CHAPTER II

MANAGING NONHAZARDOUS SOLID WASTE

In this chapter…

OVERVIEW

Congress enacted the Solid Waste Disposal Act of 1965 to address the growing quantity of solid 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 disposal capacity, rising disposal costs, and public opposition to the siting of new disposal facilities. 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 increasingly important for solid waste management officials to develop strategies to manage wastes safely and cost-effectively.

WHAT IS SOLID WASTE?

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

RCRA encourages environmentally sound solid waste management practices that maximize the reuse of recoverable material and foster resource recovery. Under RCRA, EPA regulates hazardous solid wastes and may authorize states to do so. Nonhazardous solid waste is predominately regulated by state and local governments. EPA has, however, promulgated some regulations pertaining to nonhazardous solid waste, largely addressing how disposal facilities should be designed and operated. Aside from regulation of hazardous wastes, 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 providing 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 strives to motivate behavioral change in solid waste management through both regulatory and nonregulatory approaches.

This chapter presents an outline of the RCRA nonhazardous solid waste 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 remainder of this chapter will use the term "solid waste" to mean only nonhazardous solid waste, excluding hazardous waste regulated under RCRA Subtitle C. The chapter 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)
- 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).

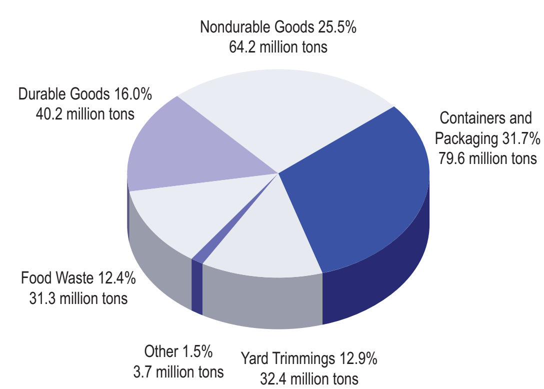
The definition of solid waste is not limited to wastes that are physically solid. Many solid wastes are liquid, while others are semisolid or gaseous.

The term solid waste, as defined by the Statute, is very broad, including not only the traditional nonhazardous solid wastes, such as municipal garbage and industrial wastes, but also hazardous wastes. Hazardous waste, a subset of solid waste, is regulated under RCRA Subtitle C. (Hazardous waste is fully discussed in Chapter III.) For purposes of regulating hazardous wastes, EPA established by regulation a separate definition of solid waste. This definition is discussed in Chapter III and pertains only to hazardous waste regulations.

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).

Figure II-I: Products Generated in MSW by Weight, 2006 (total weight - 251 million tons)



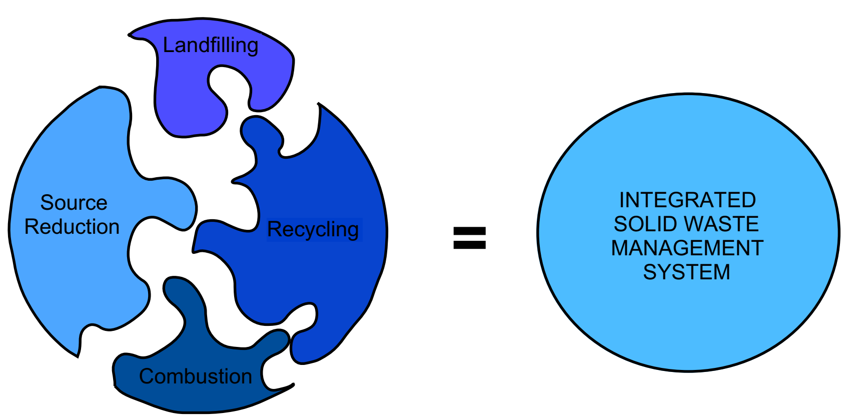
Municipal solid waste generation has grown steadily over the past 46 years from 88 million tons per year (2.7 pounds per person per day) in 1960, to 251 million tons per year (4.6 pounds per person per day) in 2006. While generation of waste has grown steadily, recycling has also greatly increased. In 1960, only about 7 percent of municipal solid waste was recycled. By 2006, this figure had increased to 32.5 percent.

