

## VII.2

# Solid waste management policies for the 21st century

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### VII.2.1. Introduction

Solid waste management has moved to the forefront of the environmental agenda. Actions to reduce the environmental risks of solid waste treatment and disposal operations have reached unprecedented levels. Nations are considering restrictions on packaging and controls on products in order to reduce solid waste generation rates. Local and regional governments are requiring wastes to be separated for recycling, and some have even established mandatory recycling targets. Incinerators and waste-to-energy plants have been equipped with state-of-the-art air pollution controls. Landfills are being designed with liners, impervious caps and liquid collection systems, and gas and groundwater are being routinely monitored.

Previously considered a local issue, it is now clear that solid waste management has international and global implications. Concern about transboundary shipment of hazardous waste has led to the adoption of the Basel Convention by the United Nations. Recognizing the inter-relationship between solid waste standards and economic development, the European Community is moving forward to harmonize waste disposal requirements in member countries. Solid waste management in countries with developing economies poses a special set of problems. In these countries quite often financing is not available for the construction of waste treatment facilities, and there is a lack of trained personnel to operate waste management systems. Also, there are generally no regulations or control systems, no administrative body responsible for solid waste control and no obligation for industry to dispose of wastes properly.

More than ever before, solid waste management policy makers worldwide need sound and reliable information on the technical performance, environmental impact and costs of solid waste collection, recycling, treatment and disposal systems.

### VII.2.2. Integrated solid waste management

Most solid waste management professionals recognize that there is no single, simple solution to solid waste problems. Instead an integrated approach is necessary combining the elements of several techniques. Integrated solid waste management is a comprehensive strategy involving four key elements applied in an integrated manner:

1. reducing the volume and toxicity of the solid waste that is generated,
2. recycling or reusing wastes to the extent feasible,
3. recovering energy from the remaining waste through combustion systems equipped with the best available pollution control technology, and
4. utilizing landfills with adequate environmental controls.

In the following sections each of the elements of this strategy will be discussed in turn.

#### ***VII.2.2.1. Waste reduction***

Waste reduction activities are important to halt or slow down the increasing rate of waste generation per-capita.

Waste reduction has several aspects, all of which should be addressed. One is toxicity reduction, in which the nature of the waste is changed by reducing manufacturer's use of toxic materials in consumer products. Another is volume reduction – cutting the amount of waste generated by using less material in the first place. Waste reduction also includes encouraging the production of products that can be recycled more easily, such as shifting from multi-material to one-material packaging. Other options to reduce wastes include the redesign of products, material use changes, and restrictions on specific product types.

The approach to reducing waste must be broadly based incorporating actions that can be taken by industries, individuals, commercial enterprises and governmental agencies. Industry can reduce waste through raw material substitution and redesign of products and processes. Individuals, commercial enterprises and agencies can use their purchasing power to create a demand for low waste products or items produced from recycled materials. Governments should investigate the use of economic and other incentives to encourage waste reduction. Waste reduction efforts also need to focus on consumer behavior. Education and information dissemination programs can be effective means of causing desired behavioral and attitudinal changes.

There are many cases of successful reduction of wastes produced by industrial processes. Experience has shown that modifications to industrial processes that reduce waste also result in lower raw material, energy and waste disposal costs. Productivity is often enhanced and liabilities related to release of hazardous substances are reduced.

#### ***VII.2.2.2. Recycling***

Recycling involves separating recyclable materials from the waste stream and transporting these materials to recycling markets.

Prior separation of recyclable materials has the advantage that the materials are not contaminated by other wastes. However, this requires the waste generator to separate the wastes correctly and store them in separated form. Also, the generator needs to transport the separated material to recycling centers or separate or compartmentalized collection vehicles need to be used. Key factors in success of pre-separation efforts are

the cooperation and willingness of the generator to participate in the program over the long term, and the additional collection and transport costs that may be required.

Mixed solid waste or mixed recyclables can be separated for recycling at processing centers or materials recovery facilities. These facilities can be designed to separate mixtures of glass bottles, paper and cardboard, aluminum cans and steel cans and plastics. The success of these plants depends on the processing costs and the quality of the recyclable material produced.

