

## Background Information

# An Introduction to Solid Waste Management and the Environment

Humans have always produced trash and have always disposed of it in some way, so solid waste management is not a new issue. What has changed are the types and amounts of waste produced, the methods of disposal, and the human values and perceptions of what should be done with it.

In the past, refuse was typically discarded in the most convenient manner possible with little regard to its effects on human health or the environment. Before modern notions of hygiene developed, city streets were typically open sewers that bred diseases such as cholera and dysentery. Even until the middle of the twentieth century, household trash was commonly disposed of and burned in open dumps that were neighborhood eyesores, emitted offensive odors, and attracted rats and other vermin. Chemical wastes were often haphazardly stored in on-site industrial piles or treatment ponds. Particularly noxious waste might be buried, but few controls existed to keep the toxic substances in them from seeping into nearby surface water or contaminating groundwater.

Over the past few decades, Americans have become increasingly concerned about not only the management and disposal of waste but also the difficulty of balancing the benefits of a healthy environment with the economic costs of achieving those benefits. Conflict often arises over what disposal methods should be used, whether costs of certain disposal methods outweigh benefits (or vice versa), and who should bear the economic burden. Many factors must be considered when discussing the topic of waste management: Economic, political, environmental, personal, and ethical issues all play major roles in the decision-making process.

### The Basics of Solid Waste Management

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Although the terms *solid waste*, *refuse*, *garbage*, and *trash* are often used interchangeably, solid waste professionals distinguish between them. *Solid waste* and *refuse* are synonyms that refer to any of a variety of materials that are rejected or discarded as useless.

The variety of materials referred to as solid waste or refuse is broken into several categories:

- *Garbage* strictly refers to animal or vegetable wastes, particularly by-products of food preparation. Garbage decomposes rapidly if exposed to the elements and creates offensive odors.
- *Trash* refers to solid waste that does not decompose (e.g., packaging, bottles, cans, building materials).

- *Hazardous waste* refers to waste that is ignitable, corrosive, or reactive (explosive) or that contains certain concentrations of toxic chemicals specified by the U.S. Environmental Protection Agency (EPA). In addition, the EPA maintains a list of about 500 other specific waste types also considered hazardous. (Although federal laws strictly regulate the generation, transport, and disposal of hazardous waste at most industrial and commercial facilities, hazardous materials in household trash remain exempt from these laws.)

Since most people do not make distinctions between the terms *garbage* and *trash* in everyday language, these terms are used interchangeably throughout this Background.

### Contents of the Solid Waste Stream

Most people do not spend time wondering about what types of materials they throw away or what exactly comprises a garbage truck's contents. But if you were to ask someone what category of material might make up the biggest portion of the truck's contents, you would probably get many different responses. Perceptions of the makeup, or characterization, of the *solid waste stream* are affected by many factors, including personal consumption, media reports, and visual impressions of litter and overflowing trash cans. The EPA and other government agencies periodically compile data on the contents of our national *municipal solid waste (MSW)* stream. Figure 1 summarizes key information from a 1996 EPA report that provides data about the characterization of U.S. MSW broken down by products and materials. (You can find more recent data on the EPA website at <http://www.epa.gov/> as periodic reports are published.)

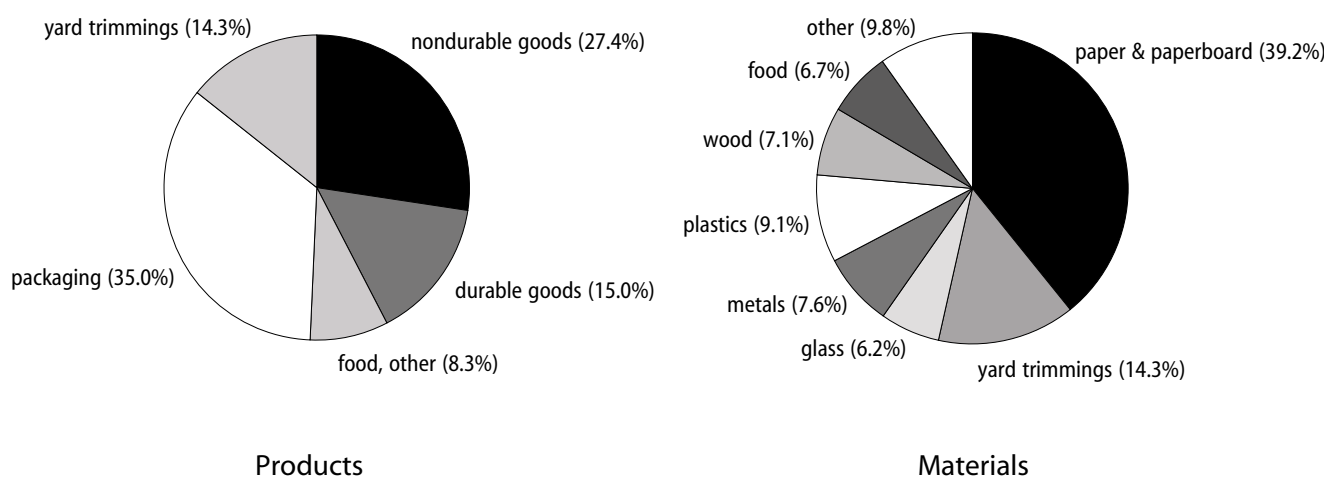


Figure 1: The contents of municipal solid waste (208 million tons in 1995) by products and materials