To address the increasing quantities of municipal solid waste, EPA recommends that communities adopt "integrated waste management" systems tailored to meet their needs. The term "integrated waste management" refers to the complementary use of a variety of waste management practices to safely and effectively handle the municipal solid waste stream. An integrated waste management system will contain some or all of the following elements: source reduction, recycling (including composting), waste combustion, and/or landfilling. In designing systems, EPA encourages communities to consider these components in a hierarchical sequence. The hierarchy favors source reduction to reduce both the volume and toxicity of waste and to increase the useful life of manufactured products. The next preferred tier in the hierarchy is recycling, which includes composting of yard and food wastes. Source reduction and recycling are preferred over the third tier of the hierarchy, which consists of combustion and/or landfilling, because they divert waste from the third tier and they have positive impacts on both the environment and 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 their systems from the four components in the three tiers to meet their specific needs, looking first to source reduction, and second to recycling as preferences to combustion and/or landfilling (see Figure II-2).

■ Source Reduction

Rather than managing waste after it is generated, **source reduction** changes the way products are made and used in order to decrease 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 all levels of government can play an active role in source reduction. Businesses can manufacture products with packaging that is reduced in both volume and toxicity. They also can 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 trimmings 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

Figure II-2: The Solid Waste Management Hierarchy



Source reduction, landfilling, recycling, and combustion are all pieces of the solid waste management puzzle. Source reduction and recycling are preferred elements of the system.

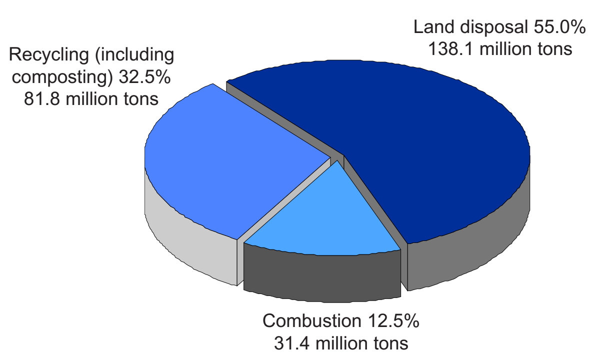
purchasing subsequently increases the demand for products with these attributes.

■ 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 2006, 32.5 percent (82.0 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 pollution associated with use of virgin materials.

Figure II-3: Management of MSW in the U.S., 2006 (total weight = 251 million tons)



Solid waste recycling also reduces greenhouse gas (GHG) emissions. For example, using the Waste Reduction Model (WARM), it can be calculated that the GHG savings of recycling 1 short ton of aluminum instead of landfilling it would be 3.71 metric tons of carbon equivalent (MTCE).

Communities can offer a wide range of recycling programs to their businesses and 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 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 25.0 percent of the total amount of municipal solid waste generated in 2006. Some communities are implementing large-scale composting programs in an effort to conserve landfill capacity.

For recycling to be successful, the recovered material must be reprocessed or remanufactured and the resulting products 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. EPA's 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 Chapter V).

■ Combustion

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 combustion of solid waste to produce steam and electricity. In 2006, combustion facilities handled 12.5 percent (31.4 million tons) of the municipal solid waste generated (see Figure II-3). Used in conjunction with source reduction and recycling, combustion can recover energy and materials and greatly reduce the volume of wastes entering landfills.

■ Landfilling

Landfilling of solid waste still remains the most widely used waste management method. Americans landfilled approximately 55.0 percent (138.1 million tons) of municipal solid waste in 2006 (see Figure II-3). Many communities are having difficulties siting new landfills, largely as a result of increased citizen concerns about the potential risks and aesthetics associated with having a landfill in their neighborhood. To reduce risks to health and the environment, EPA developed minimum criteria that solid waste landfills must meet.

