46.94	1.80	0.19	4.65	1.07
Shanghai	1990	26.67	23.15	2.78	2.43	7.50	1.10
	1993		26.86	3.34	2.34	8.94	1.01
	1995		26.47	3.72	2.16	9.22	1.10
Chongqing	1990	4.94	2.89	0.40	0.15	2.27	0.49
	1993		9.42	0.80	1.23	2.34	0.93
	1995		9.82	0.95	1.42	2.75	0.96
Haerping	1990	30.23	30.23	1.50	0.35	2.44	1.67
	1993		36.66	1.80	0.42	2.58	1.92
	1995		38.42	2.06	0.41	2.67	2.11
Shenyang	1990	39.07	37.95	2.08	0.81	5.54	1.04
	1993		41.19	2.03	0.90	5.75	0.96
	1995		46.60	2.33	1.22	5.94	1.07
Dalian	1990	14.80	14.45	0.70	0.18	4.54	0.41
	1993		14.99	0.67	0.14	4.58	0.41
	1995		17.93	0.77	0.14	4.65	0.47
Xian	1990	9.51	9.51	0.58	0.10	7.50	0.22
	1993		11.39	0.66	0.09	8.94	0.19
	1995		12.64	0.70	0.05	9.22	0.22
Nanjing	1990	4.40	42.8	0.61	0.30	2.27	0.74
	1993		4.87	0.71	0.21	2.34	0.82
	1995		6.87	0.77	0.25	2.75	0.77
Wuhan	1990	22.80	17.34	1.42	0.36	2.44	1.59
	1993		18.45	1.55	0.38	2.58	1.64
	1995		19.98	1.66	0.38	2.67	1.70
Guangzhou	1990	21.13	21.09	1.05	0.31	2.91	1.00
	1993		23.06	1.55	0.34	3.04	1.40
	1995		23.72	1.55	0.33	3.17	1.34

Source: UNEP-Infoterra China National Focal Point

those located in medium and large metropolitan areas attract hundreds and in the megacities thousands of individuals for the recovery of a variety of materials for sale. Some of the scavengers live on or near the disposal site. Living in disposal sites is not only detrimental to the health of the scavengers, but, as it has been shown in several instances, it can be dangerous due to slides and fires.

The relative closeness of the disposal site to the scavengers' dwellings and other factors make it easy for them to allow the participation of their children and other family members in segregation activities. The scavengers work at the landfills under some of the most precarious conditions and under different climatic situations (from extremely hot to very cold and wet conditions). In some of the very large disposal sites, the scavengers set up their rules and have been known to divide the site into areas where only specific groups are allowed to work.

The authors are well-aware of the fact that scavenging activities play a major role in the survival of many of the people that perform those activities. However, the methods used for the activities reduce the efficiency of the waste management system and most importantly are detrimental to the health of the scavengers.

Scavengers that perform their activities prior to the collection phase break open bags to have access to their contents or indiscriminately remove other materials from containers and leave them on the street increasing the time required to collect the materials by the formal collection sector. Resource recovery conducted during the collection process reduces the efficiency of the collection system. Scavengers that conduct their work at the disposal sites have a tremendous influence on the speed at which the collection vehicles discharge their contents as well as on the effectiveness and efficiency of the tractors and/or compaction equipment.

Adequate modifications to the existing scavenging systems must be made so that resource recovery is limited to specific locations and those that conduct the process do so under safe and 'clean' conditions. Most importantly, children and the elderly must be absolutely prohibited from conducting any kind of scavenging activities.





## Part 4: Implementation of sustainable development practices

### 4.1 Waste management and sustainable development

Historically, health and safety have been the major concerns in waste management. These two still apply – waste must be managed in a way that minimises risk to human health. However, today's society demands more than this: apart from being safe, waste management must also be sustainable. At the simplest level, sustainable waste management must therefore be:

- efficient in terms of environmental protection,
- socially acceptable,
- efficient in terms of economic viability.

In the past, the up-front economic cost of a waste management system was the most important limiting factor in the decision making process. More recently, however, environmental considerations have played an increasingly important role in this process. The social aspects of waste management, although not a new concept in itself, have been included in the decision making process to a lesser extent, as the research work into how to measure the impact of waste management systems on people's lives is only just beginning.

The challenge today is how to reach a policy where all three aspects are taken into consideration. The most important question in this context is – how do we manage our resources with a maximum of environmental protection and social acceptability?

New tools have to be developed to be able to answer these kinds of question, tools that can help the policy makers in taking more sustainable decisions. It is not our goal to find one universally applicable tool but to use different tools in a combination. Welfare cost

benefit analyses for example is such a tool, which could help to clarify complex issues and to deliver a clear strategy for realising sustainable development. Furthermore material flow analyses should also be developed and adopted by policy-makers in order to evaluate the environmental benefit.

A structured dialogue among a broad range of stakeholders will be needed to find new ways of policy-making. Waste management institutions will be challenged to contribute to that dialogue that will deal with the whole picture including the supply of primary resources, production, trade, transport and consumption. This comprehensive approach will help to achieve the goals of waste minimisation and decoupling the link of economic growth and waste generation.

Waste management should not only be a matter of managing end-of-pipe problems. Instead, it should be an integrated part of the overall environmental policy towards sustainable development. It is clear that the tail (waste management) cannot wag the dog (the entire economy). Material and substance flow analysis should be applied more widely. Focusing on the waste end alone is the wrong approach in many cases. The goals of dematerialisation and 'detoxification' of all economic activities in a long-term perspective have to become more important than goals in the field of waste management.

The first objective for sustainable waste management is clearly to reduce the amount of waste generated. However, waste will still be produced. The second objective is therefore to manage waste in a sustainable way. This involves minimising the overall environmental burdens, minimising the overall economic costs, and maximising the social acceptability of the whole waste management

system. The third objective is to shift the 'waste' focus of the whole waste debate to a 'resource' focus. Only when waste management systems evolve into optimised resource management systems will they be truly sustainable.

To put it in a nutshell, waste management has to become an integral part of sustainable integrated resource and waste management.

## 4.2 Waste management today – social dimension

### 4.2.1 Employment

As the waste management industry has developed and evolved, its social importance has increased, particularly in terms of providing employment. Employment opportunities in waste management have traditionally been within the policy sector of local and national authorities, in the regulation sector within national environmental protection agencies, and the industrial sector within waste treatment companies. This is still the case in large parts of the world.

However, with the development of sustainable waste management strategies, the focus on better uses for resources by collecting, sorting, recycling, remanufacturing and refurbishing materials, has given rise to new opportunities for employment in the recycling sector. A large number of jobs have been created in the waste management sector, and recycling is one of the main sub sectors continuing to show growth.

It is difficult to establish exactly how many people are employed in the waste sector as it is hard to identify the boundaries. In the recycling sector as one example, there is a significant number of non-profit companies, charities and voluntary organisations working in the sector in addition to public and private companies collecting, distributing and reprocessing recyclable waste. In the developing countries, there is also a large informal recycling industry through scavenging.

Many of the employment opportunities are regarded as 'blue collar' jobs that require less skills and training and therefore provide opportunities for traditionally disadvantaged or excluded elements of society. In addition, employment opportunities for less able bodied and people with learning disabilities have increased in recent years particularly due to the development of material reclamation facilities (MRF).

On the other hand, we may observe a trend in some countries that the demands placed on the waste management personnel are increasing. This is a general change of the labour market that touches upon the waste industry, as well. Waste collectors, who are in the forefront and meet the public, are often confronted with questions concerning source separation, recycling or other questions in relation to waste management. The implementation of quality assessment and environmental management systems will also put more stringent requirements on all personnel.

The implementation of compliance schemes, requirements of local waste plans and increased communication etc. have created additional 'white collar' jobs, as well. It is also likely that further legislative initiatives will generate more employment opportunities.

Gender perspectives are rarely discussed in the waste management industry.<sup>(4)</sup>

### 4.2.2 Public participation and public perception

The growth of the waste management sector and the implementation of schemes that involve the public, either in terms of participation or employment, or both, have caused the social issues associated with the industry to become more apparent. In most countries, it has become increasingly difficult to obtain planning permission for landfill sites or waste to energy facilities. The general public has a rather negative perception of the options in the lower half of the waste hierarchy.

(4) However, the Commune of Capri, Italy, may serve as a good example in the field of female labour. Unemployed people were taken on to run a treatment plant for WEEE and other electronic wastes and waste recycling schemes. 20 persons are now employed full time and 95% of these are women.

NIMBYism ('not in my backyard') has become an important factor, as the public is focused on their right to a clean environment, and unfortunately there is mistrust regarding the level of environmental emissions associated with landfill and incineration even when the highest of standards are adhered to. This public antipathy has generally resulted from emotive rather than scientific evidence, promoted by environmental groups.

Often, the public has a negative perception of the waste industry. There is concern among some sectors of the industry that environmental groups are unfairly targeting them.

The negative press that the waste industry has received as a result of several incidents has made it imperative that good clear lines of communication are opened up between waste managers and the local population in the siting and operation of waste facilities. The public's uncertainty concerning waste practices means it is increasingly difficult to obtain a consensus and make people accept different waste management options. Most, if not all, waste facilities require a full environmental impact assessment, which takes into consideration environmental and social issues. Where lines of communication were opened in the early stages of a project and information and data was transparent and accessible, the relationships between the public and the proposer of the waste facility have been more positive.

The South East London Combined Heat and Power facility is a good example in the United Kingdom, where involvement of the public in the decision making process throughout meant that planning permission was eventually granted for what is generally regarded as an unpopular option by the public.

A number of different measures can be taken to improve relations with the public and ensure that good environmental practice is adhered to. These range from liaison

committees, round table discussion groups, open days, visits for schoolchildren, leafleting, and special events. Many waste treatment facilities establish proactive liaison committees with local residents, the local authority and the operators of the plant in order to address any issues of concern, promote good communications practices, and raise the public's awareness with regard to the facility. This high level of engaging the public in waste management projects is becoming more widespread, particularly in the case of more contentious projects such as energy from waste and landfill.

Information provision is an important step in minimising concerns that people may have regarding the safety of a waste management system. Waste companies publish environmental reports on a regular basis and make their company information more accessible to the public. The increased use of the Internet has opened up new channels of communication and the waste industry is already using it as an effective tool in information dissemination.

### 4.2.3 Environmental justice

An important issue in relation to the social dimension of waste management is environmental justice. Environmental justice can be defined as 'fair treatment for people of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies' (US EPA). People are concerned that minority populations and low-income populations bear a disproportionate amount of adverse health and environmental effects. Is the increased attention to environmental problems prevalent in all segments of the society?

Environmental justice and the right to a clean environment are related to the location of facilities. Today, it is very difficult to find locations for new waste treatment plants. Citizens groups are established to demonstrate against attempts to locate a facility in their

neighbourhood. Those demonstrations and the public opposition are often sufficiently strong to force the planners to make changes to the project. But successful opposition depends upon the capacity, time, number and competence of the complainants to pursue their interests.

One would tend to draw the conclusion that higher-income populations are in a better position to mobilise the effort needed to participate actively in the public debate on the location of sites for waste facilities. In developing countries, the lack of efficient waste planning, communication channels and site permission procedures and above all, more basic preoccupations, may further increase the problem.

#### 4.2.4 Occupational health

Occupational health is another social issue in the context of sustainable development, which must be given sufficient attention. There is a risk of replacing an outside environmental problem by an internal environment problem. The well-documented traditional accidents and risks for waste collectors are replaced by new health risks. Technical solutions and changes in working routines have been introduced to reduce the risk of, for example, sharp and cutting waste and accidents connected to heavy lifting. But the changes in the waste management chain that were made to obtain sustainable waste management have not sufficiently taken into account the issue of occupational health.

The collection of a biodegradable fraction and its impact on the health of the waste collectors, for example, has not been sufficiently investigated. Another example is the working conditions at sorting plants where, for the whole or parts of the sorting process, manual sorting takes place. This problem is especially difficult at sorting facilities that receive household hazardous waste in dispersed quantities and often without proper labelling or indication of content.

