

SECTION II

MANAGING SOLID WASTE – RCRA SUBTITLE D

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OVERVIEW

Since the 1960s, Americans have sought to provide efficient and favorable methods of waste management. Congress enacted the Solid Waste Disposal Act of 1965 to address the growing quantity of waste generated in the United States and to ensure its proper management. Subsequent amendments to the Solid Waste Disposal Act, such as RCRA, have substantially increased the federal government's involvement in solid waste management.

During the 1980s, solid waste management issues rose to new heights of public concern in many areas of the United States because of increasing solid waste generation, shrinking landfill capacity, rising disposal costs, and public opposition to the siting of new landfills. These solid waste management challenges continue today, as many communities are struggling to develop cost-effective, environmentally protective solutions. The growing amount of waste generated has made it

WHAT IS A SOLID WASTE?

- Garbage
- Refuse
- Sludges from waste treatment plants, water supply treatment plants, or pollution control facilities
- Nonhazardous industrial wastes
- Other discarded materials, including solid, semisolid, liquid, or contained gaseous materials resulting from industrial, commercial, mining, agricultural, and community activities.

increasingly important for solid waste management officials to develop strategies to manage wastes safely and cost-effectively.

RCRA Subtitle D encourages environmentally sound solid waste management practices that maximize the reuse of recoverable material and foster resource recovery. Solid waste is predominately regulated by state and local governments. EPA has, however, promulgated some regulations pertaining to solid waste, predominately addressing how disposal facilities should be designed and operated. EPA's primary role in solid waste management includes setting national goals, providing leadership and technical assistance, and developing guidance and educational materials. The Agency has played a major role in this program by developing tools and information through policy and guidance to empower local governments, business, industry, federal agencies, and individuals to make better decisions in dealing with solid waste issues. The Agency's involvement is intended to create incentives to motivate behavioral change in reference to solid waste management through a nonregulatory approach.

This section presents an outline of the Subtitle D program. In doing so, it defines the terms solid waste and municipal solid waste, and it describes the role EPA plays in assisting waste officials in dealing with solid waste management problems. The section will provide an overview of the criteria that EPA has developed for solid waste landfills, and will introduce some Agency initiatives designed to promote proper and efficient solid waste management.

DEFINITION OF SOLID WASTE

RCRA defines the term **solid waste** as:

- Garbage (e.g., milk cartons and coffee grounds)
- Refuse (e.g., metal scrap, wall board, and empty containers)
- Sludges from waste treatment plants, water supply treatment plants, or pollution control facilities (e.g., scrubber slags)

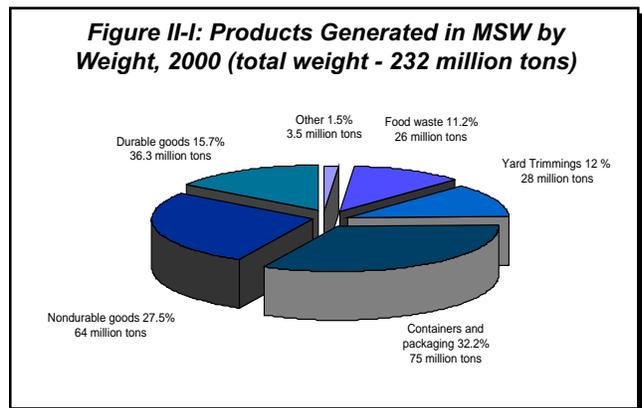
- Nonhazardous industrial wastes (e.g., manufacturing process wastewaters and nonwastewater sludges and solids)
- Other discarded materials, including solid, semisolid, liquid, or contained gaseous materials resulting from industrial, commercial, mining, agricultural, and community activities (e.g., boiler slags).

The term solid waste is very broad, including not only the traditional nonhazardous solid wastes, such as municipal garbage, but also some hazardous wastes. Hazardous waste, a subset of solid waste, is regulated under RCRA Subtitle C. (Hazardous waste is fully discussed in Section III.) RCRA Subtitle D addresses solid wastes, including those hazardous wastes that are excluded from the Subtitle C regulations (e.g., household hazardous waste), and hazardous waste generated by conditionally exempt small quantity generators (CESQGs).

The definition of solid waste is not limited to wastes that are physically solid. As noted above, many solid wastes are liquid, while others are semisolid or gaseous.