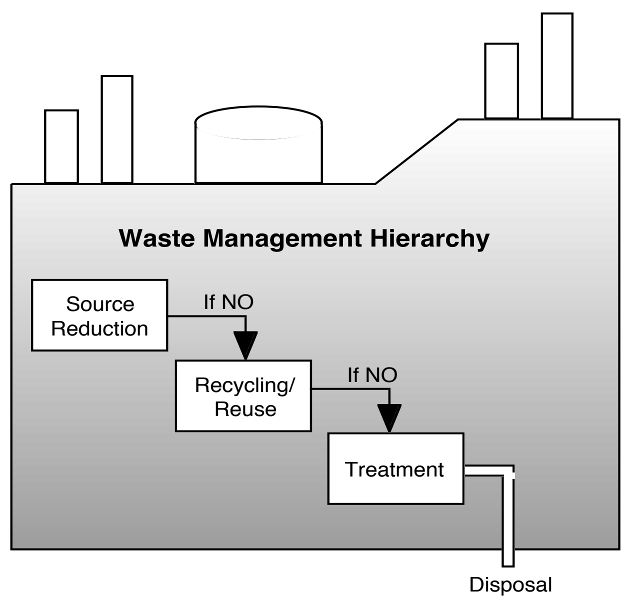
INDUSTRIAL WASTE

Industrial waste is also a subset of solid waste and is defined as solid waste generated by manufacturing or industrial processes that is not a hazardous waste regulated under Subtitle C of RCRA. Such waste may include, but is not limited to, waste resulting from the following manufacturing processes: electric power generation; fertilizer or agricultural chemicals; food and related products or by-products; inorganic chemicals; iron and steel manufacturing; leather and leather products; nonferrous metals manufacturing or foundries; organic chemicals; plastics and resins manufacturing; pulp and paper industry; rubber and miscellaneous plastic products; stone, glass, clay, and concrete products; textile manufacturing; transportation equipment; and water treatment. Industrial waste does not include mining waste or oil and gas production waste.

Each year in the United States, approximately 60,000 industrial facilities generate and dispose of approximately 7.6 billion tons of industrial solid waste. Most of these wastes are in the form of wastewaters (97%). EPA has, in partnership with state and tribal representatives and a focus group of industry and public interest stakeholders, developed a set of recommendations and tools to assist facility managers, state and tribal regulators, and the interested public in better addressing the management of land-disposed, nonhazardous industrial wastes.

Similarly to municipal solid waste, EPA recommends considering pollution prevention options when designing an industrial waste management system. Pollution prevention will reduce waste disposal needs and can minimize impacts across all environmental media. Pollution prevention can also reduce the volume and toxicity of waste. Lastly, pollution prevention can ease some of the burdens, risks, and liabilities of waste management. As with municipal solid waste, EPA recommends a hierarchical approach to industrial waste management: first, prevent or reduce waste at the point of generation (source reduction); second, recycle or reuse waste materials; third, treat waste; and finally, dispose of remaining waste in an environmentally protective manner (see Figure II-4). There are many benefits of pollution prevention activities, including protecting human health and the environment, cost savings, simpler design and operating conditions, improved worker safety, lower liability, higher product quality, and improved community relations.

Figure II-4: Waste Management Hierarchy



When implementing pollution prevention, industrial facilities should consider a combination of options that best fits the facility and its products. There are a number of steps common to implementing any facility-wide pollution prevention effort. An essential starting point is to make a clear commitment to identifying and taking advantage of pollution prevention opportunities. Facilities should seek the participation of interested partners, develop a policy statement committing the industrial operation to pollution prevention, and organize a team to take responsibility for it. As a next step, facilities should conduct a thorough pollution prevention opportunity assessment. Such an assessment will help set priorities according to which options are the most promising. Another feature common to many pollution prevention programs is measuring the program's progress. The actual pollution prevention practices implemented are the core of a program. The following sections give a brief overview of these core activities: source reduction, recycling, and treatment.

■ Source Reduction

Source reduction is 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. Source reduction activities for industrial waste include equipment or technology modifications; process or procedure modifications; reformulations or redesign of products; substitution of less-noxious product materials; and improvements in housekeeping, maintenance, training, or inventory control.

One source reduction option is to reformulate or redesign industrial products and processes to incorporate materials more likely to produce lower-risk wastes. Some of the most common practices include eliminating metals from inks, dyes, and paints; reformulating paints, inks, and adhesives to eliminate synthetic organic solvents; and replacing chemical-based cleaning solvents with water-based or citrus-based products.