A number of measures have been taken to minimise the risks and unpleasant working conditions, but fact is that the effects on human health have not been sufficiently investigated. This issue is also directly related to the concept of environmental justice, as most of the jobs referred to above are low qualified and low-paid jobs.

### 4.3 Waste management today – economic dimension

The economic aspects of waste management can be divided into the three following categories:

- costs,
- funding of waste management,
- taxes.

The first two points will be described in this chapter; the issue of taxes is discussed in section 5.3.1 on economic instruments.

#### 4.3.1 Costs

The total cost for waste management depends on the system in place, and the funds allocated to waste management determine the future of the system. This is an area where great variations will be found in different regions of the world. In developed countries, the allocation of resources is assured by established organisational structures and by the public's interest, willingness and capacity to pay. Many developing countries have a large number of citizens who are not at all concerned about the cleanliness of the urban neighbourhood and the allocated resources are small. But they are of critical importance because they usually consume a substantial fraction of urban revenues.

Table 3 below provides an overview of the annual expenditure on urban services and waste services in a number of cities. The cost of a waste service is compared with the state of national prosperity (measured in GNP per capita). Where data on total urban

Table 3: Urban expenditure, total and on waste, selected cities and years

City	Year	Annual expenditure		GNP per capita	% GNP spent on waste
		Total urban expenditure USD per capita	Solid Waste USD per capita		
Accra <sup>1</sup>	1994	2.76	0.66	390	0.17
Ahmedabad <sup>2</sup>	1995	24.27	1.61	350	0.46
Bogota <sup>3</sup>	1994		7.75	1,620	0.48
Bombay <sup>2</sup>	1995	63.65	3.92	350	1.12
Bucharest <sup>4</sup>	1995	94.75	2.37	1,450	0.16
Budapest <sup>5</sup>	1995	310	13.80	4,130	0.33
Buenos Aires <sup>6</sup>	1989		10.15	2,160	0.47
Caracas <sup>6</sup>	1989		6.67	2,450	0.27
Dhaka <sup>7</sup>	1995	8.31	1.46	270	0.54
Hanoi <sup>8</sup>	1994		2.00	250	0.80
Jakarta <sup>9</sup>	1993	82.75	2.50	740	0.34
Kuala Lumpur <sup>10</sup>	1994		15.25	4,000	0.38
Lahore <sup>11</sup>	1985	9.70	1.77	390	0.45
London <sup>12</sup>	1991		46	16,550	0.28
Madras <sup>13</sup>	1995	14.75	1.77	350	0.51
Moroccan cities <sup>14</sup>	1990	1.12-2.03	950	0.12-0.21	
New York <sup>15</sup>	1992	5,804	97	23,240	0.42
Riga <sup>5</sup>	1995	153	6.00	2420	0.25
São Paulo <sup>6</sup>	1989		13.32	2540	0.52
Strasbourg <sup>16</sup>	1995	1,600	63	24,990	0.25
Surabaya <sup>17</sup>	1993		3.90	740	0.53
Sydney <sup>18</sup>	1995		38	18,720	0.20
Tallinn <sup>5</sup>	1995		8.11	3,080	0.26
Tokyo <sup>19</sup>	1987	3,010	100	15,840	0.63
Toronto <sup>20</sup>	1994	2,043	48	19,510	0.25

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Source: WHO, 1998

expenditure per capita was available, it has been added. From this it is possible to portray the proportion of waste costs to total urban expenditure. The data should be taken as indicative only, because no two cities provide fully comparable services, and no uniform urban accountancy system has been adopted to permit reliable comparisons. However, the data permit some assessment of relative cost burdens in these cities.

The costs implied with waste management can be divided into three categories:

- overhead as for administration, planning, information, enforcement, inspections etc. New costs occur for municipalities when different systems for household hazardous waste, batteries, electrical and electronic waste etc. are implemented;
- collection and transport; significant rationalisations have been made, but with increased separation at source the industry will be confronted with increased;
- treatment of waste; the costs increase as well.

The total costs for waste management seem to be increasing and the allocation of financial resources to the different components is changing. The increase in the overall costs related to waste management is less important than might be expected. Costs for collection and transportation have decreased due to increased efficiency, improved collection technologies and better logistics.

On the other hand, overhead and treatment costs have increased. The legal requirements on treatment facilities and the political ambitions to make better use of waste have implied higher costs. As referred to on several occasions in this report, the increasing need for information for and dialogue with the public has incurred increased costs, as well. Some costs are new in the sense that they correspond to services that were not carried out before.

Furthermore, what is done must be done with an improved environmental performance. In several countries, different taxes on waste have been introduced in order to divert waste from landfill to options higher up in the waste hierarchy. Those taxes are constituted in a number of different ways and are sometimes returned to the industry. But they will nevertheless increase the costs for the disposal of waste.

#### 4.3.2 Financing/cost recovery

The financing of waste management differs from one country to another. Fees and charges recover the costs for waste management but taxes are also used. In some cases, there is no direct recovery from the collective using the waste services; instead, the service is financed by the general municipal budget. The contributor is normally the household.

Developing countries face the problem that people can hardly afford to pay for the waste service and are often not willing to do so. At the same time, local taxation systems are often inadequately developed and the financial basis for waste management services is weak. There are systems, in both developed and developing countries, in which the costs for waste management are linked to the electricity or water bill to ensure that the services provided are paid for.

Countries with well-established procedures for waste management cost recovery now examine new systems to recover costs. A dilemma that may be observed in some countries with far-reaching source separation and a high level of public engagement in waste prevention, recycling and separation is that people expect to pay less since they discard smaller amounts of waste.

Citizens who take an active role in the minimisation of waste consider it a reasonable compensation for their effort to be charged less. Instead, they may even notice that costs

are increasing. It is an important function of the waste management authorities to explain the mechanism behind the cost charged to the consumer and which elements the charge consists of.

There is a trend towards promoting the fairer distribution of waste management costs across households. The base for calculating this fee or charge can be made in a variety of ways – by household, by weight or volume, by size of domicile. Another trend is the use of differentiated waste fees to change public behaviour. Households play an important role in waste management. The application of service-related fees is a direct, visible and immediate means of influencing people's behaviour.

## 4.4 Waste management today – environmental dimension

### 4.4.1 Environmental effects

Waste that is not properly collected, stored and treated gives rise not only to detrimental environmental effects, but, what is even more urgent, it poses a risk to public health. The first priority is therefore to ensure the proper collection and storage of waste in order to minimise risks to both the environment and to public health. In countries without sufficient coverage of collection services, the resulting adverse environmental effects clearly correspond to the lack of collection services.

A number of environmental effects is potentially caused by the waste management industry and all of them should be properly controlled. Waste management affects the environment through land use, through pollution with hazardous substances that escape into air, water and soils. Waste facilities produce greenhouse gases in varying quantities, either in the form of methane gas from landfill sites or carbon dioxide from composting or energy from waste plants.

Other influences on the air environment are the destruction of the ozone layer caused by refrigerants and rain acidification caused by sulphur dioxide and oxides from nitrogen from incineration plants. The waste management industry also affects the soil, ground and surface waters through leachate escape from landfills, land spreading and waste storage. Leachate may contain persistent, toxic and bio-accumulable compounds, and nutrients that can cause eutrophication.

### 4.4.2 Waste quality and quantities

Waste management is a service industry providing recycling, recovery and different treatment methods and final disposal. The waste generated by the industry itself is minimal, especially considering the amounts that the industry receives. The environmental effects of the industry are in direct relation to the quality and quantity of the waste it receives.

In the last decades, the awareness of sustainable consumption has increased and there is a trend to phase out a number of products and substances that have direct and unquestionable effects on human health and on the environment (asbestos, PCBs etc). This has had positive effects on the environment and there is a large number of good examples where the environment and its fauna and flora are recovering well. The trend of detoxification of production and consumption has also had its effects on the environmental performance of the waste industry. But there is still important work to be done to increase the quality of waste through preventive actions in the production and consumption phases.

One measure that affects both the quality and the quantity of the waste requiring disposal is the source separation of a number of types of waste that are known to generate environmental nuisances (household hazardous waste). As to the quality aspect, some fractions cause harm when found in the general MSW stream, but if taken care of correctly, the



environmental effects can be limited. Some waste fractions have a positive economic value and can be sold on the market. The possibility to sell waste fractions and the price obtained is in direct relation to its quality, because cleanliness and purity enhance its value. Therefore source separation is a necessary requirement. With regard to the quantity, source separation has a preventative effect and it increases the public awareness of waste management by making families aware of their responsibility for the separation of their waste.

The technology and operation processes are also improving and can still be optimised to control the environmental effects caused by the specific waste treatment method. In the developed countries, the environmental effects of individual waste treatment facilities have improved substantially during the last years. But the quantities of waste produced are still rising; therefore the total pollution from the waste industry is also still increasing. Technical improvements will continue to minimise the environmental effects of waste management – especially in countries where the standard for waste treatment is low. But the main challenge is to minimise the quantity of waste that goes to waste treatment facilities.

#### 4.4.3 Hazardousness of waste

One of the most important goals of the waste hierarchy is to prevent and minimise the amount of waste. The aim for the waste that cannot be prevented or minimised is to render it as least hazardous as possible.

Waste management is subject to strict legislation in most developed countries and the highest of standards are adhered to in an effort to limit the environmental impact of the different processes and operations. But emissions from landfill and incineration processes can lead to air, land and water pollution on a local and global scale. This is why it is so important to have regulations that ensure that standards are maintained, legislation is adhered to and potential impacts are minimised.

The quality of waste reflects the production and consumption patterns of society. That means that efforts must be made in other sectors of society, as well (for example, chemical policy).



## Part 5: Means of implementation

Within the waste industry, a wide range of instruments is used to implement environmental policies and attain set environmental goals. Some are voluntary and others are regulatory, some again are financial whereas others are aimed at raising awareness and public perception. Nevertheless, the main priority and the basis for further action is the adoption of a regulatory framework connected with sufficient means to reach goals and objectives set.

### 5.1 Regulatory framework

#### 5.1.1 Waste policy

Waste management can no longer be regarded as a single activity carried out by the local authorities. It is one part of society infrastructure that depends upon a number of other factors. An overall national or regional waste policy determines and governs the framework for the activities in the waste sector:

Most countries do have a waste policy, but a long-term and well-prepared waste policy is still requested by the waste industry all over the world. A clear, concise and consistent policy is a necessary requirement for the waste industry to establish and set up waste management systems and make necessary investments.

The content and the quality of existing waste policies vary considerably. Apart from considering environmental and health aspects, a waste policy must take into consideration socio-economic, political, structural and cultural factors. The lack of traditional procedures and of a proper understanding of how to integrate all the relevant factors is a hindrance to successful waste policy. Some factors may change rapidly – which will have an effect on the policy – and others may contradict each other.

Nevertheless, a well-established and supported waste policy is of crucial importance for the state of the waste management in any country. Another limiting factor is the financial resources required to ensure the realisation of a well-functioning infrastructure for the treatment of waste.

One element common to most waste policies is a waste hierarchy. This hierarchy is a stepwise approach to waste management in the order of environmental priority for different waste management options. The general principle of the waste hierarchy is as follows:<sup>(5)</sup>

- waste minimisation and reuse,
- recovery and recycling,
- safe final disposal.

How flexibly should this hierarchy be applied, and secondly, which components constitute the different levels of the hierarchy? We believe that the hierarchy must be seen as a general guideline and as a good basis for establishing a waste policy. The ranking was made with regard to the environmental effects and does not take into consideration economic and social criteria. Any decision must take into account a broader range of factors than just considering the environmental effects.

A waste hierarchy based on the ranking above forms a good basis for the creation of a waste policy if the hierarchy is applied with flexibility and takes into account economic and social criteria. If the waste policy is furthermore well elaborated and contains clear, concise and consistent objectives and measures, the waste industry has the necessary political framework to plan and organise the local waste management system.