MUNICIPAL SOLID WASTE

Municipal solid waste is a subset of solid waste and is defined as durable goods (e.g., appliances, tires, batteries), nondurable goods (e.g., newspapers, books, magazines), containers and packaging, food wastes, yard trimmings, and miscellaneous organic wastes from residential, commercial, and industrial nonprocess sources (see Figure II-1).



Municipal solid waste generation has grown steadily over the past 35 years from 88 million tons per year (2.7 pounds per person per day) in 1960, to 232 million tons per year (4.5 pounds per person per day) in 2000. While generation of waste has grown steadily, recycling has also greatly increased. In 1960, only about 7 percent of municipal solid waste was recycled. By 2000, this figure had increased to 30 percent.

To address the increasing volumes of municipal solid waste that are generated on a daily basis, EPA recommends using an integrated, hierarchical approach to waste management with four components: source reduction, recycling, combustion, and landfilling. The hierarchy favors source reduction to reduce both the volume and toxicity of waste and to increase the useful life of manufactured products. Next preferred is recycling, including composting of yard and food wastes, because it diverts waste from combustion facilities and landfills and has positive impacts on both the environment and the economy. The goal of EPA's approach is to use a combination of all these methods to safely and effectively manage municipal solid waste. EPA recommends that communities tailor systems from the four components to meet their individual needs, looking first to source reduction, and second to recycling as preferences to combustion and landfilling (see Figure II-2).

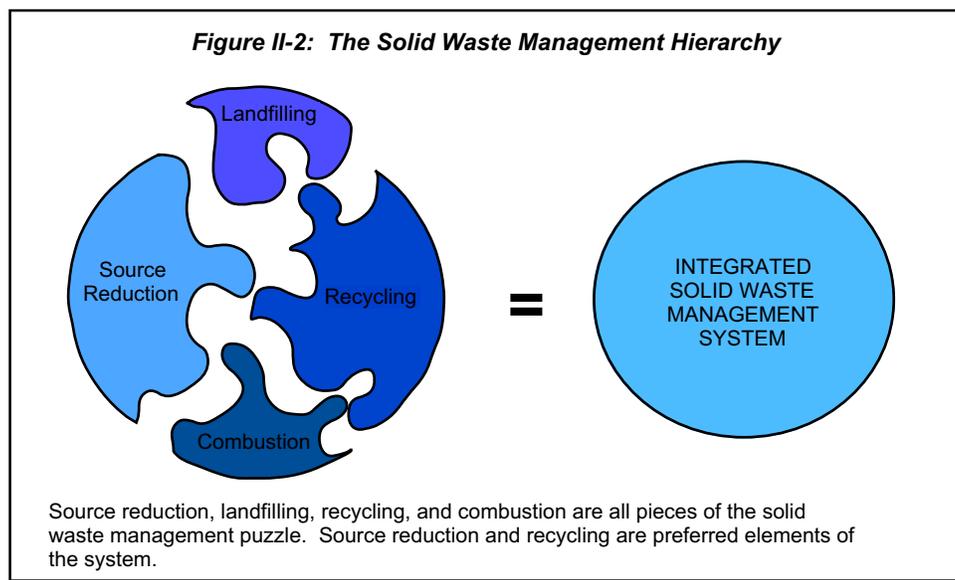
■ Source Reduction

Rather than managing waste after it is generated, **source reduction** is designed to change the way products are made and used in order to minimize waste generation. Source reduction, also called waste prevention, is defined as the design, manufacture, and use of products in a way that reduces the quantity and toxicity of waste

produced when the products reach the end of their useful lives. The ultimate goal of source reduction is to decrease the amount and the toxicity of waste generated. Businesses, households, and state and local governments can all play an active role in source reduction. Businesses can manufacture products with packaging that is reduced in both volume and toxicity. They can also reduce waste by altering their business practices (e.g., reusing packaging for shipping, making double-sided copies, maintaining equipment to extend its useful life, using reusable envelopes). Community residents can help reduce waste by leaving grass clippings on the lawn or composting them with other yard waste in their backyards, instead of bagging such materials for eventual disposal. Consumers play a crucial role in an effective source reduction program by purchasing products having reduced packaging or that contain reduced amounts of toxic constituents. This purchasing subsequently increases the demand for products with these attributes. State and local governments include source reduction in their long-term planning for solid waste management in order to ensure its effectiveness.