Newer process technologies often include better waste reduction features than older ones. For industrial processes that predate consideration of waste and risk reduction, adopting new procedures or upgrading equipment can reduce waste volume, toxicity, and management costs. Some examples include redesigning equipment to cut losses during batch changes or during cleaning and maintenance, changing to mechanical cleaning devices to avoid solvent use, and installing more energy and material-efficient equipment.

In-process recycling involves the reuse of materials, such as cutting scraps, as inputs to the same process from which they came, or uses them in other processes or for other uses in the facility. This furthers waste reduction goals by reducing the need for treatment or disposal and by conserving energy and resources. A common example of in-process recycling is the reuse of wastewater.

Some of the easiest, most cost-effective, and most widely used waste reduction techniques are simple improvements in housekeeping. Accidents and spills generate avoidable disposal hazards and expenses. They are less likely to occur in clean, neatly organized facilities. Good housekeeping techniques that reduce the likelihood of accidents and spills include training employees to manage waste and materials properly; keeping aisles wide and free of obstructions; clearly labeling containers with content, handling, storage, expiration, and health and safety information; spacing stored materials to allow easy access; surrounding storage areas with containment berms to control leaks or spills; and segregating stored materials to avoid cross-contamination, mixing of incompatible materials, and unwanted reactions.

■ Recycling

Industry can benefit from recycling: the separation and collection of byproduct materials, their subsequent transformation or remanufacture into usable or marketable products or materials, and the purchase of products made from recyclable materials.

Many local governments and states have established materials exchange programs to facilitate transactions between generators of byproduct materials and industries that can recycle wastes as raw materials. Materials exchanges are an effective and inexpensive way to find new users and uses for a byproduct material.

Recycling can involve substituting industrial by-products for another material with similar properties. For example, coal combustion ash has value as a construction material, road base, or soil stabilizer. The ash replaces other, non-recycled materials, such as fill or Portland cement, not only avoiding disposal costs but also yielding a quality product and generating revenue. Other examples of industrial materials recycling include using wastewaters and sludges as soil amendments and using foundry sand in asphalt, concrete, and roadbed construction. State regulatory agencies may require advance approval of planned recycling activities and may require testing of the materials to be recycled. Others may pre-designate certain by-products for recycling, as long as the required analyses are completed. Generally, regulatory agencies want to ensure that recycled materials are free from constituents that might pose a greater risk than the materials they are replacing. Industrial facilities should consult with the state agency for criteria and regulations governing recycling before implementing this option.

Increasing industrial materials recycling is a priority of EPA's Resource Conservation Challenge (RCC). Through the RCC, EPA forms collaborative partnerships with industries to encourage them to generate less waste and recycle by-products through environmentally sound practices. The objective is to achieve the economic and environmental benefits of recycling industrial by-products as inputs to new products and to extend the useful life of landfills, conserve virgin materials, and reduce energy use and associated greenhouse gas emissions.

For example, the reuse of coal combustion products (CCPs) reduces the emission of greenhouse gases (GHGs) in many ways. The primary way CCP reuse can reduce GHG emissions is through using coal fly ash as a replacement for a portion of the portland cement used in making concrete. Without using coal fly ash, it takes the equivalent of 55 gallons of oil to produce a single ton of cement. Using CCPs in place of virgin materials also reduces the energy-intensive mining operations needed to generate virgin materials. Reduction in mining energy use leads to reduction in GHG emissions.

EPA is pursuing four broad strategies in increasing the beneficial reuse of industrial materials: analyzing and characterizing the target materials; identifying environmentally safe and beneficial practices; identifying incentives and barriers to beneficial reuse; and increasing outreach and education on the benefits of source reduction, recycling, and beneficially using wastes/materials. Industrial materials recycling activities under the RCC are discussed further in Chapter IV.