(5) Some countries have developed a slightly different waste hierarchy - it is often more detailed - but the main grouping of the hierarchy is globally recognised.

The second issue mainly concerns the final disposal option. In most countries, biological treatment is considered as a recycling option through the recuperation of compost and other end-products. Incineration with energy recovery is considered as final disposal. As with all waste management options, there are large differences in the performance and efficiency levels of different incineration facilities and the role of that option in different countries. In some parts of the world waste-to-energy makes an important input to public district heating and is therefore regarded differently from incineration that takes place without energy recovery.

In other parts of the world, incineration is literally a 'technology': to put waste on fire to reduce its volume and the risks for diseases.

### 5.1.2 Legal framework – effective implementation and enforcement

Apart from the adoption of a detailed and well-structured waste policy, the waste industry requires a legal framework that enables it to reach set objectives and targets. A well-elaborated legal framework will assist in the effective implementation of those targets. The legal framework must also be provided with an effective enforcement system.

In most countries, environmental legislation was introduced as a reaction to an occurring environmental problem. There is often a lack of coordination between different pieces of legislation that protect different environmental interests. Legislation is often incoherent, as well, since it was developed at different times and for different reasons, protects different interests and encompasses different objectives.

In the context of environmental legislation, the EU is superior to national legislation. It has instituted a large number of different legal acts in the field of environmental protection. The result is a good example of a legal framework that has responded to environmental problems rather than being proactive. The

Commission has announced that they believe that the pieces of legislation necessary for the time being have been adopted and that focus must be made on consolidation.

Most modern waste legislation contains requirements on licensing, authorisation and compliance for waste management facilities. Those requirements are complemented with powers of inspection and enforcement. This is normally referred to as 'command-and-control'. The legal framework constitutes the baseline. In several parts of the world, the industry has become a driving environmental force that even goes ahead of the legislator in some aspects.

### 5.1.3 Waste planning

The national and/or regional waste policy together with the legal framework forms the basis for waste planning on regional or local level. The general policy must be transformed into tangible action and the establishment of a system that provides a service to the citizens.

Thus, efficient waste planning is another necessary element to ensure a well functioning waste management system. Waste planning at local level is often insufficient when compared to national planning. Again, local factors must be taken into consideration in the preparation of a waste management plan. Experience and information can be transferred to and collected from other regions and localities, but each plan is specific to the local circumstances. One major problem in the field of waste planning is the lack of competent and skilled human resources. This problem is especially pressing in developing countries.

Local waste planning is of more tangible character and a local waste plan will encompass figures on waste quantities, waste composition and treatment capacity. Typically, it will also contain measures on waste minimisation and prevention, on recycling and on a reduction of waste going to landfill. A well-prepared waste plan at local level can be

a very useful tool for local waste managers to improve local waste management. Furthermore, the long-term planning assists in making provisions and enables waste managers to be pro-active before it comes to deficiencies in the system (bottlenecks in the disposal capacity, major investments etc).

In developing countries, waste planning is concerned with other issues and realities; the most limiting factor is how to achieve the most with the limited funds available to the waste service. But improvements are not necessarily dependent on massive investments. Developing countries can probably increase their performance by using what they already have in a more efficient way. Good organisational structure and a high-quality management are two other important factors for efficient waste management. The process of waste planning forces people to consider those factors; it may help to stress their importance.

## 5.2 Market-based initiatives

### 5.2.1 Public procurement

The market for public procurement is large and therefore the potential to make environmental improvements is considerable. Environmental considerations can be introduced as an important aspect in the setting of tender specifications and evaluation of the responses.

Again, the legal framework is of importance in public procurement. In most countries, public procurement is regulated concerning both the content of the tenders and the criteria for evaluating the responses. The legal framework may hinder the consideration of environmental effects at the evaluation stage if that implies higher costs. On the other hand, public procurement can also enhance the markets for recyclables by promoting (or even making obligatory) the use of recyclable materials in products that are subject to a tendering process.

With the current trend towards deregulation and increased competitiveness in the industry and with the role of the local waste management authority as increasingly one of planning, determining and buying waste services, the role of public procurement becomes increasingly important. The buyer needs to be competent in order to buy well and to know what to ask the service provider for: It is not a question of only looking at the price – but to look at the price for a given quality and quantity level as specified by the buyer.

There is a large number of innovative and successful tenders, but it would require too much space to report them here. Therefore, we would like to give some examples of environmental considerations that could be specified in a tender for waste management services:

- definition of the level of environmental performance required,
- requirement that an environmental management scheme be used as part of a process,
- environmental classification of vehicles,
- green fuel standard used in vehicles,
- requirements on primary materials and recycled material in products,
- stipulation that a product or its components must have an eco-label or energy label or similar environmental label if available,
- requirement on personnel involved to have specific training or specific environmental experience.

### 5.2.2 Environmental management systems

Within the commercial sector, the drive towards more sustainable practices has resulted in an increase in the implementation of environmental management systems (EMS).<sup>(6)</sup> In some countries, the local authorities have also taken the step towards implementing an EMS. The waste management

(6) There are two main recognised systems for EMS: the worldwide recognised ISO 14001 and the European voluntary scheme EMAS (Eco Management and Audit Scheme). But there is no obligation to have an EMS certified or registered.

industry (both public and private) has a high public profile and is closely scrutinised by local residents, pressure groups and environmental authorities. Therefore it is advantageous and necessary for the industry to improve its environmental performance and thus also improve its image by addressing environmental issues.

The scope of environmental improvements through an EMS can be considerable. Many waste management organisations are already reaping the rewards. The waste industry is therefore in a unique position to set an example for high standards in environmental management.

The arguments for implementing an EMS in the waste industry are the same as in other industries. But it can be argued that the waste industry is more closely connected to the environment than other industry sectors. Whatever method is used to treat or dispose of waste, it is ultimately the environment that is used to dilute, disperse, break down or stabilise the waste. Furthermore, the waste industry in its role as a public service provider is not in the position to prescribe the quality of the waste that is delivered to them for treatment and/or disposal. By implementing an EMS, the waste industry can demonstrate that they take the environmental effects of their activity seriously.

An EMS at its simplest has a systematic approach to understanding how the laws of a country affect an organisation's activities, to identifying which environmental effects its activities may generate, to developing a strategy of how to reduce and control these effects and finally of how to communicate to the public the actions taken and the results of those actions. However, waste companies are increasingly seeking recognition for the standards they are achieving, which results in more companies registering for EMAS or ISO 14001.<sup>(7)</sup>

(7) There are also examples of national 'simplified' programmes. In Norway, for example, there is a local environmental certification scheme for companies named 'Miljøfyrtårn'. This certification is much easier to obtain for small-sized companies than ISO 14000 certification. It is organised by the local municipality and is a co-operation of the industry and the local authorities. 240 enterprises have so far achieved certification and 60 municipalities have started to certify municipally owned companies.

A study carried out by a number of European waste management organisations in 1999 showed that there is an interest within the European waste industry to implement an EMS. At that time the number of EMAS-registrations and ISO 14001-certifications was not very high. But the number of companies participating is continually increasing.

### 5.2.3 Life cycle assessment and cost-benefit analysis

Specific tools, such as life cycle assessments (LCA), are extremely useful when we consider the overall impact of a product and assess its sustainability. LCA measures inputs and outputs, from the mining of the resources to final disposal. It can take into consideration environmental benefits and costs and include the technical, social and economic implications of different waste management options.

LCA has been used to an increasing extent by environmental groups or as a marketing initiatives. LCA can be used to compare comparative acceptability of consumer products, such as disposable nappies versus cotton nappies, plastic drinks containers versus glass. But it can also be used in more complex situations as when evaluating the setting up of a local waste management system in order to determine which treatment methods to rely on. Any LCA will, of course, depend on the local circumstances and the results may vary from one region to another.

The following example of LCA used in the waste industry is from the United Kingdom. The WISARD (Waste Integrated Systems Assessment for Recovery and Disposal) computer software launched by the United Kingdom Environment Agency was designed to help waste managers identify more sustainable, integrated approaches to waste management. The system uses life cycle assessment for recovery and disposal and allows modelling of all aspects of different waste management systems and compares their environmental impacts.

Another example is an Austrian study<sup>(8)</sup> based on LCA and CBA that compares one-way beverage packaging with refillables. The results led to significant changes in the Austrian legislation regarding targets for beverage packaging.

#### 5.2.4 Standardisation

Standards within the waste industry can cover everything from the bins used for collection to references for the best available technology. Even if waste management must take into consideration local, political, cultural and socio-economic factors in each country, there is still some scope left for the co-operation across country borders.

A number of organisations promote best practice and the creation of best practice guidelines for the waste industry. The EU has set up a body with the aim to establish reference documents for different activities covered by the EU Directive on Integrated Production and Pollution Control.<sup>(9)</sup> There are also different national initiatives to set national standards. We believe that the correct way of setting standards in a globalised world is to turn to the international scene first and try to set standards there. Only if this attempt fails should recourse be made to national standards.

#### 5.2.5 Voluntary initiatives

In a large number of countries, different forms of voluntary initiatives have been introduced. There is no uniform terminology for voluntary initiatives, but it is a large field that encompasses a large number of different actions.

There have always been voluntary initiatives in the waste sector for the collection of different separated waste fractions. The establishment of those initiatives relied upon a positive economic market for the material in question. Different associations (charities, sport clubs, etc.) collected material to sell in order to receive money.

Another kind of voluntary initiative are initiatives taken by industry to show their goodwill and sense of responsibility in different aspects – environmental, social or educational. Different companies have launched take-back schemes in order to keep a high environmental profile. Any such schemes are of benefit to the waste management as they normally tend to sort out a waste fraction that is not desirable in the feed stock (for example printer toners, ink cartouches, mobile telephones, batteries etc).

Voluntary agreements have recently become one way for the industry to be proactive to avoid detailed national legislation. In Norway, for example, there is at the moment no legal regulation of the collection and recycling targets for packaging waste. The government and the industry have agreed on a voluntary initiative on the part of the industry to fulfil certain collection and recycling targets. As long as the industry lives up to its commitment, the government is not going to regulate. The list of such examples could be very long.

### 5.3 Economic instruments

There are different economic instruments that are increasingly used either directly in the waste industry (for example landfill taxes) or at levels that directly influence the generation of waste (taxes or fees on packaging). It is very difficult to compare different financial initiatives in different countries since there is no common ground either for the definition of taxes, charges, fees etc. or for defining who contributes to them. A broad range of instruments, including economic instruments where appropriate, in the right mix is most likely to achieve the goals set.

A simple explanation of an economic instrument used in waste management quickly becomes complex. The costs for waste management include taxes and charges, and in some countries taxes are used as the basis for the funding of waste management systems.

(8) The legislative authorities and the relevant industries jointly commissioned the expert opinion expressed in this study.

(9) The Reference Documents (BREFs) must be taken into account when the competent authorities of EU Member States determine the conditions for IPPC permits. The BREFs will inform the decision makers about what may be technically and economically available to the industry in order to improve their environmental performance and consequently improve the whole environment.

What is a tax in one country may be a charge in another; a fee in one country does not necessarily have an equivalent in another country.

In a large number of countries, there is a trend to shift the focus towards effective market-based and other economic instruments such as environmental charges and the use of fiscal instruments to achieve waste policy goals.

Below we have tried to distinguish between different financial instruments that are used to change people's behaviour or that simply indicate a preferred direction of policy and means of recovering the costs for waste management services.

### 5.3.1 Taxes

Similar measures may be defined variously as taxes, charges, levies, fees and duties in different countries. The definition of a term in one language does not necessarily have an exact counterpart in other languages. There are also differences between taxes; some are explicitly recognised as having an environmental purpose whereas others have significant effects on the environment although their original purpose was revenue considerations. In the following, we distinguish between fiscal instruments and measures that are explicit or implicit payments for various services. The latter type of instrument is discussed in chapter 4.3.2 'financing/cost recovery'.