The MSW characterized in the EPA report includes waste from residential, commercial, institutional, and industrial sources. (Industrial waste here includes only packaging and administrative waste, not hazardous or process waste. Other kinds of solid waste, such as agricultural waste and municipal sludge, are not addressed in the EPA report.)

### **Integrated Waste Management**

Today, most communities use *integrated waste management* to deal with their solid waste. An integrated waste management system tries to accommodate the waste management needs of a city or region through a specific mix of available waste management options. Ideally, because waste management is the third-highest cost to local governments, each waste item should be matched to the waste disposal method that costs the least and provides the greatest benefit. The methods of meeting these criteria vary from community to community, but of the MSW stream in the United States, approximately 56.9% is landfilled, 27% is recycled, and 16.1% is incinerated.

An integrated waste management system combines two or more of the following processes:

- source reduction
- reuse
- recycling
- composting
- incineration
- landfill burial or encasement

### **Source Reduction**

Probably the most important component of any effective integrated waste management system is a strategy for reducing the amount of refuse entering the waste stream in the first place. Source reduction includes any action that reduces the volume or toxicity of solid waste prior to recycling or disposal.

#### *Where to Begin*

In general, communities can promote awareness of source reduction by encouraging individuals to reduce waste at home. Local government agencies, businesses, and civic groups can educate people through programs that suggest simple source reduction tasks that everyone can take part in—for example, using rechargeable batteries; using both sides of paper or using scrap paper; sending messages through e-mail; reusing boxes, packaging, and envelopes for mailing; composting a percentage of yard and household waste; and even repairing or reusing products or buying higher-quality new products that last longer. Additionally, companies and organizations can reduce waste on a larger scale. The EPA-sponsored WasteWi\$e program works with businesses to identify and implement innovative and cost-saving waste reduction measures.

### *A Packaging Example*

In the United States, 5.6% of all steel, 50% of all paper, 65–70% of all glass, 25–30% of all aluminum, and 23.5% of all plastics produced are used for packaging. For every \$10 spent on food in America, \$1 goes into its packaging, thereby making packaging the single item that comprises about a third of the country's MSW stream. Table 1 shows different types of packaging and their percentage of total packaging waste in 1995.

Packaging Type	Percent of Total Packaging in MSW Waste Stream
paper and paperboard	52.2%
glass	15.8%
plastic	10.6%
metals	6.6%
other	14.8%

### **Reuse**

It is easy to fall into the pattern of believing that newer is always better. Unfortunately, many perfectly good products are routed into the waste stream every day to make way for new products. Even some heavily used items might still have value—they just need to be repaired or refurbished.

By some estimates, up to 10% or more of the solid waste stream is made up of items that could be reused fairly easily. Obvious examples include clothing, books, toys, tools, housewares, and furniture. Many recycling centers have swap shops that store and distribute such items; local social service agencies often provide collection points for repair and resale; and antique stores, flea markets, thrift shops, and garage sales are all good sources for used products.

Reusing products delays the need for producing new products and landfilling the existing ones; and individuals buying used items get something they value for less than the cost of a new product. When reuse is possible, it is sometimes a better waste-reduction strategy than recycling. Recycling often requires additional energy for machines to separate, process, and manufacture the existing products into new ones, not to mention the time spent distributing and selling the new products.

## Recycling

Each person in the United States generates, on average, 4–5 pounds of MSW per day. A large part of this waste can undergo *resource recovery*, where the materials are salvaged as raw materials through recycling or composting or as energy through incineration. In 1994, the Resource Conservation and Recovery Act (RCRA) Subtitle D regulations came into full force, imposing tighter regulations on every MSW landfill in the nation. The next year, an estimated 27% of that year's solid waste was recovered, surpassing the agency's goal of 25% recovery. The EPA's most recent projections indicate that a recovery rate of 35% is possible.

As shown in Figure 2, annual MSW recycling rates steadily increased from 1960 to 1995.