■ Treatment

Treatment of nonhazardous industrial waste is not a federal requirement. However, it can help to reduce the volume and toxicity of waste prior to disposal. Treatment can also make a waste amenable for reuse or recycling. Consequently, a facility managing nonhazardous industrial waste might elect to apply treatment. For example, treatment might be employed to address volatile organic compound (VOC) emissions from a waste management unit, or a facility might elect to treat a waste so that a less stringent waste management system design could be used. Treatment involves changing a waste's physical, chemical, or biological character or composition through designed techniques or processes. There are three primary categories of treatment – physical, chemical, and biological. Physical treatment involves changing the waste's physical properties such as its size, shape, density, or state (i.e., gas, liquid, solid). Physical treatment does not change a waste's chemical composition. One form of physical treatment, immobilization, involves encapsulating waste in other materials, such as plastic, resin, or cement, to prevent constituents from volatilizing or leaching. Listed below are a few examples of physical treatment:

- Immobilization, including encapsulation and thermoplastic binding
- Carbon absorption, including granular activated carbon and powdered activated carbon
- Distillation, including batch distillation, fractionation, thin film extraction, steam stripping, thermal drying, and filtration
- Evaporation/volatilization
- Grinding
- Shredding
- Compacting
- Solidification/addition of absorbent material.

Chemical treatment involves altering a waste's chemical composition, structure, and properties through chemical reactions. Chemical treatment can consist of mixing the waste with other materials (reagents), heating the waste to high temperatures, or a combination of both. Through chemical treatment, waste constituents can be recovered or destroyed. Listed below are a few examples of chemical treatment:

- Neutralization
- Oxidation
- Reduction
- Precipitation
- Acid leaching
- Ion exchange
- Incineration
- Thermal desorption
- Stabilization
- Vitrification
- Extraction, including solvent extraction and critical extraction
- High temperature metal recovery.

Biological treatment can be divided into two categories–aerobic and anaerobic. Aerobic biological treatment uses oxygen-requiring microorganisms to decompose organic and non-metallic constituents into carbon dioxide, water, nitrates, sulfates, simpler organic products, and cellular biomass (i.e., cellular growth and reproduction). Anaerobic biological treatment uses microorganisms, in the absence of oxygen, to transform organic constituents and nitrogen-containing compounds into oxygen and methane gas (CH_4). Anaerobic biological treatment typically is performed in an enclosed digestor unit.

The range of treatment methods from which to choose is as diverse as the range of wastes to be treated. More advanced treatment will generally be more expensive, but by reducing the quantity and risk level of the waste, costs might be reduced in the long run. Savings could come from not only lower disposal costs, but also lower closure and post-closure care costs. Treatment and post-treatment waste management methods can be selected to minimize both total cost and environmental impact, keeping in mind that treatment residuals, such as sludges, are wastes themselves that will need to be managed.

■ Landfilling

As with municipal solid waste, industrial facilities will not be able to manage all of their industrial waste by source reduction, recycling, and treatment. Landfilling is the least desirable option and should be implemented as part of a comprehensive waste management system. Implementing a waste management system that achieves protective environmental operations requires incorporating performance monitoring and measurement of progress towards environmental goals. An effective waste management system can help ensure proper operation of the many interrelated systems on which a unit depends for waste containment, leachate management, and other important functions. If the elements of an industrial waste landfill are not regularly inspected, maintained, improved, and evaluated for efficiency, even the best designed unit might not operate efficiently. Implementing an effective waste management system can also reduce long- and short-term costs, protect workers and local communities, and maintain good community relations.

Industrial waste landfills can face opposition as a result of concerns about possible negative aesthetic impact and potential health risks. To reduce risks to health and the environment, EPA developed minimum criteria that industrial waste landfills must meet. The federal criteria for nonhazardous industrial waste facilities or practices are provided in 40 CFR Part 257, Subparts A and B. The criteria for solid waste disposal facilities are discussed later in this chapter.

■ Guide for Industrial Waste Management

EPA, in close collaboration with state and tribal representatives through the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), and a focus group of industry and public interest stakeholders, developed a set of recommendations and tools to assist facility managers, state and tribal regulators, and the interested public in better addressing the management of land-disposed, nonhazardous industrial wastes. The *Guide for Industrial Waste*

Management (EPA530-R-03-001) provides considerations and Internet-based tools for siting industrial waste management units; methods for characterizing waste constituents; fact sheets and Web sites with information about individual waste constituents; tools to assess possible risks posed by the wastes; principles for building stakeholder partnerships; opportunities for waste minimization; guidelines for safe unit design; procedures for monitoring surface water, air, and ground water; and recommendations for closure and post-closure care.