Taxes can be divided into different categories:

- cost-covering charges where the revenue is used either to pay for disposal services or to finance recycling;
- incentive taxes levied to change environmentally damaging behaviour (with no specific intention to raise revenues);
- fiscal environmental taxes where the surplus revenue from the tax can be used to finance budget deficits or shift taxes from labour to resources. This can also be referred to as ETR – ecological tax reform.

In 1997, the European Commission presented a communication on *Environmental Taxes and Charges in the Single Market*. The paper supports the increased use of fiscal instruments to make environmental policy more efficient and cost-effective and to ensure that the environmental taxes and charges are used in ways that are compatible with Community legislation. At EU-level, any economic instrument must in design and application avoid trade barriers and a distortion of competition. Customs duties and charges with similar effects are not accepted. This goes for state-aid rules, as well.

A comparison of taxes is often misleading since both the tax-base and the tax-rate differ from one country to another. It is difficult to get comparable figures unless we study the rules and applications of a tax. The structures and the objectives of taxes are comparable, however.<sup>(11)</sup>

### 5.3.2 Cost recovery – waste fees and charges

In this section, we will discuss the use of waste fees and charges as tools to instigate a certain desirable behaviour on the part of the population. As already mentioned above, the funding of waste management differs from one country to another. Fees, charges and taxes are used to recover the costs for waste management. The legal status of these instruments may differ considerably as may those who contribute to the fee or charge. In the case of municipal waste, it is normally the households that finance the system.

The different methods for recovering the costs from the households are a good means to influence and change public behaviour. It can also be a way of making people aware of the fact that their behaviour has an impact on waste generation. When the costs are recovered via a tax, the use of innovative methods is less transparent. It may even be difficult to be transparent and show the costs of the waste management system to the

(11) The United Kingdom, for instance, has a landfill tax that indirectly also provides income and economic support for other sectors via the landfill tax credit scheme. Landfill operators can use 20% of their landfill tax contribution to support or develop environmental projects, thus generating further employment and investment opportunities. The scheme is intended to direct at least 40% of the money available to recycling and waste minimisation projects.



citizens. The waste management services will then be one item among others in the general municipal budget.

Recovering costs via a charge or fee makes it easier to design the system in an innovative way and in a way also to support a specific behaviour. The task of identifying and allocating costs is a good exercise for the waste management authorities.

When fees or charges are used to fund the service provided, it is easier to make the whole process transparent and to communicate to the contributor what he is actually paying for. This is why differentiated waste fees are used to an increasing extent: to change public behaviour or to promote a fairer distribution of waste management costs across households. The behaviour at household level plays an important role in waste management. The application of fees and charges is a direct, visible and immediate means of influencing their behaviour. By constructing the fee or charge in a certain way, the households can be encouraged to display certain behaviour. The waste quantities generated by households vary considerably as do the efforts to reduce those quantities.

The base for calculating the fee or charge can be made in many different ways.<sup>(12)</sup> Some part of the costs will always be fixed since it does not occur in relation to the quantity of waste (planning and information, for example), whereas other parts of the costs could be variable. If a part of the costs depends on the amount collected or on the number of times the waste is collected, the households could influence their contribution. The differentiated approach may help to attain a set goal<sup>(13)</sup>, but reverse effects must be closely examined.

## 5.4 Informative instruments

### 5.4.1 Raising awareness and promoting public participation

In a large number of countries, the local authorities launch education projects and awareness raising initiatives. Most local authorities have in employment a waste minimisation officer, recycling officer or Agenda 21 officer. Many waste management companies also run a communication and public relations programme. Those campaigns aim either at generally raising awareness, or they aim at giving more detailed and specific information.

Another important issue in this context is public participation in projects prior to their realisation, especially if these projects are likely to have an impact on people's lives. In most countries, environmental impacts assessments are required for a large number of infrastructure projects. One of the components in such assessments is that of establishing communication with the public. Here again, cultural differences influence the way in which the public communication takes place and which importance it is accorded in the decision-making process.

One chapter of the *New Spanish Urban Waste National Plan 2000-2006* deals with the issue of public consciousness. A general programme for raising public awareness will be launched, with a special programme for the different activities in municipal waste management.<sup>(14)</sup>

In 2000, the Swedish Ministry of the Environment launched an information campaign to promote the separate collection of household hazardous waste. The aim of the campaign was to increase public knowledge of hazardous substances and hazardous waste. The campaign was arranged together with the municipalities.

(12) By household, by weight or volume, or by size of domicile.

(13) For example, reduce waste quantities, encourage recycling, introduce a system of payment in relation to service utilised, etc.

(14) The budget for this programme is a total of 12 million Euro. This Consciousness Programme will be co-ordinated with other initiatives in the field of professional qualification and development in agreement with the representatives of the Union of Workers. The Professional Qualifications and Training budget totals almost 60 million Euro.

In the United Kingdom, the campaign 'Are you doing your bit?' is another example of a nationwide awareness campaign. The £25 million publicity campaign was launched by the government to promote sustainable lifestyles. Simple environmental messages (for example on recycling) are broadcast through TV, press and radio advertisements in addition road shows and special events.

#### 5.4.2 Professional qualifications and training

It is of crucial importance to have an effective and competent workforce at all levels of waste management. Compared with other fields within the sector of civil engineering, waste management lacks a structured academic approach to get the required professional qualifications. During the last ten years, different environmental programmes were booming, with the issue of waste management forming part in varying degrees. In developing countries, there is also an acute problem caused by the lack of academic programmes to achieve diplomas in waste management subjects.

With regard to education and training, the International Solid Waste Association (ISWA) and its national members offer training courses on a range of waste management issues designed for different levels. Both national and international consultancies and other training providers offer different types of in-house training in environmental management for business and the industry. Many waste management companies have also taken up the challenge of internal education programmes, mostly as part of their quality and environmental management schemes. Today, such initiatives form an integral part of the social and ethic dimension of corporate policies.

In the era of new communication technologies, there is a large number of examples where Web-based resources are used to enhance training opportunities and to

spread information and knowledge in the field of waste management. A number of universities is also offering distance-learning courses to provide training for those already employed in this sector. There is a need not only to prepare people entering the sector; but also to make people active in the sector evaluate their practical experience and to encourage them to go in for higher education.

#### 5.4.3 Environmental reporting

Environmental reporting is a way of presenting the environmental effects of an activity in a clear and systematic manner. Environmental reporting is complementary to financial reporting and so far, only a few countries impose legal obligations to provide environmental reports. On the other hand, the market is pushing for those reports and companies in the waste industry are increasingly interested in demonstrating their environmental ambitions and achievements.

In Denmark, an amendment concerning green accounts was made to the Danish Environmental Protection Act in 1995. This amendment requires certain types of industrial sites to prepare green accounts and send them to the Danish Commerce and Companies Agency. Most facilities in the waste sector are required to draw up green accounts.<sup>(15)</sup> Public or private companies are not required to submit green accounts. They are, however, allowed to do so on a voluntary basis. Their accounts have to fulfil the same requirements as the compulsory green accounts.

The green accounts are required to be prepared and drawn up in accordance with certain rules listed in the statutory order. The statement of green accounts must include three parts:

- basic particulars;
- a management report;
- specification of environmental impacts summarising the consumption of energy,

(15) Eg. waste incineration plants and plants for the processing, treatment and final disposal of waste. Excluded from this obligation are usually landfills, collectors of waste (haulage contractors) and composting plants.



water and raw materials, the nature and quantity of the most important pollutants involved in the production process, the products and wastes as well as the discharges to soil, water and air.

#### 5.4.4 Research and technology transfer

There is a continuing need for research and technology transfer between countries. The exchange of experience can take place from industrialised countries to developing countries or between developing countries.

The R&D of solid waste management is often given low priority in developing countries. Handbooks and guidelines for developing countries which discuss the choice of waste management options need to be complemented with studies that take into consideration the appropriate management approaches and technologies, local climatic and physical conditions, the financial and human resources as well as social and cultural acceptability.



## Part 6: Future challenges and goals

### 6.1 Key areas of progress achieved

- The whole waste industry has made great progress over the last ten years. Significant progress has been made at a technical level.
- More and more developing countries are concerned with sustainable waste management.
- The development of national waste strategies has also been an area of progress. Most developed countries have adopted waste management plans and implemented measures to achieve set objectives and targets. Sustainable waste management has been defined at the policy level and statutory targets were set to increase recycling and move away from the options on the lower half of the waste hierarchy. The local and/or regional waste management plans have also taken shape and in some cases they have already been subject to first revisions.
- The most dynamic change for the public was the increase in public awareness and participation. Community recycling has improved and so has the willingness to participate in different source separation schemes.
- Another area of progress was the response of business and industry to sustainable waste initiatives. Important improvements have been made in the design and conception stage of products. This can particularly be seen within the regulated market for packaging that has been encouraged to optimise material use for packaging. There has also been an increase in the incorporation of environmental management systems in the business and industry sector, which has in turn led to

increased recycling and reduced waste generation.

### 6.2 Key areas for future progress

- Waste policies have to be made more consistent and coherent; the legal framework and its implementation and enforcement need to be improved on a national and supranational level in all parts of the world. Substantial efforts in that field are of greatest importance especially in developing countries.
- Mid-term waste management plans at national and local level are required that can serve as a sound and reliable basis for the improvement of and investments in waste management systems. This is especially urgent where public health is already adversely affected.
- It is of highest priority to achieve a reduction in the amount of generated waste and to decouple the link of economic growth to waste generation. For this purpose, a uniform waste industry approach is required to raise public and political interest in the establishment of sustainable waste management in all parts of the world.
- A most pressing area for future progress is information and education. There needs to be a co-ordinated strategy with regard to information provision; considerable work needs to be done to change people's attitudes towards waste management as a whole and to increase participation in recycling and minimisation schemes. Once the public is participating in the recycling schemes, it is important to give them feedback on what happens with the recycled waste to keep up their interest in participation.

- Information and education are also needed to allay the fears that people have with regard to waste management and to encourage them to take responsibility for the waste they generate. One major goal that needs to be achieved is increasing public confidence in the waste management sector at large. Extensive work needs to be done to remove the negative perceptions and replace emotive views with views based on sound science and agreed facts.
- The markets for recyclables have to be improved, as well. Producers must be encouraged to incorporate life cycle assessments (LCA) in the development stages of their products and consider waste management issues in the design stages – something that does not happen as a general rule at present.
- Alternatives have to be made available so that consumers are encouraged to minimise their waste or buy products of a comparably high standard and price that are less harmful to the environment.
- The access to transparent and coherent waste data is crucial if strategies are to be successful and sustainable waste management practices achieved. The industry needs to have access to clear, transparent and replicable data and information. This access and the quality of waste data cause difficulties at a national level, and the difficulties are even greater at the international or regional level. The waste management industry, the public sector and researches have to become more aware of the present and future networking opportunities to facilitate information flow and the exchange of know how.
- We need standards for the whole waste industry that include new and emerging technologies and also the management of specific waste types such as agricultural waste. Considerable investment needs to be made in emerging technologies and support should be given to R&D on a national level.
- Developing countries need appropriate technologies and management approaches which are compatible with the specific local demands, requirements, capabilities, and resources.
- While progress has been encouraging to date, partnerships need to be developed continually so that all stakeholders can work together towards a common goal. Participation by all parties in the decision making progress is an important issue. The waste industry has to encourage and take part in multiple stakeholder involvement.
- The key priorities and the most efficient measures with the biggest possible benefit for the environment have to be identified on the basis of facts and figures. Tools like environmental impact assessment, material flow analysis or macro-economic cost-benefit analysis must be applied more widely for improved and scientifically based decision-making. To achieve substantial progress in the minimisation and detoxification of wastes, a broad range of stakeholders must be involved.
- The waste industry must set and achieve sustainability targets.
- Step by step, the isolated 'end of pipe' view of waste management must be transformed into integrated resource and waste management. The system definitions for analyses used in decision- and policy-making must include the issues of waste generation and resource consumption on a global scale. This is especially important in developing countries.
- There needs to be access to training and education for everyone involved in waste

management. An increasing awareness of networking opportunities is required to facilitate information flow.