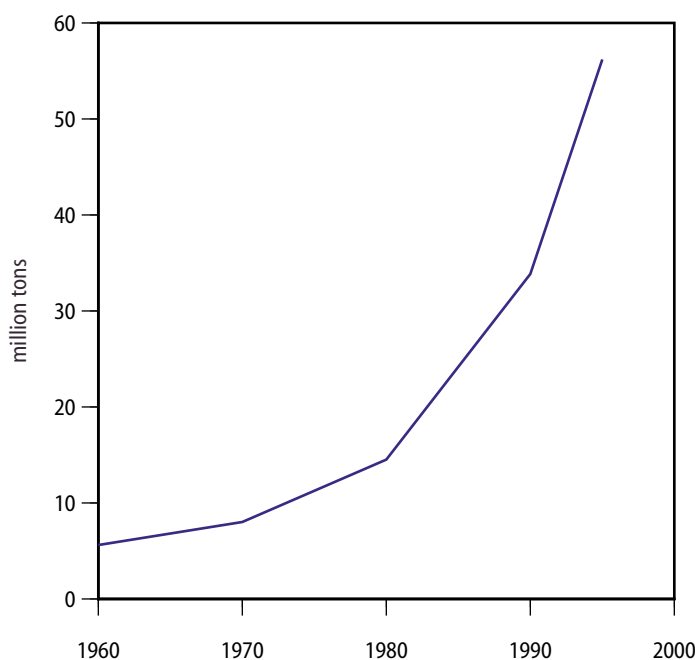


Figure 2: Annual MSW recycling rates from 1960 to 1995

### *What's Recyclable?*

Materials currently recycled in substantial quantities include office paper, magazines, plastic soft-drink bottles and milk jugs, glass containers, corrugated cardboard boxes, construction and demolition debris, wood, aluminum and other nonferrous metals, and iron and steel. Leaves, grass clippings, branches, and animal wastes are composted on a large scale. Figure 3 illustrates recycling rates of key household items.

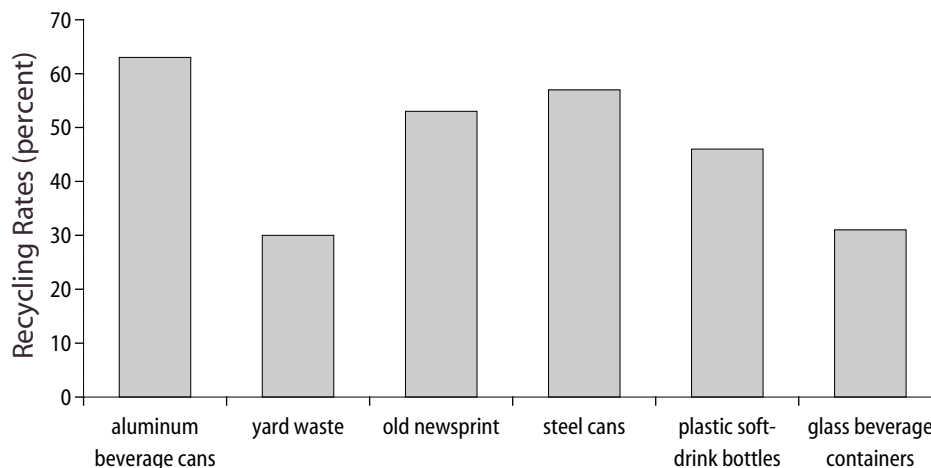


Figure 3: Recycling rates of key household items in 1995

Although recycling can be both profitable and good for the environment, in some cases a cost/benefit analysis must be used to determine whether recycling certain materials is both practical and beneficial. Additionally, costs of recycling versus landfilling greatly vary from place to place. For instance, the market in some areas for recycled newspaper is saturated, making landfill disposal a less expensive option.

#### *Most Commonly Recycled Items*

Among the most easily recycled materials are paper, metals, glass, and plastics. The recycling potential of each resource is described below.

*Paper.* Paper and paperboard are recycled at a higher rate than any other material. In 1995, approximately 40% of the total paper and paperboard in the MSW stream was recycled. The following paper items are most frequently recycled:

- *Corrugated cardboard boxes*—largest single source of waste paper collected. In 1995, Americans recycled about 64.2% of the corrugated cardboard used, more than any other paper product. Manufacturing cardboard from recycled materials not only saves about three-quarters of the energy needed to make cardboard from virgin materials but also reduces the emission of air pollutants.
- *Newspapers*—recycled at a rate of 53%. Top uses include more newsprint, paperboard, construction paper, insulation, egg cartons, and animal bedding.
- *Old telephone books*—made with the lowest-quality paper. Phone books can be reprocessed and made into ceiling tiles, textbook covers, and insulation.
- *Mixed paper*—colored paper, windowless envelopes, cover stock, and so on. Mixed paper can be made into paperboard, the thin type of cardboard used in cereal boxes.

- *Office paper*—prized by recyclers because it is made with strong, short fibers that hold up well the second time around. Office paper consists of computer paper, office stationery, and other white paper; can be made into roofing paper, tar paper, and asphalt shingles; and can be sorted into grades of varying values. Recycling office paper cuts down on emissions of dioxin, a toxic by-product of paper milling; and uses an average of two-thirds less energy than pulping trees. Recycling paper can reduce water pollution from papermaking alone by as much as 35% and air pollution by 74%. One-third of the paper mills in the United States uses waste paper exclusively.