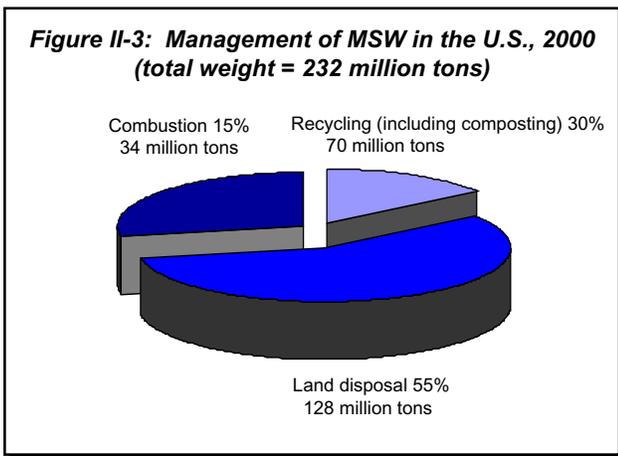
■ Recycling

Municipal solid waste **recycling** refers to the separation and collection of wastes, their subsequent transformation or remanufacture into usable or marketable products or materials, and the purchase



of products made from recyclable materials. In 2000, 30 percent (70 million tons), of the municipal solid waste generated in the United States was recycled (see Figure II-3). Solid waste recycling:

- Preserves raw materials and natural resources
- Reduces the amount of waste that requires disposal
- Reduces energy use and associated pollution



- Provides business and job opportunities
- Reduces greenhouse gas emissions
- Reduces pollution associated with use of virgin materials.

Communities can offer a wide range of recycling programs to their residents, such as drop-off centers, curbside collection, and centralized composting of yard and food wastes.

Composting processes are designed to optimize the natural decomposition or decay of organic matter, such as leaves and food. Compost, the end product of composting, is a humus-like material that can be added to soils to increase soil fertility, aeration, and nutrient retention. Composting can serve as a key component of municipal solid waste recycling activities, considering that food and yard wastes accounted for 23 percent of the total amount of municipal solid waste generated in 2000. Some communities are implementing large-scale

composting programs in an effort to conserve landfill capacity.

The key to a successful recycling program is to ensure that the recovered material is actually reprocessed or remanufactured, and that the products are bought and used by consumers. Recycling programs will become more effective as markets increase for products made from recycled material. The federal government has developed several initiatives in order to bolster the use of recycled products. The federal procurement guidelines, authorized by RCRA Subtitle F, are designed to bolster the market for products manufactured from recycled materials. The procurement program uses government purchasing to spur recycling and markets for recovered materials. (This program is fully discussed in Section V.)

■ Combustion

For centuries, burning has been a popular method of reducing the volume of solid waste. Before the Clean Air Act (CAA) of 1970 essentially banned it, the burning of waste was rampant and uncontrolled. While uncontrolled burning of solid waste can be detrimental to health and the environment, confined and controlled burning, known as **combustion**, can not only decrease the volume of solid waste destined for landfills, but can also recover energy from the waste-burning process. Modern waste-to-energy facilities use energy recovered from the burning of solid waste to produce steam and electricity. In 2000, combustion facilities handled 15 percent (34 million tons) of the municipal solid waste generated (see Figure II-3). Used in conjunction with source reduction and recycling, combustion can recover resources and materials and greatly reduce the volume of wastes entering landfills.

■ Landfilling

Despite the effectiveness of source reduction, recycling, and combustion, there will always be waste that cannot be diverted from landfills. In fact, landfilling of solid waste still remains the most widely used waste management method as

Americans landfilled approximately 55 percent (128 million tons) of municipal solid waste in 2000 (see Figure II-3). Many communities are having difficulties siting new landfills largely as a result of increased citizen and local government concerns about the potential risks and aesthetics associated with having a landfill in their neighborhoods. To reduce risks to health and the environment, EPA developed minimum criteria that solid waste landfills must meet in order to alleviate some of the concern raised over landfill siting and health concerns.

CRITERIA FOR SOLID WASTE DISPOSAL FACILITIES

One of the initial focuses of the Solid Waste Disposal Act (as amended by RCRA) was to require EPA to study the risks associated with solid waste disposal and to develop management standards and criteria for solid waste disposal units (including landfills) in order to protect human health and the environment. This study resulted in the development of criteria for classifying solid waste disposal facilities and practices.