- The practical experience of practitioners and planners, regulators and operators, scientists and researchers in waste management must be made more available to developing countries and economies in transition. Immediate support and know-how transfer is most valuable as it facilitates the implementation of sound waste management strategies and practices. In many cases, a small amount invested in training and education can enable local staff and regional regulators to help themselves effectively.
- From a global point of view, the most urgent need is to close the gap between developed and developing countries. The first priority is to provide sufficient collection services to as large a part of the world's population as possible and to raise the quality of landfills.

## 6.3 Specific areas of attention

### 6.3.1 Clear, transparent and reliable data

Thorough knowledge and consistent data about waste generation patterns, waste composition and developments are necessary requirements in the preparation and monitoring of efficient waste regulations and in waste planning. It is highly important that the national authorities provide clear, transparent and reliable data to the industry and that the waste industry participates in the provision of the basic data.

### 6.3.2 Waste prevention and minimisation – improved resource management

Most modern waste strategies recognise a waste hierarchy that has the prevention and minimisation of waste as its the first priority. But there is a direct link between economic

growth and waste production. It is a major challenge for the industry as a whole to decouple this link. The means to do this is mainly in sectors other than the waste industry itself.

Waste prevention and minimisation take place at the conception stage of a product and not when it enters into a waste treatment facility. There are different approaches to reach the aim of waste prevention and minimisation. These are based on resource management – as the integrated product policy (IPP), sustainable production etc.

Within the waste industry, there are also several measures to be taken that will be driving forces in changing production and consumption behaviour. Economic instruments, such as taxes or differentiated gate-fees depending on the quality of the waste, have proved especially efficient in raising the awareness of commercial waste generators. The waste industry also plays an important role in communicating with the industry and calling the industry's attention to possible improvements.

### 6.3.3 Render waste less hazardous

Another important goal is to render waste less hazardous. This again is closely linked to areas outside waste management. Current chemical policies and production and consumption patterns influence the quality of the waste and the environmental impact of waste management systems. But rendering waste less hazardous also depends on the existing collection systems for hazardous waste and on the level of information and education of both the industry and of households. The setting up of collection systems for household hazardous waste will help to create public awareness of the risks this type of waste poses to human health and to the environment. In the long run, this awareness will lead to changed consumption patterns and to an increasing demand for substitute products with less risk.

The issue of rendering waste less hazardous is of great importance in developing countries, mainly for public health reasons. Most developing countries do not separate waste; the waste collected consists of household waste, hazardous waste and healthcare waste. Improper storage, collection and treatment of this waste pose a high risk to public health. This is a priority area for making improvements.

Hazardous waste, regardless if it originates from households or industries, should not be included in the municipal waste fraction for several reasons. The most important one was mentioned above. Another reason why the industry is interested in ensuring that hazardous wastes are properly collected and taken care of is of commercial nature. As attempts are being made to create markets for recyclables, compost and other end-products from biological treatment, it is vital that hazardous waste is taken care of correctly in order to eliminate any risk of contamination of those tradable waste fractions.

### 6.3.4 Developing countries

Waste management is often either virtually non-existent or unsatisfactory in developing countries. Any measure taken will be a great improvement to public health and to environmental protection. The increased transfer of experience and knowledge from the north to the south, but also among countries of the south, is a factor of high importance in this context. The first step to improve waste management systems in developing countries is to use more efficiently what they already have and not necessarily immediately look at major investments to remedy the situation.

When waste management schemes are set up or improved, the large numbers of scavengers have to be considered, as well. They should be integrated in the system in a socially balanced way that improves their health situation.

### 6.3.5 Economy and costs

The issue of costs is an important one, and it needs to be addressed by all stakeholders. Currently, landfilling is still the cheapest option and this creates difficulties when we attempt to persuade the local authorities to adopt more sustainable practices, which would probably result in higher charges. But the implementation of a sustainable waste management system needs to be funded accordingly.

### 6.3.6 Improved public perception

A concerted effort will be needed to address the poor public perception of the waste industry today. There is severe opposition to the siting of landfills and waste to energy facilities, and even opposition to composting facilities, MRFs and recycling centres. People have to become more aware of their responsibility for the waste they produce. The waste industry needs to work closely with all stakeholders to implement a communication strategy to change public perception and ultimately encourage the public to make lifestyle changes towards more sustainable practices.

### 6.3.7 Occupational health

This is an important issue in the field of waste management that has been widely neglected even in the most advanced countries. In order to avoid replacing one problem with another, we need to more research work on this topic and we have to make it a priority issue.

### 6.3.8 Sustainability reporting and performance indicators

Sustainability reporting has a larger scope than just environmental reporting; it covers economic and social issues, as well. Sustainability reporting is a way for the waste industry to present a clear picture of the environmental, economic and social impacts of the industry. It is important that the waste industry establishes widely accepted reporting principles that should be applied consistently to promote transparency and credibility. The

elaboration of a set of relevant performance indicators is an issue of importance for the future.

### 6.3.9 Professional qualifications and training

Improving the standards of waste management systems will have great effect on the issue of environmental protection. Therefore, we need well-trained and highly qualified professional waste managers who understand the effect of poor operations and misguided policies on the environment and who have the skills necessary to lead change. Thus, other challenges for the waste industry are the establishment of guidelines for professional qualifications and more access to qualified training in the future.

information and the transfer of ideas and good practice among them.

- Increased collaboration among all sectors is of paramount importance. People have to recognise the need to work together towards a common goal.
- A greater sense of responsibility is needed in the use of material resources and in the generation of waste.
- Sustainable practices should be fully incorporated at the earliest possible time.

## 6.4 Roles of other stakeholders

- There needs to be a co-ordinated nationwide approach towards awareness raising and information provision. This will require all relevant organisations to work more closely together in delivering a single message, which can then be built upon at a regional and local level.
- A greater level of awareness and increased use of LCA and design for the environment within the product design, development and manufacturing sectors will prevent the delivery of mixed messages to consumers and encourage the consideration of waste management throughout the life cycle of a product instead of making it an end-of-pipe solution.
- Other stakeholders should work towards reduced use of energy and materials resources.
- Clear lines of communication should be established between all other stakeholders to encourage the dissemination of

## Annexe I: Case study I:

### Sustainable development in Switzerland – an example of good practice with regard to electronic scrap disposal

In the late-1980s, those using office and informatics equipment in Switzerland expressed the view, in increasingly clear terms, that they expected instructions from producers as to how used equipment could be disposed of without a detrimental effect on the environment. The then practice of taking such equipment to refuse incineration plants or disposal sites met with resistance from those using such equipment, as well as the authorities because it meant, among other things, that key resources were irretrievably lost and pollutants released into the environment.

Consequently, manufacturers and importers of office and informatics equipment created solutions for their products which enabled customers to return their used equipment and have it recycled against payment of a fee. This seemed to correspond to the consumers' wishes, but the solution was not viable from a practical point of view for a number of reasons. It would have been necessary, for example, to account for users of various brands of informatics equipment, and the sorting and returning of individual items would have required a disproportionate effort.

The manufacturers and importers therefore approached their association, SWICO (Swiss Association for Information, Communications and Organisational Technology, Zurich), and asked for the development of a recycling concept for the sector to remove the disadvantages of individual solutions and conform to the principles of a lasting development.

The subsequent concept developed by SWICO in collaboration with its members in 1993 is based on *four pillars*.

1. The manufacturers and importers assume responsibility for their products up to the end of the useful life of such equipment. This means they provide the trade companies and the ultimate consumers with a working recycling system that is operated by their association.
2. The system in which equipment is taken back operates on a region-wide basis and in line with the population's practice of dealing with other types of waste. The owner of used equipment can hand it in at an allocated site; this may be the manufacturer/importer, the dealer or an official collection site. Returning equipment to the dealer or manufacturer is strongly recommended because here are specialists to assess the possibility to recycle equipment or parts of it.
3. Used equipment is taken back free of charge to make people respond to the system. The logistics and recycling costs are financed via an advance recycling fee imposed on new equipment. The costs that arise for used equipment are thus covered by the fees imposed on new equipment by way of a cost allocation method.
4. Specialist companies are issued licences to process the used equipment. These companies meet the high requirements of processing, classifying pollutants according to types and recycling raw materials without undue harm to the environment. The licensed companies are continually checked by a control office which also advises the association regarding further development of the recycling technology. The control office endeavours to increase the recycling quota and improve the quality of the recycled material.



The concept was authorised in December 1993 by the association members during an extraordinary annual general meeting. The introduction of the system was adopted on 1 April 1994.

However, the resolution of the association members was not sufficient in itself to ensure the implementation of the system. Since there was no legal pressure in place at that time, companies had to be convinced one by one to sign up to the voluntary agreement. This step was a success as a result of the environmental management systems and concepts that are increasingly better incorporated in the companies. The SWICO Recycling Guarantee – this is the name of the system – has grown from initial 36 members to an association of more than 150 members. In addition to office and informatics equipment, appliances from the mobile telephone and graphics industries are now also taken back.

After almost eight years' operations of the system, the following conclusions can be drawn.

1. The amount of returned used equipment increases every year. This is due to two factors: on the one hand, the system has become more widely known and, on the other hand, the amount of installed equipment has increased sharply. The proportion of incorrectly disposed equipment has decreased significantly.
2. The processing of used equipment according to strict regulations means that 78% of the materials contained in such equipment can be recycled. The sorting and dismantling of equipment is carried out by specialist companies that employ many people who are socially underprivileged. The SWICO Recycling Guarantee has also provided the processing industry with an important impetus. As a result of the investments made, the sector has become a model of excellence, and it is taken as an example in other countries because of its

high technical knowledge.

3. The financing model of using an advance recycling fee has proven successful. Consumers prefer to pay their contribution when they purchase new equipment as opposed paying it when the equipment is returned. The system is well-designed and comprehensive which has resulted in savings that can be passed on to consumers in the form of low advance fees.
4. The success of the voluntary sector solution shows that it is possible to take steps to achieve greater environmental compatibility without strict legal regulations. The assumption of responsibility by the manufacturers/importers has, on the contrary, resulted in a clear division of tasks in the system, which simplifies the organisation and has a positive effect on costs.

The Ordinance on the return, the taking back and the disposal of electrical and electronic appliances, ORDEA, which has been in place in Switzerland since 1 July 1998, provides the legal basis for an obligation of consumers to return equipment and the obligation of the trade companies and manufacturers to take back and dispose of equipment. SWICO will further develop and supplement its concept in line with the future requirements of ORDEA and incorporate the wealth of experience gained during the past eight years. The next step has already been introduced – the inclusion of consumer electronics equipment in the disposal solution as per 1 January 2002 .

## Annexe 2: Case study 2:

### Waste management in Metropolitan Cape Town.

#### A case study – the challenges facing a developing city<sup>(16)</sup>

Cape Town is a developing city with all the symptoms of a city in transition. New solid waste strategies are needed which aim at involving all citizens and achieving a sustainable system. The status quo with regard to solid waste management in Cape Town is discussed in this paper, highlighting the problems and possible solutions that can be incorporated into policy and strategies. In conclusion, the paper postulates that it is possible to achieve the goal for Cape Town of being a world class yet African city, while caring for the needs of all people, and without compromising the environment. This depends on whether the right decisions are made and solutions to the challenges that face the city are adopted in the short term. Public involvement, along with education and information processes, are seen as the keys to success of the solid waste system.

#### Introduction

Cape Town is a metropolitan city of some three million people, situated on the southern most tip of Africa. The city is located in an area of extraordinary beauty and variety – a rich floral kingdom, rugged mountain ranges, forests and endless coastlines. In stark contrast, a large percentage of the population is poor, with many living below the breadline who cannot afford even rudimentary services. Mere survival and basic housing issues, which are taken for granted in most first world cities, are issues that need to be addressed in Cape Town.