*Metals.* Aluminum cans and other packaging comprise the largest sources of aluminum in the U.S. MSW.

- *Aluminum cans and packaging*—approximately 51.8% recovered for recycling in 1995. Using recycled aluminum cans saves 95% of the energy required to make aluminum cans from ore and cuts production costs by 40%. Recycling 1 metric ton of aluminum saves 4 metric tons of bauxite and about 700 kg of petroleum coke and pitch; it also prevents the emission of almost 35 kg of toxic aluminum fluoride. Recycling aluminum reduces the air pollution from aluminum production by an estimated 95% and water pollution by 97%.
- *Tin and steel cans*—100 million used every day in the United States. “Tin” cans are actually 99% steel coated with a thin layer of tin to prevent rusting. Recycling steel cans saves 60–70% of the energy used to produce them from raw materials and reduces air emissions by as much as 86%. Recycling cuts down on water use and water pollution and also conserves raw materials.

*Glass.* According to EPA estimates, glass makes up about 6.2% of America’s MSW. Over a ton of resources is saved for every ton of glass recycled: 1,330 pounds of sand, 433 pounds of soda ash, 433 pounds of limestone, and 151 pounds of feldspar. A ton of glass produced from raw materials creates 384 pounds of mining waste; using 50% crushed recycled glass (cullet) cuts mining waste by about 75%. Using 50% cullet can also double the life of a furnace because cullet melts at a lower temperature than raw materials. Recycling glass can reduce total air pollution by 14–20%, water use by 50%, and energy use by 25–32%. Most bottles and jars contain at least 25% recycled glass.

*Plastics.* The overall recovery of plastics for recycling is only 5.3%, but recovery of some plastic containers is increasing.

- *Polyethylene terephthalate (PETE)*—About 45.5% of all soft-drink bottles and their base cups were recycled in the United States in 1995. PETE bottles are actually a form of polyester and can be used to make clothing, carpeting, and fiberfill. Recycling keeps about 360,000 tons of PETE out of landfills every year, but 1.33 million tons of PETE are still discarded.

- *High-density polyethylene (HDPE)*—commonly used in milk jugs and recycled at a rate of 30.2%. HDPE can be recycled into items like flowerpots, trash cans, traffic barrier cones, curbside recycling bins, and detergent bottles. Clean HDPE scrap can be worth \$150–600 per metric ton; however, as much as \$120 million worth of it is discarded every year.
- *Polyvinyl chloride (PVC)*—used in pipe, fencing, and packaging. Less than 0.05% of PVC in the waste stream is recycled. The alternatives to recycling have important environmental drawbacks. In landfills, if certain PVC containers were exposed to water, solvents, or other trash, the chemicals added to make the plastic more flexible (plasticizers) could leach into water and soil. PVC contains chlorinated compounds, so when it is incinerated with other trash, it releases a corrosive gas called hydrogen chloride.
- *Plastic bags and film wrappings*—account for about 20% of our plastic garbage. Although at present very little is recycled, plastic bags are among the few plastic products that can be recycled in a *closed loop*, meaning that recycled plastic bags can be made into more plastic bags. “Biodegradable” plastic bags do not eliminate the problem of plastic waste since sanitary landfills are designed to prevent decomposition.

### *Community Recycling Programs*

Material Recovery Facilities (MRFs), also known as Intermediate Processing Centers (IPCs), recover recyclable materials from mixed solid waste by employing hand-sorting and various types of machinery—air classifiers, magnets, cyclones, trommels, crushers, grinders, and balers—to produce clean, segregated loads of recyclable materials in large quantities. Any community can implement a number of other types of recycling programs:

- drop-off centers at central locations;
- buyback and processing centers;
- commercial recycling programs that accept office paper, corrugated boxes, construction and demolition debris, bulk waste, and other materials;
- residential curbside collections;
- apartment building collections; and
- rural landfill collection containers.

### **Composting**

Composting is the controlled biological process of turning organic waste into a soil conditioner. In nature, organic matter such as wood, paper, animal waste, and plant materials is decomposed by bacteria. Exposure to the elements releases nutrients that can be used by other organisms. Composting differs from natural decomposition in that conditions are controlled to make the decomposition occur more rapidly and efficiently. Composting produces a nutrient-rich soil additive called *compost*, which is used to improve soil quality (and thus plant growth) by increasing nutrient availability, water-holding capacity, aeration, and biological activity. Compost can be mixed into soil or applied on top of soil as mulch.



### *Yard Waste*

In 1995, Americans disposed of 29.75 million tons of yard waste—leaves, tree trimmings, and grass—accounting for about 14.3% of the MSW stream. It is estimated that grass clippings, which usually do not need to be picked up, make up about half of that yard waste. If grass clippings are short enough, they will quickly decompose and supply the soil with nitrogen and carbon. Longer grass clippings can be raked up and used as mulch.