A major recycling impediment is the question of continued viability and availability of secondary materials markets. It is important to understand that separation of materials from the solid waste stream in itself does not constitute recycling. Recycling only occurs when these materials are incorporated into products that enter commerce. Therefore, requirements to separate certain fractions of materials from waste may produce a supply of materials, but these requirements in themselves will not ensure recycling. In fact, if markets for these materials are not found, the materials are subsequently disposed of, and all of the costs of recycling are experienced with none of the benefits. Similarly, requirements to incorporate separated waste materials in products will not result in recycling unless these products are of a quality and price that they successfully compete in the marketplace.

### ***VII.2.2.3. Combustion with energy recovery***

Waste-to-energy facilities employ the controlled combustion of solid waste for the purposes of reducing its volume. Municipal waste-to-energy facilities produce a number of benefits to a waste management system. Combustion can destroy bacteria and viruses in wastes as well as harmful organic compounds. Combustion can reduce the volume of solid waste by up to 90% thereby conserving landfill space. It also offers the possibility of recovery of energy in the form of steam or electricity. Modern solid waste-to-energy facilities burn wastes at high temperatures with residence times necessary for efficient combustion. There are several decades of experience with this technology and research and technological developments have significantly advanced the state of the art and practice. There are hundreds of examples of well-designed and operated municipal waste combustion systems around the world.

Environmental management of municipal waste combustion facilities includes the control of air emissions and the management of ash residues. Standards for control of air emissions incorporate good combustion practices, emission monitoring and highly efficient air pollution control systems to control organic emissions (dioxin and furans), metals, acid gases and other pollutants.

With respect to management of ash from municipal waste combustion facilities, technologies are available to safely dispose of these residues. These include specially designed landfills for ash disposal and technologies to chemically extract metals or to solidify and stabilize the ash. The added costs of these techniques can be offset if the ash is treated to the extent that it can be used safely as an aggregate or building material.

#### ***VII.2.2.4. Sanitary landfills***

The disposal of waste on the land continues to be a predominant method used worldwide. It is important here to distinguish between sanitary landfill and uncontrolled open dumping. The open dumping of waste on the land without adequate controls can result in serious public health, and safety problems and severe adverse environmental impacts. However, a sanitary landfill is an engineered structure that is designed and operated to protect public health and the environment.

Sanitary landfill technology has advanced very rapidly over the past decade. Today's state-of-the-art landfills are equipped with leachate collection systems, liner systems, systems for control of landfill gas, groundwater monitoring, closure and post-closure care. The objective is to ensure that landfilling is performed in a manner that greatly reduces the chance of release of contaminants to the environment – and also, to assure that any release that does occur is quickly detected and corrected. Since land disposal of solid waste is practiced on such a wide-scale basis it is important that the best available technologies be used.

#### **VII.2.3. Strategies for the future**

Any discussion of solid waste management policies for the future must refer to Agenda 21, adopted at the United Nations Conference on Environment and Development in 1992. Agenda 21 addresses the pressing environmental problems of today and aims at preparing the world for the environmental challenges of the 21st century. Agenda 21 deals explicitly with solid waste management in two chapters: Chapter 20 on the environmentally sound management of hazardous waste, and Chapter 21 on the environmentally sound management of solid wastes. Agenda 21 holds out the hope that sustainable development, that integrates environmental protection and economic development, will lead to the fulfillment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future.

In order to be consistent with sustainable development, solid waste management systems must meet the needs of the present without compromising the ability of future generations to meet their needs. This involves efficient management of today's wastes while conserving resources and protecting the environment for current and future generations. Using Agenda 21 as a starting point, 10 principles or strategies for future solid waste management programs can be suggested.

##### ***VII.2.3.1. Waste prevention and toxic reduction as strategies of choice***

Traditional waste management strategies have relied primarily on collection of wastes followed by treatment and disposal. A waste prevention strategy emphasizes not creating the waste in the first place, and reducing the use of toxic materials so that the wastes that are generated are less toxic or less hazardous. Waste prevention not only enhances environmental protection, it often involves economic benefits. Waste prevention is a very powerful concept that has significant potential for reconciling both environmental and

economic goals. Waste prevention should be the cornerstone of sustainable waste management policies.