The city can be regarded as a developing African city; it exhibits many of the symptoms associated with cities in transition. The challenges facing Cape Town include social,

financial and environmental. The demands are growing whereas resources are somewhat static. In addition, the local government is in a process of transition as the local authorities and the Cape Metropolitan Council, in the Metropolitan Area, are presently being transformed into a single modern unicity council, the new City of Cape Town. Along with this change comes a new service delivery strategy which was developed to remove past inequalities in service levels.

It is difficult to improve the waste management system without sufficient financial resources. But the funds available are used for seemingly more pressing issues, such as housing, health, fighting crime etc.

'Sustainable cities' is a buzz-word widely used these days and achieving sustainability and harmony with the environment is a major challenge for new Cape Town. Sustainability cannot be achieved in isolation, it must include waste issues and environmental aspects as well as consider the social makeup of the city. Waste strategists, scientists and managers have to ensure that the needs of the city and its inhabitants are addressed without compromising the environment.

#### Legislation and policy

Section 24 of South Africa's Bill of Rights (Constitution of the Republic of South Africa – Act 108 of 1996) states that everyone has the right to an environment that is not harmful to their health and well-being. Furthermore, everyone has the right to have the environment protected, for the benefit of present and future generations. This is achieved through reasonable legislative measures that (i) prevent pollution and ecological degradation, (ii) promote conservation and (iii) secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development. The Act allows citizens to take legal action against the local government to ensure these rights.

(16) P.H. Novella, City of Cape Town, Waste Management Department, PO Box 16548, Vloeberg 8018, Cape Town, South Africa

Legislation and policy to uphold this right have already been implemented or are currently in the process of preparation or promulgation. These are: the White Paper on Integrated Pollution and Waste Management – Gazette No. 20978 (DEAT, 1999), the National Environmental Management Act (Act 107 of 1998) and the National Waste Management Strategy (NWMS) (DEAT, 1999). This legislation and the resulting actions once it is fully implemented will make a holistic, integrated and sustainable approach to waste management mandatory in South Africa.

Waste disposal was specifically neglected in the past; landfills were mostly poorly sited, unengineered and badly managed. The Environment Conservation Act (Act 73 of 1989) (DEAT, 1999) introduced new requirements for landfills. 11 years after the promulgation of the act, some landfills have improved, but a number have not. A large number of landfills remain unlicensed. In order to implement the provisions of the Act, a series of guideline documents (the Minimum Requirements) that enable compliance with the Act, were published in 1994 and revised in 1998 (DWAf, 1998). The minimum requirements have become important reference documents for waste disposal in South Africa. These documents were also used to form the basis for waste disposal policy in other countries.

### Problems in the field of waste management

The Unicity of Cape Town has recently been formed out of seven autonomous Councils each with its own administration, level of service and tariffs for its residents. The problems in the field of waste management are immense. Fourie (2000) reports that there is fragmentation and duplication of services which results in wastage and places a burden on financial resources. The problems are exacerbated by the fact of ever increasing debtors' books which resulted from unpaid accounts. These arrears are increasing at an

alarming rate as a culture of non payment prevails in certain communities within the city. The resulting lack of funds causes infrastructural problems as well as operational and capital budget cutbacks. In addition to the presence of many bureaucratic procedures, there is also a lack of performance management and incentives for staff.

There are pockets of excellence in the provision of services including the handling of solid waste. These are overshadowed by areas which are littered and which have become the dumping ground for unscrupulous illegal dumpers. These persons dump their waste at the roadsides or in any open space in the dead of night or even in broad day light, thereby causing health problems and other major environmental problems.

In every community there are people who have little concern for the state of the environment. This is due to ignorance or social hardship. There is little formal environmental education on a significant scale for the residents of Cape Town. Numerous clean-up programmes have been run in the past, but they have had only limited success in keeping Cape Town clean.

The importance of waste disposal facilities has been neglected in the past and the city is facing a shortage of suitable landfill space for both general and hazardous waste. But there is still an increase in hazardous waste imports into the Cape Town area from other cities in South Africa that are worse off with regard to hazardous waste facilities. An intensive capital investment programme was introduced to address these problems; it aims at closing unsuitable sites, upgrading suitably positioned sites and modernising facilities which have become run-down. Legislation has been drafted to control the flow of waste into sites in Cape Town from outside the metropolitan area.

The problems associated with illegal dumping and the task of getting all waste into the formal waste stream and upgrading the collection, transfer and disposal facilities coupled with the lack of supporting legislation have resulted in a slow progress towards the goals of waste reduction, minimisation and recycling. The waste stream is mixed and very little pre-sorting takes place on a formal level.

### Structural reorganisation

Following the international trend, water, electricity and solid waste management are reorganised into outcome focused, ring fenced business units with an emphasis on the core business of each unit. This will result in efficient, cost-effective services for all residents, which are not harnessed by unnecessary bureaucracy. In the initial study, the trading arm of solid waste, which comprises waste transfer and disposal, has been identified as an area of progress, which could result in improved internal mechanisms or corporatisation into, for example, a utility company. This part of the service is tariff funded and has clearly defined customers from both within as well as outside the council.

Waste collection is receiving attention and will be subject to similar studies at a later stage. If the decision-makers favour utility companies, as has been the case in Johannesburg, these companies will be registered with the council as the sole share holder. The adoption of clear lines of responsibility, accountability, control of resources linked to performance management and possible incentive schemes will surely result in greater operational and economic efficiency. Bad debts might still remain a problem, however, we hope that the improved levels of service as well as increased visibility and responsiveness to the needs of all customers will result in a culture of payment for services over time.

The issue of cleaning the city has been discussed in many debates. It has been proposed that the owners of the components

that make up the city must take responsibility for keeping that area clean and ensuring a strategy that keeps it clean. In this way, the cleaning of the street-scape is identified as a roads function, the cleaning of beaches is within the responsibility of beach amenities etc. In this way, the specialised solid waste systems of waste collection, transfer and disposal can be customer-focused in their business and do not have to perform the task of cleaning up everyone else's mess. Along with this an intensive educational drive will ensure that all citizens are aware of environmental protection as well as of the effects of littering, illegal dumping and other bad waste management practices.

The involvement of communities will be encouraged through policies that assist in the employment of SMMEs (small, micro and medium enterprises). In addition, policies are investigated that focus on waste management as a vehicle for job creation. Entrepreneurial community-based collection systems have already been successfully implemented in Cape Town, where previously unemployed people are now small business owners and employers. These community waste management systems all have a place in the integrated waste management plan for Cape Town.

### Sustainable and integrated waste management

The development of sustainable environmental plans such as IMEP (integrated metropolitan environmental programme) is under way which include integrated waste plans for Cape Town. These plans cannot be developed and implemented overnight. In addition, continual review and assessment are necessary to keep the plans up to date and make sure that they respond to the needs of a rapidly changing city.

It is important to understand the terms sustainability and integrated in the context of waste management. These terms mean different things depending on the context. In

this paper; they are defined as follows:

- sustainability: 'solving today's problems in a responsible and environment-friendly manner without prejudicing the ability of future generations to exist or solve their own problems',
- integrated waste management: 'the consideration of all components which make up the waste hierarchy and the selection of appropriate components in consideration with each other in a cradle-to-grave approach'.

The first step to sustainability can be achieved by complying with all legislation in the field of environmental protection. In addition, specific impacts are analysed and mitigatory actions are taken to minimise those impacts. It must be clear, however, that the waste management approach alone cannot be considered sufficient to achieve sustainability.

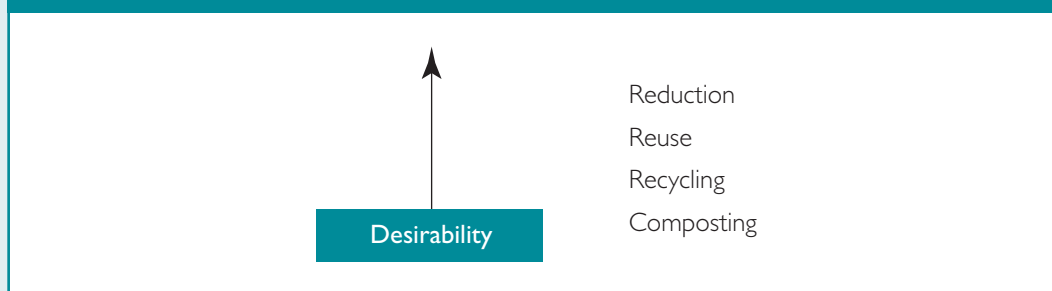
Just as waste management systems must have an integrated approach, so too, must waste management be integrated into other services that have an impact on the environment. All planning and operational activities must be considered holistically. A city development strategy (CDS) for the city as a whole and a council-specific integrated development plan (IDP) are being developed for Cape Town to facilitate overall integration.

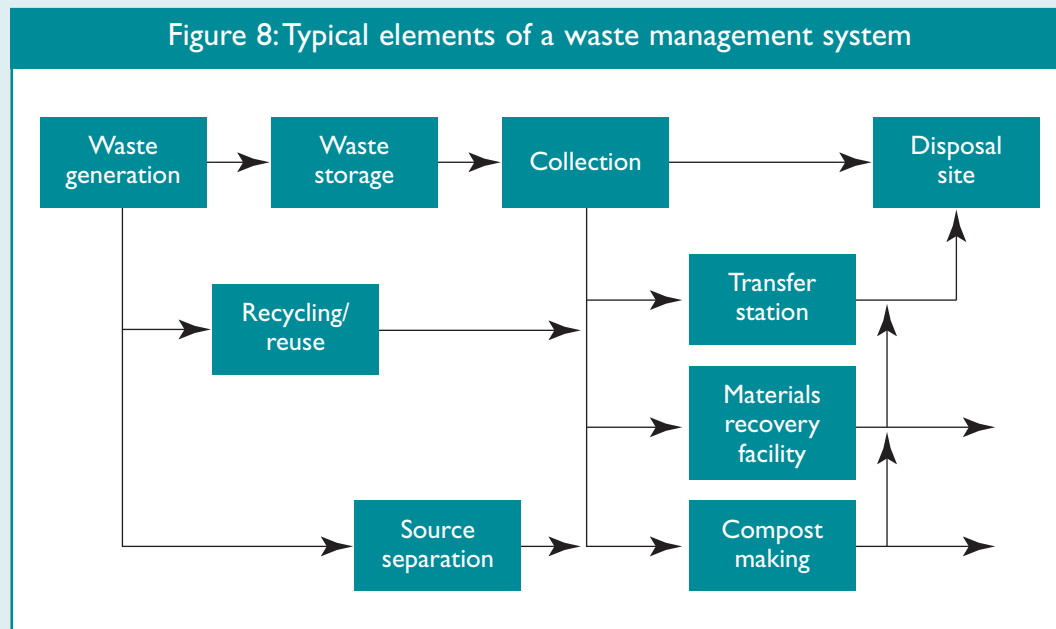
In order to be sustainable, waste management must consider the waste stream in a holistic cradle-to-grave manner in order to optimise the use of natural resources and reduce environmental impacts. An integrated approach, which combines several techniques such as waste reduction, reuse, recycling, composting, treatment and disposal must be considered. Figure 7 shows the widely accepted desirability hierarchy in integrated waste management, which is used to guideline waste management planning and policy development to an increasing extent.

The decision on which processes to use must be based on an appraisal of all costs and benefits as well as of the impacts on the environment. Aumonier and Coleman (1997) point out that LCA is an appropriate technique for examining waste management scenarios.

The overall emphasis of the system used must be on reducing waste quantities, thereby protecting natural resources and hence reducing the mass requiring disposal. The mix of processes must be selected with a goal in mind. Figure 8 (page 60) shows a typical waste management system with a number of options. Once the desired mix of processes has been selected, an environmental management system (EMS) which embraces ISO 14001 needs to be developed and put in place to ensure that environmental objectives are met on a permanent basis in each process.