■ Criteria for Classification of Solid Waste Disposal Facilities and Practices

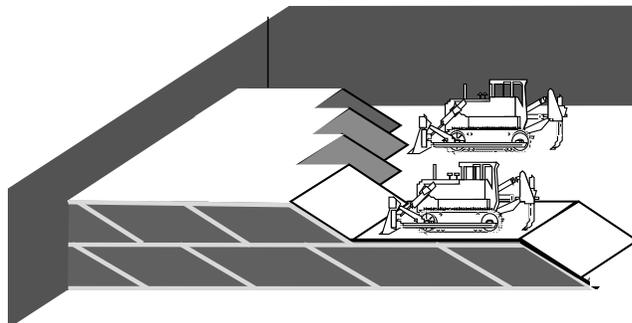
On September 13, 1979, EPA promulgated criteria to designate conditions under which solid waste disposal facilities and practices would not pose adverse effects to human health and the environment (Part 257 Subpart A). Facilities failing to satisfy the criteria were considered **open dumps** requiring attention by state solid waste programs. As a result, open dumps had to either be closed or upgraded to meet the criteria for sanitary landfills. States were also required to incorporate provisions into their solid waste programs to prohibit the establishment of new open dumps.

WHAT IS AN OPEN DUMP?

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D criteria. Using the Part 257, Subpart A criteria as a benchmark, each state evaluated the solid waste disposal facilities within its borders to determine which facilities were open dumps that needed to be closed or upgraded. For each open dump, the state completed an Open Dump Inventory Report form that was sent to the Bureau of the Census. At the end of fiscal years 1981 through 1985, the Bureau compiled all of the report forms and sent them to EPA, where they were summarized and published annually.

■ Technical Criteria for Solid Waste Disposal Facilities

The Part 257, Subpart A regulatory criteria used to classify solid waste disposal facilities and practices consist of general environmental performance standards. The criteria contain provisions designed to ensure that wastes disposed of in solid waste disposal units will not threaten endangered species, surface water, ground water, or flood plains. Further, owners and operators of disposal units are required to implement public health and safety precautions such as disease vector (e.g., rodents, flies, mosquitoes) controls to prevent the spread of disease and restrictions on the open burning of solid waste. In addition, facilities are required to install safety measures to control explosive gases generated by the decomposition of waste, minimize the number of birds attracted to the waste disposed of in the unit, and restrict public access to the facility. The criteria also restrict the land spreading of wastes with high levels of cadmium and polychlorinated biphenyls (PCBs) in order to adequately protect ground water from these dangerous contaminants.



These criteria serve as minimum technical standards for solid waste disposal facilities. As a result, facilities must meet the Part 257 standards to ensure that ongoing waste management operations adequately protect human health and the environment. If they fail to do so, the facility is classified as an open dump and must upgrade its operations or close. States have the option of developing standards more stringent than the Part 257, Subpart A criteria.

■ Technical Criteria for Municipal Solid Waste Landfills

Protection of human health and the environment from the risks posed by solid waste disposal facilities was an ongoing concern of Congress after RCRA was passed in 1976. As a result, HSWA required EPA to report on the adequacy of existing solid waste disposal facility criteria and gather detailed data on the characteristics and quantities of nonhazardous solid wastes.

Report to Congress on Solid Waste Disposal

In October 1988, EPA submitted a Report to Congress indicating that the United States was generating an increasing amount of municipal solid waste. The Report revealed that approximately 160 million tons of municipal solid waste were generated each year, 131 million tons of which were landfilled in just over 6,500 MSWLFs. EPA also reported that although these landfills used a wide variety of environmental controls, they may pose significant threats to ground water and surface water resources. For instance, rain water percolating through the landfills can dissolve harmful constituents in the

waste and can eventually seep into the ground, potentially contaminating ground water. In addition, improperly maintained landfills can pose other health risks due to airborne contaminants, or the threat of fire or explosion.