### ***VII.2.3.2. Economically sound recycling and recovery***

Recycling and recovery of materials and energy from solid waste not only reduces the volume of waste for disposal but also conserves natural resources. However, in order for recycling to be consistent with sustainable development it must be economically feasible. Otherwise, resources are wasted not conserved.

In order to effectively carry out successful recycling programs, solid waste managers must operate in a business-like manner as raw material suppliers. They must treat the users of their materials as customers. This means they must produce recyclable materials meeting the customer's material quality requirements, and offer recyclable materials at a price competitive with other material supplies. They must operate their separation, collection and processing systems to produce competitively priced, quality materials at the lowest possible costs. The elements of success of a recycling operation are the same as for any successful business; staying close to the customer, understanding and meeting their quality needs and operating in a cost-effective manner to produce a competitively priced product.

### ***VII.2.3.3. Product stewardship***

It is important to understand that wastes are simply discarded products and the design and use of a product can have a significant impact on the nature of the waste that is produced. For example, waste prevention and toxic reduction can be accomplished by substituting raw materials, changing product designs, increasing process efficiencies, and extending product lifetimes. Recycling and reuse can be enhanced by designing products so that components and materials can be easily separated, by eliminating contaminating materials that inhibit recycling, and by using more recycled materials in the original product. Eliminating certain materials from products can also reduce the release of toxic materials to the environment during waste treatment and disposal.

Product stewardship involves taking responsibility for a product throughout its entire life cycle including responsibility of management of wastes after the product is discarded. While persons responsible for waste management can identify desirable changes in products from a solid waste management perspective, the responsibility for making such changes lies with product manufacturers.

Product stewardship will be encouraged when the full costs of managing the product as a waste, including all environmental costs, are reflected in the economic decisions of product manufacturers and consumers.

### ***VII.2.3.4. Establishment of environmentally sound treatment and disposal facilities***

Even with maximum feasible rates of waste reduction and recycling, there will still be a need for waste treatment and disposal facilities. The state-of-the-art waste treatment and disposal has advanced rapidly in recent years, primarily due to requirements of

environmental regulatory programs. Today, technologies are available to effectively treat and dispose of wastes in an environmentally sound manner.

It is important that new facilities employing these new technologies capable of meeting stringent regulatory standards are established and issued operating permits. Otherwise, older, less environmentally sound facilities will continue to be used resulting in adverse environmental impacts and higher long-term costs.

#### ***VII.2.3.5. Rigorous enforcement of environmental laws and standards***

The establishment of a national regulatory control program with appropriate legislation, regulations, ordinances and licenses is an extremely important step in protecting human health and the environment from the mismanagement of solid wastes. Furthermore, in the absence of regulatory controls, adequate treatment and disposal facilities are not developed.

Environmental standards must be rigorously enforced in order to assure the public that our solid waste systems are operated in ways that protect human health and the environment. Enforcement must create an incentive for compliance with environmental standards. It must level the playing field so that violators are not at a competitive economic advantage to the good citizens that comply.

#### ***VII.2.3.6. Control of transboundary waste shipments and elimination of illegal international traffic***

Agenda 21 points out that illegal traffic of hazardous wastes may cause serious threats to human health and the environment and impose a special burden on the countries that receive such shipments. The prevention of illegal traffic in hazardous waste will benefit the environment and public health in all countries, especially developing countries. The Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal controls transboundary movements of hazardous wastes through a system of prior notification and written consent.

Recognizing that simple elimination of transport of wastes is not sufficient for environmental protection, the Basel Convention also encourages efforts to reduce waste generation, develop national self-sufficiency in hazardous waste disposal, and ensure environmentally sound treatment and disposal systems. Wide-scale ratification and implementation of the Basel Convention are essential to control international shipments of hazardous waste and assure their proper treatment and disposal.