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.

On September 13, 1979, EPA promulgated criteria to designate solid waste disposal facilities and practices which would not pose adverse effects to human health and the environment (Part 257, Subpart A). Facilities failing to satisfy the criteria are considered **open dumps** requiring attention by state solid waste programs. RCRA prohibits open dumping. 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. States have the option of developing standards more stringent than the Part 257, Subpart A criteria.

Solid waste disposal is overseen by the states, and compliance is assured through state-issued permits. EPA does not issue permits for solid waste management. 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 states without an approved program, the federal criteria are self-implementing; the owner or operator of a solid waste disposal facility in those states must directly implement the requirements. In addition to the minimum federal criteria, some states may impose requirements that are more stringent than the federal requirements. Citizen suits (under RCRA §7002) may also be used to enforce the federal criteria in addition to state-issued permits.

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 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 attraction of birds to the waste disposed 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.

■ Conditionally Exempt Small Quantity Generator Waste Disposal Facilities

In July of 1996, EPA promulgated standards for non-municipal, nonhazardous waste facilities that may receive **conditionally exempt small quantity generator (CESQG)** waste (40 CFR Part 257, Subpart B). These revisions address location restrictions, requirements for monitoring for ground-water contamination, and corrective action provisions to clean up any contamination. (CESQGs are fully discussed in Chapter III, Regulations Governing Hazardous Waste Generators).

■ Technical Criteria for Municipal Solid Waste Landfills (MSWLFs)

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, the 1984 Hazardous and Solid Waste Amendments (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 municipal 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 municipal solid waste would be protective of human health and the environment. All other solid waste disposal facilities and practices, besides MSWLFs, remain subject to Part 257, Subpart A or B.

Criteria for Municipal Solid Waste Landfills

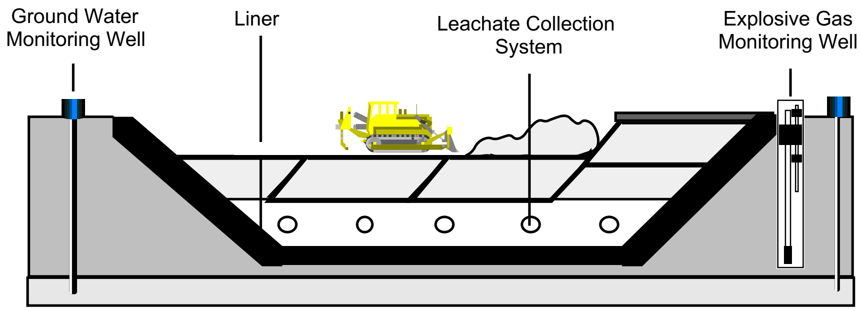
A **municipal solid waste landfill** is defined as a discrete area of land or excavation that receives household waste. A MSWLF may also receive other types of nonhazardous wastes, such as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator (CESQG) waste, and industrial nonhazardous solid waste. In 2006, there were approximately 1,754 MSWLFs in the continental United States.

The revised criteria in 40 CFR Part 258 address seven major aspects of MSWLFs (see Figure II-5):

- Location
- Operation
- Design
- Ground-water monitoring
- Corrective action
- Closure and post-closure activities
- Financial assurance.

The location 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).

Figure II-5: Cross-Section of a Municipal Solid Waste Landfill



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.

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. 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. The liner and collection system prevent the potentially harmful leachate from contaminating the soil and ground water below the landfill. States with EPA-approved MSWLF permit programs can allow the use of an alternative liner design that controls ground-water contamination.

In order to check the performance of system design, MSWLF facility managers 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 endanger 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. To this end, 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 known corrective action.

■ Bioreactor Landfills

EPA is investigating the feasibility of improving how waste is managed in MSWLFs. Projects are being conducted to assess bioreactor landfill technology. A bioreactor landfill operates to more 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 shorter time frame than occurs in a traditional landfill. This provides a potential decrease in long-term environmental risks and landfill operating and post-closure costs.