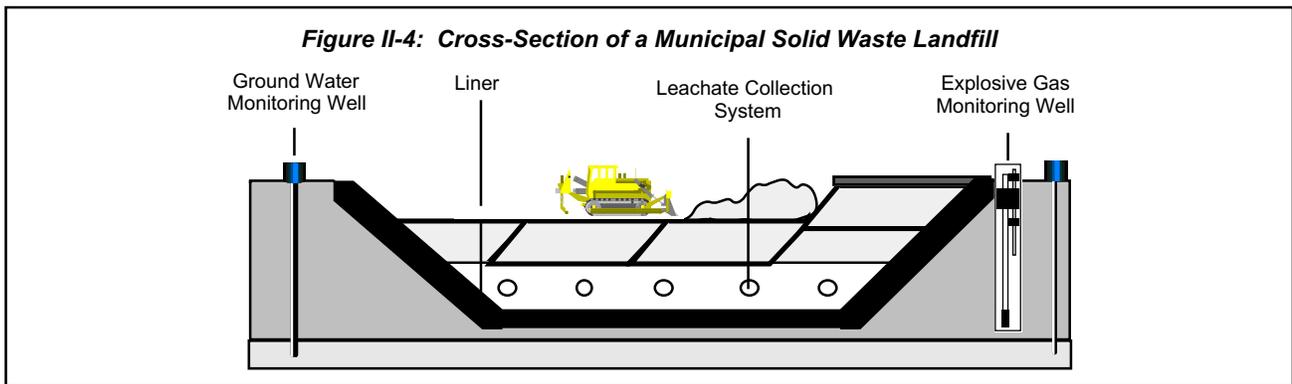
To address these environmental and health concerns, and to standardize the technical requirements for these landfills, EPA promulgated revised minimum federal criteria in Part 258 for MSWLFs on October 9, 1991. The criteria were designed to ensure that MSWLFs receiving solid waste would be protective of human health and the environment. All landfills that were not MSWLFs remained subject to the Part 257, Subpart A criteria.

Criteria for Municipal Solid Waste Landfills

A **municipal solid waste landfill** is defined as a discrete area of land or excavation that receives household waste. A MSWLF may also receive other types of RCRA Subtitle D wastes, such as commercial solid waste, nonhazardous sludge, CESQG waste, and industrial nonhazardous solid waste. In 2000, there were approximately 2,000 MSWLFs in the United States.

The revised criteria address seven major aspects of MSWLFs (see Figure II-4):

- Location
- Operation
- Design
- Ground water monitoring
- Corrective action
- Closure and post-closure
- Financial assurance (i.e., responsibility).



The first set of criteria restrict where a MSWLF may be located. New landfills must meet minimum standards for placement in or near flood plains, wetlands, fault areas, seismic impact zones, and other unstable areas. Because some bird species are attracted to landfills, the criteria also restrict the placement of landfills near airports to reduce the bird hazards (i.e., collisions between birds and aircraft that may cause damage to the aircraft or injury to the passengers).

The operating criteria establish daily operating standards for running and maintaining a landfill. The standards dictate sound management practices that ensure protection of human health and the environment. The provisions require covering the landfill daily, controlling disease vectors, and controlling explosive gases. They also prohibit the open burning of solid waste and require the owner and operator of the landfill to control unauthorized access to the unit.

The design criteria require each new landfill to have a liner consisting of a flexible membrane and a minimum of two feet of compacted soil, as well as a leachate collection system. **Leachate** is formed when rain water filters through wastes placed in a landfill. When this liquid comes in contact with buried wastes, it leaches, or draws out, chemicals or constituents from those wastes. States with approved MSWLF permit programs can allow the use of an alternative liner design that controls ground water contamination. The liner and collection system prevent the potentially harmful leachate from contaminating the soil and ground water below the landfill.

In order to ensure that the liner and leachate collection system are working properly and that the landfill is not contaminating surrounding ground water resources, MSWLF owners and operators must also establish a ground water monitoring program. Through a series of monitoring wells, the facility owner and operator is alerted if the landfill is leaking and causing contamination. If contamination is detected, the owner and operator of the landfill must perform **corrective action** (i.e., clean up the contamination caused by the landfill).

When landfills reach their capacity and can no longer accept additional waste, the criteria stipulate procedures for properly closing the facility to ensure that the landfill does not present any danger to human health and the environment in the future. The **closure** activities at the end of a facility's use are often expensive and the owner and operator must have the ability to pay for them. As a result, the criteria require each owner and operator to prove that they have the financial resources to perform these closure and **post-closure** activities, as well as any necessary corrective action.