### *Home Composting*

Home composting can be an effective way to avoid the expense both of having waste removed and of purchasing soil additives for the lawn and garden. Additionally, modern equipment and tools make household composting easier than it used to be. Plastic bins and barrels (sometimes used with quantities of red earthworms) speed the composting process, eliminate some of the work, and help contain the odor caused by decomposition.

### *Pollution Prevention and Control*

Besides its value as a method of waste reduction and soil treatment, composting has recently been discovered to have important applications in pollution prevention and control. Compost applied to creek, lake, or river embankments or on roadsides and hillsides reduces silting and erosion. It can also reduce heavy metals and organic contaminants in stormwater runoff, preventing contamination of water. Compost degrades or completely eliminates such contaminants as hydrocarbons and pesticides. In addition, the use of mature compost can suppress plant diseases.

## **Incineration**

In addition to recycling and composting, some resources can be recovered from the MSW stream through incineration. One of the purposes of incineration is to increase the useful life of available landfills and minimize odor and sanitation problems. An efficient mass-burn incinerator can reduce the solid waste going into a landfill by as much as 80–90% in volume and 65–75% in mass.

### *The Mass-Burn Process*

The most common type of incineration, mass burn, is designed to burn virtually all the waste brought to it, with no separation or processing of materials prior to burning. Most mass-burn facilities operating today include an *energy recovery system* that converts heat from the combustion process into steam or electricity that can be used by the surrounding community. The basic mass-burn process is depicted in Figure 4 and described in the following steps.

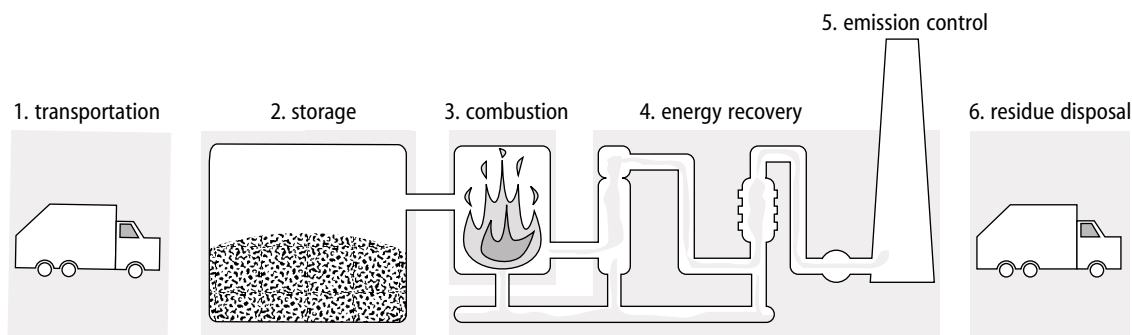


Figure 4: The mass-burn process

1. *Transportation*—MSW is collected and delivered to the mass-burn facility.
2. *Storage*—Waste is transferred to a storage pit or tipping floor.
3. *Combustion*—A conveyor or crane transfers the waste to the hopper, which feeds the waste into the furnace. Secondary combustion chambers aid a more complete combustion.
4. *Energy recovery*—The heat from combustion is transferred to water in pipes, which turns into steam. Steam is used directly for processes or to generate electricity.
5. *Emission control*—Dry and wet scrubbers and other air-pollution-control devices, such as electrostatic precipitators and fabric filters, remove some of the acid gases and particulates from the exhaust.
6. *Disposal of residue*—The ash from burning and the residue from scrubbers and other pollution-control devices are disposed of in a landfill.

### Emissions

Most energy-recovery facilities use sophisticated combustion-control systems designed to optimize combustion, minimize ash for disposal, and optimize clean burning by reducing the formation of products of incomplete combustion (PICs). Some of the waste that goes through the incineration process, however, might exit the system in one of the following forms:

- *Combustion gases*—can exit through the stack if they are not completely removed by air-pollution-control devices.
- *Particulate emissions*—lightweight particles can exit the combustion chamber along with combustion gases, if they are small enough to get past pollution-control devices.

- *Fly ash*—toxic particles light enough to be borne upward with combustion gases; a portion of these might not be heavy enough to fall or might not be large enough to be captured by pollution-control devices before exiting the stack. Comprising approximately 25% of all incinerator ash, fly ash often contains high levels of heavy metals, acid gas constituents, and PICs such as dioxin.
- *Bottom ash*—uncombusted waste such as glass and metal, generally considered nontoxic; approximately 75% of all incinerator ash.

#### *Energy Content of Different Materials*

The energy content of different kinds of solid waste varies. Paper accounts for more than 50% of the energy content and plastics for nearly 25%. Plastics derive from natural gas and petroleum and therefore have a stored energy value higher than any other material commonly found in the waste stream. When plastics burn, they help other wastes combust more cleanly and completely.

A pound of mixed MSW contains approximately 4,800 British thermal units (Btu) of heat, compared to about 13,500 Btu for a pound of anthracite coal. In 1993, U.S. refuse-to-energy plants produced approximately 328 trillion Btu.