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 initial strategy was 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) proposals to characterize/assess open dumps; 2) proposals to develop Integrated Solid Waste Management (ISWM) Plans and Tribal Codes and regulations; 3) proposals to develop and implement alternative solid waste management activities/facilities; and 4) proposals to develop and implement closure and post-closure programs.

Outreach and educational 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.

OTHER SOLID WASTE MANAGEMENT INITIATIVES

Along with the Resource Conservation Challenge (which is discussed in Chapter IV), EPA has developed a number of solid waste management initiatives to help facilitate and promote proper waste management, and encourage source reduction by both industry and the public. Several such initiatives are described below.

■ Jobs Through Recycling Program

The Jobs Through Recycling (JTR) program was developed in 1994 with the intent to foster recycling market development through assistance to state agencies, tribal authorities, and regional nonprofit organizations. However, due to funding cutbacks, JTR now operates exclusively by facilitating information exchange and providing networking opportunities via a Web site and e-mail list server. The list server, called JTRnet, allows market development officials to share insights and seek advice on problems and issues facing recycling programs in their states and regions. The Web site is available at www.epa.gov/jtr, and includes information on commodities, financing, business assistance, and profiles of the past JTR grants. It has information on the economic benefits of recycling and market development information for all 50 states. The Web site also provides information on how to participate in the e-mail list server.

Between 1994 and 1999, the JTR program provided "seed" funding totaling approximately $8 million through grants to states, tribes, and territories. These grants were awarded through a national competitive process, managed by a joint EPA Headquarters and regions team. Based on reported results, JTR funding helped create more than 8,500 new jobs, $640.5 million in capital investments, and 14 million tons of recovered materials. One job was created for every $1,000 of grant money invested.

■ Pay-As-You-Throw (PAYT)

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 pricing, or unit pricing. Unit pricing programs, sometimes referred to as pay-as-you-throw (PAYT) systems, have one primary goal: customers who place more solid waste at the curb for disposal pay more for the collection and disposal service. Thus, customers who recycle more have less solid waste for disposal and pay less. There are a few different types of unit pricing systems. Most require customers to pay a per-can or 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 PAYT communities grew to more than 7,133 in 2007, and the program serves a population of 75 million today. Based on greenhouse gas calculations, PAYT is attributed with reducing an equivalent of over 10 million metric tons of carbon dioxide annually.

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.

■ Construction and Demolition Materials

Under its Resource Conservation Challenge, EPA's Industrial Materials Recycling Program is supporting projects to reduce, reuse, and recycle materials generated from construction, renovation, deconstruction, and demolition of buildings and transportation structures, such as roads and bridges. Construction and demolition materials commonly include 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 construction and demolition materials is available at www.epa.gov/epaoswer/non-hw/debris-new/index.htm. The Resource Conservation Challenge is discussed further in Chapter IV and at www.epa.gov/rcc.

■ Industrial Ecology

The study of material and energy flows and their transformations into products, by-products, 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 inputs 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

The term "solid waste" includes garbage, refuse, sludges, nonhazardous industrial wastes, hazardous wastes, and other discarded materials. RCRA Subtitle C regulations distinguish those solid wastes which are deemed hazardous and subject to the hazardous waste regulatory program described in Chapter III. Subtitle D addresses primarily nonhazardous solid waste. Subtitle D also addresses hazardous wastes that are excluded from Subtitle C regulation (e.g., household hazardous waste). Management of nonhazardous solid waste is regulated by the states.

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

- Source reduction
- Recycling
- Disposal by combustion and/or landfilling.

As part of Subtitle D, EPA has developed detailed technical criteria for solid waste disposal facilities (40 CFR Part 257) and specific criteria for MSWLFs (40 CFR Part 258):

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

In addition, other solid waste management initiatives have been developed by EPA to help facilitate proper waste management. These initiatives focus on the environmental and economic benefits of source reduction and recycling. These initiatives include:

- Jobs through Recycling
- Pay-As-You-Throw
- Full cost accounting
- Construction and demolition materials
- Industrial ecology.

ADDITIONAL RESOURCES

Additional information about municipal solid waste management can be found at www.epa.gov/msw. Additional information on EPA's Resource Conservation Challenge is available at www.epa.gov/rcc.