Most of the solid waste program is overseen by the states, and compliance is assured through state-issued permits. Each state is to obtain EPA approval for their MSWLF permitting program. This approval process assesses whether a state's program is sufficient to ensure each landfill's compliance with the criteria. In addition to the minimum federal criteria, states may impose requirements that are more stringent than the federal requirements.

■ **Conditionally Exempt Small Quantity Generator Waste Disposal Facilities**

Businesses that produce small amounts of hazardous waste, known as **conditionally exempt small quantity generators**, need not manage their hazardous waste under the Subtitle C program. This means that CESQG waste can be disposed of in solid waste landfills. However, HSWA required EPA to establish standards to ensure that CESQG waste disposal in solid waste disposal units did not pose threats to human health and the environment. As a result, on July 1, 1996, EPA revised the Part 257, Subpart B criteria to contain standards for nonmunicipal, nonhazardous waste disposal units that receive CESQG hazardous waste. These revisions addressed location restrictions, requirements for monitoring for ground water contamination, and corrective action provisions to clean up any contamination. (CESQGs are fully discussed in Section III, Chapter 3.)

■ Bioreactor Landfills

A bioreactor landfill operates to rapidly transform and degrade organic waste. The increase in waste degradation and stabilization is accomplished through the addition of liquid and air to enhance microbial processes. This bioreactor concept differs from the traditional “dry tomb” municipal landfill approach. Thus, decomposition and biological stabilization of the waste in a bioreactor landfill can occur in a much shorter time frame than occurs in a traditional landfill providing a potential decrease in long-term environmental risks and landfill operating and post-closure costs. EPA is currently collecting information on the advantages and disadvantages of bioreactor landfills through case studies of existing landfills and additional data so that EPA can identify specific bioreactor standards or recommend operating parameters.

Additional information about bioreactor landfills can be found at www.epa.gov/epaoswer/non-hw/muncpl/landfill/bioreactors.htm.

ASSISTANCE TO NATIVE AMERICAN TRIBES

EPA developed a municipal solid waste strategy to assist Native American tribes in the establishment of healthy, environmentally protective, integrated solid waste management practices on tribal lands. The strategy is based on input from tribal focus groups convened by the National Tribal Environmental Council and discussions with tribal organizations, EPA Regional Indian Program coordinators, other EPA offices, and other federal agencies with trust responsibilities on Native American lands. The strategy emphasizes building tribal municipal solid waste management capacity, developing tribal organizational infrastructure, and building partnerships among tribes, states, and local governments. Direct EPA support of these goals includes technical assistance, grant funding, education, and outreach.

Solid waste managers on Native American lands face unique challenges. To address issues such as jurisdiction, funding, and staffing, EPA offers several resource guides featuring in-depth

information specific to Native American lands. The Agency recognizes that every solid waste management program needs funding to survive and that, in an era of tightening budgets, it may be difficult to find necessary resources. One of EPA’s ongoing priorities is to make current information available to help tribes locate the funding they need to develop and implement safe and effective solid waste programs.

One such initiative is the *Tribal Waste Journal*. The journal contains in-depth information on a variety of solid and hazardous waste topics including interviews with representatives from Native American Tribes and Alaskan Native Villages. Each issue focuses on a single topic and presents ideas, approaches, and activities that other Native American Tribes and Alaskan Native Villages have successfully employed.

Additionally, EPA has initiated the Tribal Open Dump Cleanup Project to assist tribes with closure or upgrade of open dump sites. The project is part of a Tribal Solid Waste Interagency Workgroup, which is working to coordinate federal assistance for tribal solid waste management programs. The cleanup project’s specific goals include assisting tribes with 1) completing and implementing comprehensive, integrated waste management plans; 2) developing realistic solid waste management alternatives; 3) closing or upgrading existing open dumps; and 4) developing post-closure programs.

Outreach and education materials are two other tools EPA provides to tribes to support environmentally sound integrated solid waste management practices. The Agency’s outreach support helps tribes connect and learn from each other’s experiences. Educational resources help tribal leadership as well as the general tribal community understand the importance of good municipal solid waste management. Better understanding ensures that tribal municipal solid waste programs are assigned a high priority and facilitates the communities’ adoption of new and improved waste disposal practices.