#### ***VII.2.3.7. Building institutions and capacity development***

Many countries lack the national capacity to handle and manage solid wastes, primarily due to inadequate infrastructure. This includes inadequate facilities, lack of trained personnel, lack of information and monitoring systems, inadequate regulatory programs and insufficient financing. Therefore, establishment of an effective waste management system involves building institutions, training, developing human resources and, in general, building the capacity to control and manage wastes.

Developing the capacity to carry out research and development programs is important to improve understanding of the environmental impacts of solid waste management systems and develop solutions. Research into the social and economic aspects of solid waste management is necessary to understand and better design economic incentives and information and education programs. The results of research programs must be transferred into the field as new and improved solid waste management systems are developed. Therefore, outreach efforts to apply the results of research are essential. Technology transfer to countries with developing economies is especially important.

#### ***VII.2.3.8. Full cost accounting consistent with the polluter pays principle***

Often the true economic costs of solid waste management are hidden and far removed from producer and consumer decisions. For example, some solid waste management costs are paid out of general tax revenues and are not apparent to the tax-payer. Obviously this does not produce any incentive to reduce wastes. Improper disposal of wastes often requires future clean-up actions that are borne by other parties. Uncontrolled releases from solid waste management units can result in environmental damages with economic implications. All of these costs must be fully accounted for and paid for by the responsible parties. Economic and environmental efficiency depends upon the polluter paying for the costs of pollution and not subsidizing these costs in an indirect way through other parties.

While discussions of such issues tend to dote on economic theory, there are a number of practical approaches that begin to account for these costs and incorporate them into production, consumption and waste management decisions. Pay-as-you-throw programs, which charge waste generators for the amounts of waste discarded is one example that produces an economic incentive to reduce and recycle wastes. Liability standards for waste generators produce a very strong economic incentive for waste reduction and on-site waste treatment. Product labeling programs attempt to influence consumer purchases by identifying recyclable products or products made from recycled materials.

#### ***VII.2.3.9. Public participation and education***

Providing data and information to those who make or influence decisions can lead to voluntary actions with significant environmental benefits. A good example is when various production facilities are required to inform the public of the release of certain toxic wastes to the environment. This can result in public demand for a reduction of such releases and encourage voluntary industry programs to reduce these wastes. Public information is a powerful tool that can stimulate real results and an informed public can be an effective force in environmental protection.

However, it is important to provide the public with accurate and scientifically sound information. Environmental education is very important and there is a need for: (1) support for curriculum development on solid waste management and environmental issues; (2) assistance for teacher training; (3) scholarships and fellowships for educational programs; and (4) incorporating environmental and solid waste management issues into curriculum for students of engineering, law, science, business, economics and other disciplines. It is very important to increase environmental literacy to build public support for programs to train future generations of solid waste management and environmental professionals.

**VII.2.3.10. *Integration of waste policies with other international and national policies***

Many national and international policies can have a strong influence on solid waste management practices. Consider the effect of: (1) energy policy on the incentives for waste-to-energy facilities; (2) transportation policy on freight charges for recycled materials; and (3) agricultural policy on the uses of sludge as fertilizers or soil conditioners. Other examples include the effect of financial policy on investment into environmental technologies and military policy's effect on clean-up of defense installations. Solid waste management professionals must play a role assuring the solid waste management implications of these policies are assessed in national and international forum.

**VII.2.4. *Concluding remark***

In summary, there remains a tremendous opportunity to improve waste management practices in the future. However, in order to accomplish this it will be necessary for solid waste professionals to augment their technical and engineering skills. Any vision for improvement of solid waste management practices, must include the development of a professional work force, in both the public and private sector, capable of dealing with issues such as waste and toxic reduction, product design, market development, public information and education, enforcement strategies, research and development, technology transfer, and economic incentives. National Solid Waste Associations of different countries, among them SWANA – The Solid Waste Association of North America, through its affiliation with the International Solid Waste Association can play an important role in defining solid waste management practices that are consistent with sustainable development, and in helping solid waste management professionals bring about continuous improvement in solid waste management worldwide.