Figure 7: Desirability hierarchy in integrated waste management





In terms of the NWMS, all local authorities will have to develop Integrated Waste Management Plans for waste (DEAT, 1999). In a move towards an integrated approach to waste management, the former Cape Metropolitan Council finalised a strategy with regard to waste generation, reduction, transfer and disposal for the Cape Town area. In this plan (CMC, 1999), in which waste management objectives are set, emphasis is placed on a phased approach to the implementation of more sustainable processes in addition to solving immediate problems with high priority followed by a continual improvement through review and assessment.

The selected disposal method is sanitary landfill, which must in all respects comply with the Minimum Requirements. A waste stream assessment and audit was carried out for the first time. Waste and transfer methods were assessed and landfill airspace and capacity for disposal were determined as well as the projected needs for the next 30 years. Waste generation statistics are now available for the first time. It is essential, however, that this information is transferred into a dynamic

waste information system that can be kept up to date to enable proper planning and continual review.

It has been estimated that, on average, each resident of the Cape generates approximately 1 kg of waste per day that requires landfill disposal. Existing recycling and composting programmes were evaluated. Some 6% of domestic waste is recycled. Judging from the waste that goes to landfills, it is estimated that domestic waste recycling could be increased to about 22%. As a first step, sorting of mixed waste is investigated, but long-term plans to encourage and phase in source separation will be put in place. Education and public awareness are considered as critical components in the success of the plan.

Waste management is generally considered to comprise two facets viz. community/logistics as well as scientific/engineering. In developing countries, these two facets are poles apart and require different approaches to achieve sustainability. The cleansing and waste collection services may be regarded as community services requiring a logistics approach while the planning and management of waste transfer

and disposal require a scientific/engineering approach. In order to achieve sustainability, we need an approach that takes these two facets into account. If they are considered separately, we still need an integrated approach to bring the two together.

In Cape Town, cleansing (litter removal and street sweeping) and waste collection are the most costly components of the waste management systems. These will be replaced by optimised, appropriate and cost effective systems. Communities will be encouraged to take responsibility for their waste; they will be consulted in the preparation of a strategy for cleaning their area. In addition, citizens will be made aware of and continually reminded of the aims and objectives of the waste strategy implemented in their area.

Information on waste types and quantities will be made available. The implementation of any strategy can only be successful with the active participation and support of the communities. The public must be involved in the entire process; people must be included early on in the process so that they understand the effects and costs of management of the wastes that they produce.

One of the common mistakes that were made in the past was the belief that there is one solution. This is not the case. It is now accepted that there will be a number of different strategies with varying action plans and varying costs for different sectors of the same city. For this purpose, appropriate status quo analyses are carried out and achievable, acceptable and affordable strategies are developed along with action plans.

The base is a minimum service level for all. From this basis, varying service levels will be selected with resulting differing costs. These depend on the type and quantity of waste produced as well as on the specific needs and demands of each community. There are presently three levels of collection service:

rudimentary service, black bags service, and a containerised system.

Illegal dumping in Cape Town must be stopped as soon as possible. An intensive strategy was launched to clean the city, but also to educate and inform the people. This is seen as the corner-stone of any successful strategy; bylaws are redrafted to improve the enforcement of the laws. The causes of the underlying problems are established and solutions developed; major cleanups without sustainable results are discouraged. The first and foremost task is to make all waste enter into the waste stream. Communities will be encouraged to take responsibility through proper campaigns that promote a clean and sustainable city.

### Recycling and composting

Waste reduction, recycling and composting form major components of a sustainable waste management system. Along with improved standards and increasing disposal and transport costs, waste reduction is also becoming more financially attractive. This concept includes more than just separating post-consumer materials; it also includes reuse, re-processing and re-manufacturing. The complete loop must be considered to be able to assess long-term viability and sustainability.

Recycling is also a vehicle of job creation, and a number of operations are being looked at to determine which of them are suitable for the sorting of waste to recover reusable products and raw materials. It is reported that the informal sector in Egypt was employed in the cleaning, waste collection and recycling sectors, thereby handling about one third of Cairo's waste (Iskandar Kamel, 1999).

It is important that proper planning is carried out prior to implementing a programme. Markets need to be assessed and the dynamics understood. Realistic goals must be set and the public must be involved. Decision-makers must be made aware of the total costs of the loop. The elements that should be



included are, among others, source separation, curbside collection, materials recovery facilities and mixed waste processing. There are many combinations of these elements to be considered.

Drop-off points in Cape Town currently form the major part of existing recycling initiatives. Recycling schemes in schools and other institutions all provide a necessary service and earn an income in the process. There are many success stories in school recycling schemes. In some cases, bottle and paper banks situated in convenient spots also provide other solutions. These recycling centres are, however, often poorly sited and cause social nuisances.

These sites within urban areas are currently in the spotlight as they reportedly encouraged informal salvagers to break open bags or tip out the contents in a quest to find high value waste. Managing these sites presents a challenge. Public pressure forces the city to consider closure of certain drop-off sites because of the social problems they cause. Sites must not be neglected; instead, they should be integrated into municipal programmes with appropriate control. Litterbins must be available at each site.

Composting is an internationally recognised method of waste reduction (EPA 1989). Organic material in household waste in the form of green and kitchen waste is a resource that should be returned to the environment to increase soil integrity and productivity. Composting is a natural way to turn waste into a resource in a controlled way before it is returned to the environment.

The scale of composting systems can vary from households with a compost heap in the backyard to small areas at drop-off facilities to large plant installations. In Cape Town, there are three large municipal composting facilities, all of which have been in operation for some two decades. These plants have one thing in common – they were not financially viable and

required large subsidies. However, as acceptable landfills are often scarce near areas where waste is generated and transfer stations are implemented to move the waste further afield, a new move is evaluated towards composting as a cost-effective alternative. Private sector involvement in these systems is welcome. In this way, a significant amount of organic wastes can be diverted away from valuable landfill airspace.

The method of reducing waste going to landfill by way of introducing a Web-based industrial waste exchange (IWE) system for Cape Town (Dittke and Novella, 2000) is a unique solution to the problem of reduced landfill space (<http://www.cmc.gov.za/iwe>). While such an approach is new to South Africa, similar systems have been used successfully elsewhere, for example, in the United States and in Australia, to promote the reuse of waste materials. The system has its roots somewhere between recycling and reuse with attractive financial rewards for waste providers (in terms of reduced waste disposal costs and the possible sale of waste materials) as well as for waste users (replacement of expensive virgin material). The IWE system can form an integral part of Cape Town's integrated waste system and promote sustainability.

### Disposal by landfill

Both the NWMS and the study of an integrated strategy for the Cape Town have recognised landfill disposal as an appropriate and a necessary component of waste management in South Africa. Landfills must be properly sited, well engineered, and efficiently operated, and the general effects of operations and the impact on the environment must be monitored. Thus, landfills remain an important component of Cape Town's integrated waste management plan.

Since landfills are increasingly situated in remote areas transfer stations are established. Some of them are rail based, and all of them are ideally located in strategic positions in



order to ensure long-term economic viability for the entire system.

Selected landfills are upgraded, while others are closed. Airspace is used up at a rate of some 1,5 million m<sup>3</sup> per annum. This means that there is still space available for approximately eight years. This time is increased to about 13 years by expanding selected sites. At the same time, regional studies determine whether it is possible to increase the capacity of certain sites to 30 years.

According to Novella (2000), sustainable landfills can be defined as landfills where air space, processes, use of products and residues are at an optimum with minimal negative effects on the environment. An EMS is applied to landfill operations in Cape Town to achieve ISO 14001 compliance. Reyneri *et al.*, (1999) and Bertolini *et al.*, (1999) give details useful for the development of EMSs of landfill sites. In this way, management methods and procedures followed for disposal operations will be improved. This will lead to more efficient control and improved environmental performance and the prevention or reduction of risks. Risk analysis can be used to successfully control health, hygiene, safety, security and environmental effects at landfill sites (Reyneri and Belfiore, 1999).

## Conclusions

This paper attempted to shed light on some of the complicated issues related to solid waste management in Cape Town. Improved and more sustainable waste management systems can be achieved. The following conclusions result from the above discussion. It must be noted, however, that this is an evolving dynamic subject; the conclusions must be seen in this light.

- The transformation of the fragmented solid waste management services into optimised customer focused business units is regarded as the most effective way to manage waste in Cape Town.
- Special attention needs to be given to education and information programmes, which are seen as the corner-stones of sustainable solutions.
- Sustainability can be achieved. The framework for a national system is currently in place. Local plans and policies for Cape Town are in the process of being put together and implemented.
- Sustainability must be aimed at by implementing integrated waste management systems, which use a mix of alternative solutions that complement each other. A cradle-to-grave approach is needed.
- Waste managers have the responsibility of ensuring a cradle-to-grave approach where complementing components are selected in an integrated manner. Local plans must be set with achievable goals. Review processes must be put in place to measure the effectiveness of the plans. Public participation is seen as important and will go hand in hand with education and information programmes.
- IWE system can be part of Cape Town's integrated waste management system, thereby promoting sustainability.
- Landfills are seen as part of an integrated approach. They must be designed, engineered, operated and monitored in a way that ensures environmental compliance and a sustainable approach.
- Environmental management systems that comply with ISO 14001 must be put in place. Their actual performance must be monitored. These goals cannot be achieved by waste management measures alone but as part of an overall system.
- Waste reduction, recycling and composting must be encouraged and increased as the amount of waste going to landfill is reduced.

## Acknowledgement and disclaimer

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## Annexe 3:

### Case study 3:

## Management of Municipal Solid Wastes in China<sup>(17)</sup>

### General introduction

When China implemented the policy of reform and opened to the world, the urbanisation progress sped up, the amount of cities and towns and their urban population increased rapidly. There were more than 200 cities with a total population of 200 million in the early 1980s; today, there are 668 cities and 16,500 cities and towns with a total population of nearly 400 million.

The increase in residents of cities and towns certainly leads to more municipal solid wastes. Since a considerable number of urban residents still use crude coal as energy source, the municipal refuse is not only large in quantity, but also contains large amounts of coal ash and cinder (more than 50%). This causes great difficulties in the treatment of the refuse: the fertiliser efficiency of refuse compost with large amounts of coal ash and cinder is not high; the amount of refuse for landfill treatment is large; the mixed plastics in refuse affect the compactness of landfills; and such refuse is unsuited for incineration because its calorific value is low.

Since the national financial resources are limited and the incomes of residents are relatively low, there are no sufficient financial resources to fund the construction of refuse treatment facilities. These are conditions that commonly occur in cities all over the country.

Therefore, the current management of municipal solid wastes is limited to road sweep and refuse transport. The sound disposal rate of municipal solid wastes is far behind the growth rate of generated waste, which causes serious environmental problems.

### Increasing quantities of municipal solid waste

As a result of the rapid population growth in cities and towns and the continuous improvement of living conditions, both the overall quantities and the per capita quantities of municipal solid wastes increase. Before the 1980s, per capita refuse generation per day was 1kg; the total amount of refuse generated in the whole country was about 70 million tonnes. In recent years, per capita refuse generation has increased to 1.3kg to 1.5kg, and the total amount of refuse is appr. 200 million tonnes. This is an increase by more than two times since the early-1980s.

Serious refuse problems forced some cities to increase their investments in environmental sanitation work. 11 large cities, including Beijing, Tianjin, Shanghai and Guangzhou, invested a total of 5.757 billion yuan RMB, a sum that is 5.345 times higher than the sum invested in 1986. The increase in investment was highest in Guangzhou: 9.57 times, followed by Wuhan 6.97 times, Shanghai 6.01 times, and Beijing 5.8 times. Other cities also increased their investments in varying degrees, thus increasing the capacity of the road sweep and refuse transport systems.