SOLID WASTE MANAGEMENT INITIATIVES

With the bulk of the RCRA Subtitle D program already in place, EPA launched several new initiatives to further the development of the solid waste management program. These initiatives promote proper waste management, and encourage source reduction by both industry and the public.

■ WasteWise

Many companies, institutions, and governments have demonstrated that they can save money by reducing waste and recycling material that would otherwise be disposed.



The **WasteWise** program is designed to assist companies, states, local governments, Native American tribes, and other institutions in developing cost-effective practices to reduce municipal solid waste. These partners set and achieve certain goals within three areas: waste prevention, recycling collection, and buying or manufacturing recycled products. Participation offers the partners several advantages. EPA provides technical assistance, publications, and program updates. Successful waste reduction efforts are highlighted in EPA documents, magazines, and trade publications. Participating organizations can also use the WasteWise logo to promote their participation.

These benefits along with the direct financial savings that result from waste prevention and recycling activities are helping to improve waste management and resource efficiency. In 1999, partners eliminated over 9 million tons of materials through waste prevention, continuing the upward trend in waste reduction. Partners also recycled over 8.4 million tons in 1999, avoiding approximately \$300 million in disposal costs. Since the program's inception in 1994, partners have reduced nearly 32 million tons of waste.

Additional information on the WasteWise program is found at www.epa.gov/wastewise.

■ Jobs Through Recycling Program

To support recycling markets, EPA launched the **Jobs Through Recycling** program in 1994. The goal of the program is to foster markets for recycled goods by promoting and assisting the development of businesses using recovered materials, creating new recycling jobs, and spurring innovative technologies. Under the program, EPA awards over \$1 million each year in grants to states and tribes. Jobs Through Recycling funds programs that help develop or retain intermediate processing and end-use manufacturing capacity for recyclables and reusable materials. Jobs Through Recycling supports the development and strengthening of state, multi-state, and tribal market development and economic development programs. The activities funded thus far include the creation of Recycling Economic Development Advocates (REDAs), Recycling and Reuse Business Assistance Centers (RBACs), and commodity-specific demonstration projects. REDAs are staff in state or tribal economic development agencies who pursue recycling business growth, whereas RBACs are state full-service centers providing business, technical, and financing assistance to businesses using recovered materials.

Jobs Through Recycling bolsters the job market by actively promoting the recycling industry. Recycling is estimated to create nearly five times as many jobs as landfilling. One 1994 study reported that 103,000 jobs, or 2.7 percent of all manufacturing jobs in the Northeast region of the United States, are attributed to recycling. In addition, the jobs created by recycling businesses draw from the full spectrum of the labor market (ranging from low- and semi-skilled jobs to highly skilled jobs). Materials sorters, dispatchers, truck drivers, brokers, sales representatives, process engineers, and chemists are just some of the jobs needed in the recycling industry.

Since Jobs Through Recycling's inception in 1994, \$8 million in funding has been awarded to numerous states, tribes, and multistate organizations. This funding has helped create more than 8,500 jobs, generate \$640.5 million in capital investment, create 15.3 million tons of landfill capacity, and utilize 13.9 million tons of recovered materials. One job has

been created for every \$1,040 of Jobs Through Recycling grant money invested.

Additional information about Jobs through Recycling is available at www.epa.gov/jtr.

■ Unit Pricing

Some communities are using economic incentives to encourage the public to reduce solid waste sent to landfills. One of the most successful economic incentive programs used to achieve source reduction and recycling is variable rate refuse collection, or **unit pricing**. Unit pricing programs, sometimes referred to as pay-as-you-throw systems, have one primary goal: customers who dispose of more waste pay more for the collection and disposal service. There are a few different types of unit pricing systems. Most require residents to pay a per-bag fee for refuse collection, and require the purchase of a special bag or tag to place on bags or cans. Other systems allow customers to choose between different size containers, and charge more for collection of larger containers. EPA's role in the further development of unit pricing systems has been to study effective systems in use and to disseminate documentation to inform other communities about the environmental and economic benefits that unit pricing may have for their community. The number of communities using unit pricing grew to more than 4,033 in 1999 and the population served has more than tripled since 1990 to over 35 million today.

Additional information about unit pricing or pay-as-you-throw programs is available at www.epa.gov/payt.