#### *Dangers and Disadvantages*

One disadvantage of incineration is that not all waste is suitable for combustion. One-quarter of the waste stream (by mass) is not suitable for incineration, including construction and demolition debris, and bulk waste such as discarded stoves, refrigerators, and furniture. Preprocessing and removing unsuitable waste before combustion can dramatically reduce the amount of ash as well as the toxicity of ash and emissions.

The most obvious way humans are exposed to by-products of incineration is through the inhalation of gases or particles released into the atmosphere. Deposition on the ground, irrigation, runoff, crop ingestion, animal product ingestion, and direct exposure to deposited materials are also possible sources of exposure to airborne emissions. Less obvious is the potential for airborne and waterborne dispersion of ash during storage, transport, and handling for final disposal at the landfill. Despite concerns about ash toxicity, there is widespread interest in recycling bottom ash, especially for use as aggregate in concrete or cement.

Other disadvantages of incineration include large capital investment, relatively high operating costs, expense of sophisticated pollution-control equipment, and difficulty in obtaining sites.

## Landfill Burial or Encasement

Other waste management processes cannot completely eliminate the need for landfills, no matter how successfully these processes are implemented. Landfills will always be necessary if the MSW stream continues to have the same constituents as it currently does.

## Federal Landfill Regulations

The Resource Conservation and Recovery Act (RCRA) of 1976 provided the legal base for federal regulation of sanitary landfills and, in combination with the Toxic Substances Control Act (TSCA) of that same year, provided strict regulation on production and disposal of toxic materials and a cradle-to-grave tracking system for such materials.

In 1991, the EPA established new, stricter landfill regulations, which now serve as the basis for all state landfill regulations. Enviro\$en\$e, part of the U.S. EPA's website, summarizes the regulations as follows:

- *Location restrictions*—Landfills cannot be located near ecologically valuable wetlands or in areas prone to natural disasters, such as flooding or seismic activity. They also cannot be located near airports because birds drawn to landfills can pose hazards to flying aircraft.
- *Operating requirements*—Landfills must refuse to accept regulated hazardous waste, apply a daily cover, control disease vector populations, monitor methane gas, restrict public access, control stormwater runoff, protect surface water from pollutants, and keep appropriate records.
- *Groundwater monitoring*—Landfills must be designed to ensure that groundwater meets drinking-water standards. All landfills must have monitoring wells to detect contamination and must take full corrective action if contamination occurs.
- *Closure and postclosure costs*—When a landfill stops accepting waste, it must be covered to keep liquids away from the buried waste. After closure, the operator is responsible for the final covering, leachate control, and monitoring of groundwater and methane gas for 30 years.

Environmental justice aspects also play a role in the location and operation of landfills and other solid waste management facilities. Title VI of the Civil Rights Act directs federally funded programs to identify and address disproportionately high and adverse human health or environmental effects on low-income populations. Some state and local governments have additional regulations covering environmental justice aspects.

### Types of Modern Landfills

Two types of modern landfills exist: *sanitary* and *secure*. Strict guidelines regulate each.

*Sanitary Landfills.* Sanitary landfills have filters and liners to prevent contamination of soil; leachate collection and monitoring systems to prevent the contamination of groundwater; and methods of collecting methane gas to prevent explosive pockets from building up in the landfill. (See Figure 5.)

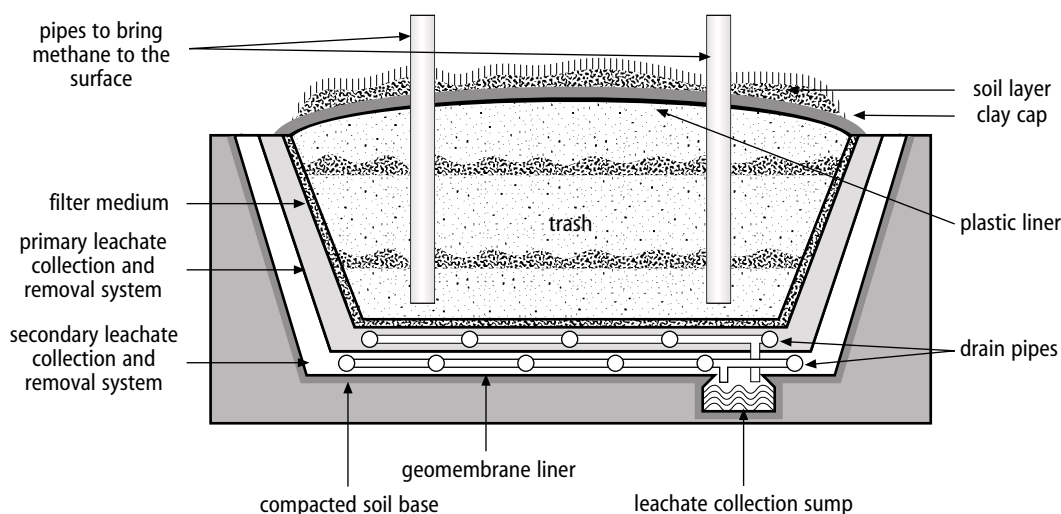


Figure 5: Cross-section of a sanitary landfill

Sanitary landfills are safer than the open dumps of the past because they are better insulated from the environment. This insulation, however, does cause slower decomposition, which means the landfill must be maintained for a longer period of time. As long as the seals and monitoring systems remain intact and the methane gas is periodically released, sanitary landfills can be relatively benign to the environment. Some landfills collect the methane gas from decomposition and use it as a fuel source for the neighboring communities.