Furthermore, some cities built several refuse treatment facilities in succession. In 1986, there was a total of 23 refuse and faeces treatment facilities, with a treatment rate of 0.07%. In 1995, there were more than 900 treatment facilities, with a treatment rate of 43.7%. The main treatment methods used are simple landfilling and high temperature composting. The quantity of landfill refuses accounts for 70%. The quantity of compost accounts for 20%. Only Shenzhen has refuse incineration facilities with a day treatment capacity of 300 tonnes. Beijing, Shanghai and Zhuhai etc. are planning to build refuse incineration facilities.

(17) Kangsheng Zhang, executive director; UNEP-Infoterra China National Focal Point

### Problems in the management of municipal solid wastes

In 1992, the sound treatment rate of municipal solid wastes and faeces in the cities of China was only 28.3%. In urban areas, per capita annual refuse generation was 440kg, with an annual growth rate of 8% to 10%. Large amounts of municipal solid wastes are simply transported to the periphery of urban areas for open dumping. Municipal solid wastes around more than 200 cities greatly damage the urban environment, worsen living conditions and hinder the development of urban construction.

Since the amounts of municipal solid wastes are so large and the proportion of sound control is so low, the majority of cities are puzzled by the problem of what to do with the refuse. By 1997, the refuse transport capacity of the national environmental sanitation system was 100 million tonnes, while the amount of refuse discharged by urban residents was 200 million tonnes.

The refuse that could not be transported was detained in uncontrolled sites. This is a source of heavy pollution. Even if the refuse is transported to refuse sites, it is generally just piled up in the open. Large amount of stacked refuse tend to ferment and generate high temperatures and methane, which often causes explosive accidents. Furthermore, there are serious environmental problems, such as stink to high heaven, rampant mosquito and fly populations, or damage caused by pathogenic bacteria and viruses.

Due to the limited financial input, the provisions against leakage at landfill sites are generally inadequate, which allows refuse pollution to leak from the ground into the underground; the leakage seriously pollutes the surrounding underground waters.

Another environmental problem caused by municipal solid wastes is that caused by the wide use of disposable plastic dinner sets and

packing bags. These certainly bring great convenience to consumers, but the arbitrarily abandoned plastic wastes cause serious 'white pollution'. Since there is a lack of management work, this does not only damage the appearance of cities and landscapes and affect air and water qualities, but also causes difficulties to treatment. As these plastic wastes can not be reduced by microbial activity, they also affect the compactness of landfills. In addition, large amounts of polyvinyl chloride waste plastics have a potentially high level of leach toxicity, so they are not suitable for landfilling.

Although waste plastics have a high calorific value, they can not be simply incinerated because incinerating polyvinyl chloride plastics at temperatures below 1,200°C will generate a very toxic matter: dioxin. The treatment of such incineration fumes will incur high investments; such funds are not available to the general incinerator plants of the country. Therefore, the pollution caused by waste plastics is a prominent difficulty among the current refuse problems.

### Measures taken in the field of solid waste management

The national principles for preventing and controlling solid waste pollution are the reduction of solid waste generation, the appropriate utilisation of solid wastes wherever possible, and the sound disposal of solid wastes. The state encourages and supports clean production in order to reduce solid waste generation; it encourages and supports the comprehensive utilisation of resources, the adequate and appropriate recovering of solid wastes; and it adopts economic and technical policies and measures that favour the comprehensive utilisation of solid wastes.

In response to the nationwide conditions, the state has formulated a short-term technical policy to control solid wastes pollution: minimisation, recycling and decontamination.

Decontamination will be the main point of solid waste pollution control for a relatively long-term. Later, the focus will be shifted from decontamination to recycling. Recycling is an important factor in the decontamination and minimisation of municipal solid waste.

### Strengthening the legal system

The state has issued a set of relevant laws and regulations in order to effectively prevent and control solid waste pollution, such as the Atmospheric Pollution Prevention and Control Law of the People's Republic of China;

- the Water Pollution Prevention and Control Law of the People's Republic of China;
- the Provisions on Preventing Electrical Installation Containing PCBs and its Wastes;
- the Certain Provisions on Preventing and Controlling Environmental Pollution in Chromic Compound Production;
- the Management Methods for Preventing and Controlling Environmental Pollution of Tailings;
- the Notice on Strictly Controlling Transform of Hazardous Wastes from abroad to Our Country;
- the Control Standards for Agricultural Use of Refuse;
- the Pollution Control Standards for 11 Pollutant Compounds of Industrial Solid Wastes, etc.

The Solid Waste Pollution Control Law of the People's Republic of China was issued on 30 October 1995. The law puts forward directive principles for the comprehensive prevention and control of solid waste pollution. This marks the end of a long period without laws and regulations for the prevention and control of solid waste pollution and without supervisory management. Thus, the prevention and control of solid waste pollution in the country enters into a new stage.

Detailed rules and regulations for the minimisation, recycling and decontamination of

solid wastes should be stimulated on the basis of the act for solid waste pollution control. Special rules for hazardous wastes should be drawn up as soon as possible. The whole process management of production, collection, storage, treatment, disposal or utilisation should be implemented as soon as possible.

### Implementing the policy of solid waste minimisation

The basic task of solid waste minimisation is to use appropriate tools to reduce the quantity and volume of solid wastes. It should be accomplished in two respects: treatment and utilisation of solid wastes and reduction of solid waste generation. In addition, a technical policy and encouraging measures for clean production should be stimulated. Action guidelines for waste minimisation of those main industries (such as metallurgical industry, chemical industry, light industry, etc.) that generate hazardous wastes should be laid down and implemented.

There are other measures to be implemented, as well. These are a reform of traditional production modes, the improvement of process and equipment, the use of clean raw materials and energy, and shifting the focus from 'end-of-pipe' management to 'source' control. The state has set up a Centre for Clean Production, and it has selectively compiled the first set of effective techniques of clean production in electrical, chemical, mechanical, light, textile, building material, metallurgical and nonferrous metal industries for allocation and dissemination.

### Management measures and actions

In the field of municipal solid waste management, the following measures and actions should be taken:

- Formulate and implement laws and regulations governing municipal solid wastes, improve the system of managing urban refuse with all due haste and gradually introduce a system of fees for the

treatment of refuse. Cities that attract tourists should establish a system for the segregated collection and safe disposal of refuse in the near future, while other cities will achieve this goal more gradually. Individuals and institutions are encouraged to create professional service companies for municipal solid waste collection, transportation and safe disposal.

- Take measures to minimise the generation of municipal refuse, such as increasing the supply of coal gas and natural gas and developing district central heating systems to reduce solid residues from direct coal combustion. Measures will also include providing clean vegetables to urban residents in developing decomposable plastic packaging, gradually implementing the use of garbage bags and segregated disposal, and encouraging waste recycling.
- Promote the safe disposal and recycling of urban refuse in accordance with local conditions. The primary options for the safe disposal and recycling of municipal solid wastes are sanitary landfill and composting, although some cities might employ incineration. By means of high-temperature composting, domestic refuse is now being processed into organic fertiliser and used locally. Monitoring of the rural environment must be improved. From the year 2000 on, biogas generated in sanitary landfills will be recovered and closed composting piles will be afforested;
- Establish appropriate economic policies to encourage the development of comprehensive technologies for utilising municipal solid wastes, for example in brick-making and cement-making.
- Improve the infrastructure for sanitation by, for example, improving public lavatories, municipal solid waste transfer sites, faeces disposal sites, parking for sanitation vehicles and sanitation works yards. These kinds of

improvements to the infrastructure are to be integrated into the design, construction and operational planning processes for municipal and industrial development.

- Improve technical engineering studies on municipal refuse collection and treatment. Introduce and assimilate advanced technologies from other countries. Emphasise the development of environmentally sound technologies and equipment for use in the reclamation, treatment and utilisation of municipal solid wastes.
- Establish demonstration projects as models for municipal refuse treatment and disposal. These should demonstrate sanitary landfills, high temperature composting, incineration and comprehensive recycling. Implement well-designed citywide programmes for municipal refuse collection and transport.

#### **Comprehensive utilisation of solid wastes**

Comprehensive utilisation is the most effective approach for recycling and decontamination of solid wastes. It is of a great significance in the prevention and control of solid waste pollution and in the protection and improvement of the environment. Practical experience has shown that comprehensive utilisation of solid wastes is an important component in the implementation of sustainable development strategies.

Our regulations will: implement a preferential policy for the production and construction of comprehensive utilisation of resources, such as remitting taxation, financial support, preferential credit, etc; implement the principle of 'who invests will benefit' to the enterprises employing comprehensive utilisation. Benefits from comprehensive utilisation projects constructed with funds raised by the enterprises themselves belong to the enterprises. The responsible departments and administration departments should support them in this context. They should neither levy

nor apportion charges, nor should they arbitrarily allocate products. One of the main check-up targets for mine enterprises will be the raising of the total recovery rate of mineral resources.

Carrying out comprehensive utilisation resources and scientific and technical research should be encouraged, as well. Scientific and technical markets for comprehensive utilisation should be organised. Technical transfer including payments should be practised. The state should set up comprehensive utilisation rewards in order to encourage the units and individuals that make contributions to the development of comprehensive utilisation.

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## UNEP contribution to the World Summit on Sustainable Development

The mission of the United Nations Environment Programme (UNEP) is to provide leadership and encourage partnerships in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations. The UNEP Division of Technology, Industry and Economics (DTIE) contributes to the UNEP mission by encouraging decision-makers in government, business, and industry develop and adopt policies, strategies and practices that are cleaner and safer; make efficient use of natural resources, ensure adequate management of chemicals, incorporate environmental costs, and reduce pollution and risks for humans and the environment.

This report is part of a series facilitated by UNEP DTIE as a contribution to the World Summit on Sustainable Development. UNEP DTIE provided a report outline based on Agenda 21 to interested industrial sectors and co-ordinated a consultation process with relevant stakeholders. In turn, participating industry sectors committed themselves to producing an honest account of performance against sustainability goals.

The full set of reports is available from UNEP DTIE's web site (<http://www.uneptie.org/wssd/>), which gives further details on the process and the organisations that made it possible. The following is a list of related outputs from this process, all of which are available from UNEP both in electronic version and hardcopy:

- industry sectoral reports, including
  - accounting
  - advertising
  - aluminium
  - automotive
  - aviation
  - chemicals
  - coal
  - construction
  - consulting engineering
  - electricity
  - fertilizer
  - finance and insurance
  - food and drink
  - information and communications technology
  - iron and steel
  - oil and gas
  - railways
  - refrigeration
  - road transport
  - tourism
  - waste management
  - water management
- a compilation of executive summaries of the industry sectoral reports above;
- an overview report by UNEP DTIE;
- a CD-ROM including all of the above documents.

UNEP DTIE is also contributing the following additional products:

- a joint WBCSD/WRI/UNEP publication entitled *Tomorrow's Markets: Global Trends and Their Implications for Business*, presenting the imperative for sustainable business practices;
- a joint WB/UNEP report on innovative finance for sustainability, which highlights new and effective financial mechanisms to address pressing environmental, social and developmental issues;
- two extraordinary issues of UNEP DTIE's quarterly *Industry and Environment* review, addressing key regional industry issues and the broader sustainable development agenda.

More generally, UNEP will be contributing to the World Summit on Sustainable Development with various other products, including:

- the Global Environmental Outlook 3 (GEO 3), UNEP's third state of the environment assessment report;
- a special issue of UNEP's *Our Planet* magazine for World Environment Day, with a focus on the International Year of Mountains;
- the UNEP photobook *Focus on Your World*, with the best images from the Third International Photographic Competition on the Environment.

## Sustainability profile of the Waste Management industry

- Achievements

- Improved environmental and technical performance.
- Awareness among decision-makers and consumers.

- Unfinished business

- Integrated research on effects of waste management on soil, air, water and climate.
- Waste management in developing countries.

- Future challenges and possible commitments

- Decouple the link of economic growth and waste generation.
- Improve communication, education and training.

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