■ Full Cost Accounting for Municipal Solid Waste

Full cost accounting is an additional financial management tool that communities can use to improve solid waste management. Full cost accounting is an accounting approach that helps local governments identify all direct and indirect costs, as well as the past and future costs, of a MSW management program. Full cost accounting helps solid waste managers account for all monetary costs of resources used or committed, thereby providing

the complete picture of solid waste management costs on an ongoing basis. Full cost accounting can help managers identify high-cost activities and operations and seek ways to make them more cost-effective.

EPA is continually studying these and other programs in order to assist communities in deciding whether one of these programs is right for them. In addition to these initiatives, EPA has published numerous guidance documents designed to educate both industry and the public on the benefits of source reduction, to guide communities in developing recycling programs, and to educate students on the benefits and elements of source reduction and recycling.

Additional information about full cost accounting can be found at www.epa.gov/fullcost.

■ Extended Product Responsibility

Extended product responsibility, also known as product stewardship, is a product-centered approach to environmental protection. This approach recognizes that lasting and substantial environmental improvements in product systems can only occur with the combined expertise, ingenuity, cooperation, and commitment of each individual involved in the product chain, from suppliers, designers, manufacturers, and distributors, to retailers, customers, recyclers, remanufacturers, and disposers. Product manufacturers have the greatest ability, and therefore must take on new responsibilities to reduce the environmental impacts of their products. Reducing use of toxic substances and designing for reuse and recyclability are just a few ways for companies to rethink their products in order to provide more value at less environmental impact.

Additional information about extended product responsibility is available at www.epa.gov/epaoswer/non-hw/reduce/epr/index.htm.

■ Green Building

Buildings that are designed, constructed, operated, and ultimately removed in such a way as to

minimize their environmental impacts are referred to as “green” buildings. **Green buildings** are characterized by improved energy and water efficiency, use of renewable sources of energy, improved indoor air quality, and efficient use of building materials. EPA supports projects to reduce, reuse, and recycle waste generated from building construction, renovation, deconstruction, and demolition. Construction and demolition wastes commonly include building materials, and products such as concrete, asphalt, wood, glass, brick, metal, insulation, and furniture. From incorporating used or environmentally friendly materials into a building’s construction or renovation to disassembling structures for the reuse and recycling of their components, each phase of a building’s life cycle offers opportunities to reduce waste.

Additional information about green buildings is available at www.epa.gov/greenbuilding.

■ Industrial Ecology

The study of material and energy flows and their transformations into products, byproducts, and waste throughout industrial and ecological systems is the primary concept of **industrial ecology**. This initiative urges industry to seek opportunities for the continual reuse and recycling of materials through a system in which processes are designed to consume only available waste streams and to produce only usable waste. Wastes from producers and consumers become input for other producers and consumers, and resources are cycled through the system to sustain future generations. Individual processes and products become part of an interconnected industrial system in which new products or processes evolve out of or consume available waste streams, water, and energy; in turn, processes are developed to produce usable resources.

SUMMARY

Subtitle D addresses primarily nonhazardous solid waste. The term solid waste includes garbage, refuse, sludges, nonhazardous industrial wastes, and other discarded materials. Solid waste also includes

hazardous wastes that are excluded from Subtitle C regulation (e.g., household hazardous waste).

Municipal solid waste, a subset of solid waste, is waste generated by businesses and households. EPA recommends an integrated, hierarchical approach to managing municipal solid waste that includes, in descending order of preference:

- Source reduction
- Recycling
- Combustion
- Landfilling.

As part of Subtitle D, EPA has developed detailed technical criteria for solid waste disposal facilities, including specific criteria for MSWLFs. These criteria include specific provisions for MSWLF:

- Location
- Operation
- Design
- Ground water monitoring
- Corrective action
- Closure and post-closure
- Financial assurance (i.e., responsibility).

EPA has helped develop and implement new initiatives and programs that aid businesses, states, local governments, and Native American tribes in implementing effective solid waste management programs. Focusing particularly on the environmental and economic benefits of source reduction and recycling, EPA fosters integrated solid waste management in communities and businesses. These initiatives include:

- WasteWiSe
- Jobs Through Recycling program
- Unit pricing
- Full cost accounting
- Extended product responsibility
- Green buildings
- Industrial ecology.

ADDITIONAL RESOURCES

Additional information about municipal solid waste management can be found at www.epa.gov/msw.