*Secure Landfills.* Secure landfills are authorized to accept toxic waste and have much stricter safety precautions than sanitary landfills. Different types of toxic waste are entombed in separate chambers, and a careful inventory is kept of what items are buried there. Rather than having just a compacted-soil base and a permeable geomembrane liner (like that of

sanitary landfills), secure landfills have two compacted base layers—clay and soil—and an impermeable plastic liner protecting the landfill walls. The cap is also deeper and stronger, and a groundwater monitoring well is installed to help detect leaks. (See Figure 6.)

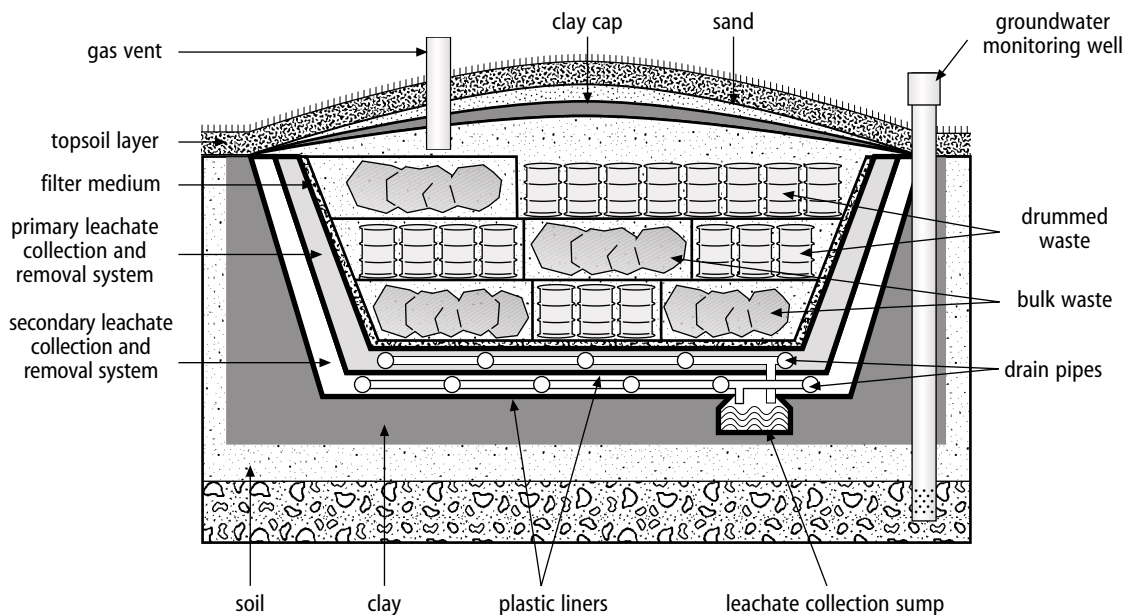


Figure 6: Cross-section of a secure landfill

Secure landfills require the highest degree of care in their design and upkeep. They are designed for the indefinite storage of toxic chemicals, and great vigilance must be taken to prevent leaks. Because of the nature and concentration of the chemicals buried there, a secure landfill that leaks can cause deadly contamination of the surrounding environment, much more serious than contamination from a sanitary or unsanitary landfill.

### A Primer of Hazardous Materials

A hazardous material is one that poses some form of danger to humans or the environment. More specifically, according to RCRA, materials are considered hazardous if they “cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.”

### Classifications for Hazardous Materials

Many hazardous materials may fall into more than one category. Descriptions of the hazards posed by these materials are classified into seven basic types:

- *Flammable/Combustible*—ignites easily and burns rapidly.
- *Explosive/Reactive*—explosive chemicals produce a sudden, almost instantaneous release of pressure, gas, and heat when subjected to abrupt shock, high temperature, or an ignition source; reactive chemicals vigorously undergo a chemical change under conditions of shock, pressure, or temperature.
- *Sensitizer*—on first exposure causes little or no reaction in humans or test animals; but on repeated exposure may cause a marked response not necessarily limited to the contact site. Skin sensitization is the most common form; respiratory sensitization to a few chemicals also occurs.
- *Corrosive*—causes visible destruction of or irreversible alterations in living tissue by chemical action at the site of contact.
- *Irritant*—noncorrosive chemical that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact as a function of concentration or duration of exposure.
- *Carcinogen*—either causes cancer in humans, or, because it causes cancer in animals, is considered capable of causing cancer in humans.
- *Toxic*—poisonous to living organisms when they are ingested, inhaled, or absorbed through the skin. For a discussion of how toxic chemicals enter the body, see “An Introduction to Toxicology” Background.

### Labels for Associated Risks

By law, hazardous products must bear labels that explain the hazards associated with them and how to prevent injury or damage. The following signal words determined by law express the relative risk associated with a product.

- *No signal word*—relatively nonhazardous
- *Caution or Warning*—generally mildly to moderately hazardous or toxic; can cause temporary adverse health effects, such as skin irritation or vomiting
- *Danger*—more severely hazardous or toxic; can cause permanent serious health effects, such as skin burns or stomach ulcers
- *Poison*—highly toxic; can be fatal if ingested

The term “nontoxic” is an advertising word that has no legal meaning except when used to describe art supplies.

## Who Produces Hazardous Waste?

Although industrial sources comprise the primary producers, users, and disposers of hazardous substances, hazardous products are found in almost every household in the United States. Regardless of source, any hazardous substance improperly used or disposed of can be released into the environment, sometimes with serious consequences.

### *Industry and the Toxics Release Inventory*

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 was established two years after an industrial chemical release in Bhopal caused thousands of deaths and many more thousands of injuries. Through EPCRA, the Toxics Release Inventory (TRI) was created—an EPA-administered, publicly available database. The annual *Toxics Release Inventory Public Data Release Report* contains information on chemical releases and other waste management activities provided by facilities in 27 industry sectors.

In 1999, more than 22,000 federal, manufacturing, and other facilities reported on- and off-site releases of 7.77 billion pounds of TRI-listed substances. The largest amount of toxic chemicals released that year (more than one-quarter) consisted of on-site air emissions (40% of which were produced by electric-generating facilities). The second-largest amount, on-site land releases, accounted for 4.75 billion pounds of listed hazardous waste (83% of which was reported by metal-mining facilities). Also reported that year were 29.49 billion pounds of TRI chemicals and chemical compounds treated by waste-management facilities.

*TRI Benefits and Limitations.* The benefits of this information are many: It is used not only by the federal government to help reduce toxic waste production, avoid accidents, and identify environmental “hot spots,” but also by industry for self-regulation purposes and by the general public to locate and possibly prevent local problems that have occurred or might occur. Several limitations to the TRI exist, however, and must be considered when using the data:

- Industry sectors not covered by the TRI need not report their use and disposal of toxic substances. Additionally, any toxic substances not listed on the TRI remain unreported.
- Manufacturing and processing facilities must only report TRI-listed substances in quantities over 25,000 pounds; other types of facilities need only report quantities over 10,000 pounds.
- Only estimated data is reported, and no facility is required to actually monitor its releases.
- Until 1998, only manufacturing and production facilities were required to report. After that year other industry sectors were added, such as metal and coal mining (respectively reporting 51.2% and 0.2% of 1999 TRI Total Releases), electrical utilities (reporting 15.0%), and some hazardous waste treatment and disposal facilities (reporting 3.7%).
- Until 1999, threshold levels for persistent bioaccumulative toxic chemicals (PBTs) were considered the same as other hazardous chemicals. A recent attempt has been made to lower those thresholds.



*Household Hazardous Waste.* Hazardous materials can be found in many areas of the home:

- *Garage*—antifreeze, brake fluid, wax polish, engine degreaser, carburetor cleaner, creosote, radiator flushes, asphalt, roofing tar, air conditioner refrigerants, and car batteries
- *Workbench*—rust preventatives, wood preservatives, wood strippers, wood stains, paint thinner, oil-based paint, solvents, degreasers, sealants, and varnish
- *House*—drain cleaners, oven cleaners, furniture polish, metal polish, window cleaners, expired prescriptions, arts and crafts supplies, photography chemicals, floor cleaners, chemistry sets, mothballs, and rug and upholstery cleaners
- *Garden shed*—pesticides (including chlordane), herbicides, insect sprays, rodent killers, pool chemicals, insect strips, fertilizers, and septic system cleaners

Hazardous wastes should never be disposed of as regular trash. Hazardous waste can injure trash collectors or pose other problems for human health and the environment. Commonly, household hazardous waste is mixed in with regular waste and sent to a sanitary landfill or an incinerator. People also dispose of hazardous wastes by burning them; dumping them onto the ground or into waterways; or pouring them down a sink, toilet, or storm sewer. If certain hazardous chemicals are discharged into a waterway, even a small amount can contaminate large amounts of water. One liter of motor oil disposed of improperly can pollute nearly 950,000 L of water.

Hazardous materials should be disposed of through periodic hazardous waste collections sponsored by fire departments or other local government agencies or in some other way that will prevent them from coming into contact with humans or the environment.

## Summary

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In waste management, as with other issues that have environmental concerns, clear lines do not always exist between what is good for the environment and human health and what is bad. Because waste management decisions are made within the context of society, however, social and personal issues should always be a part of the political process.

## References

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