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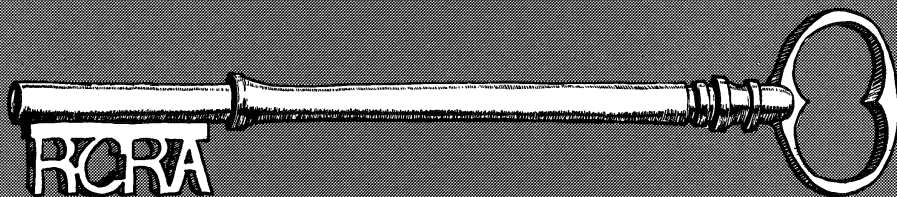
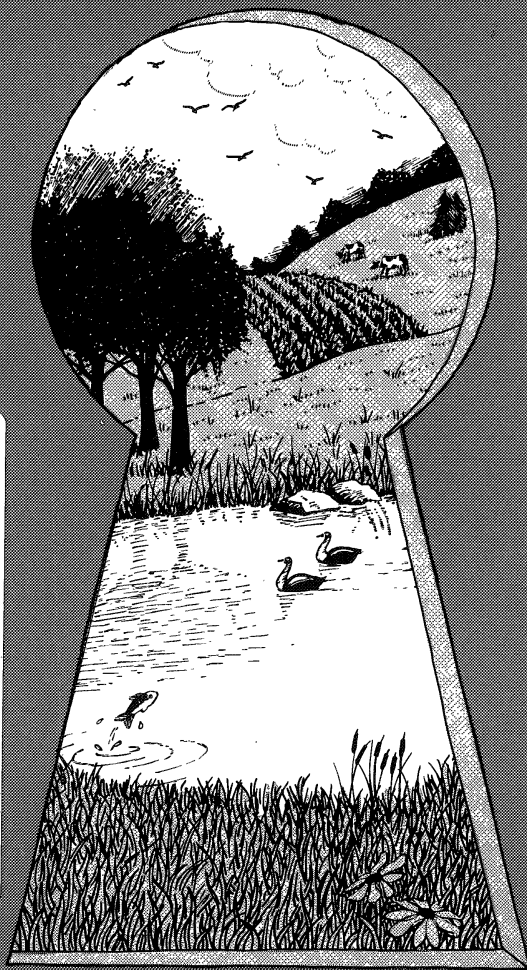
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Solving the Hazardous Waste Problem

EPA's RCRA Program

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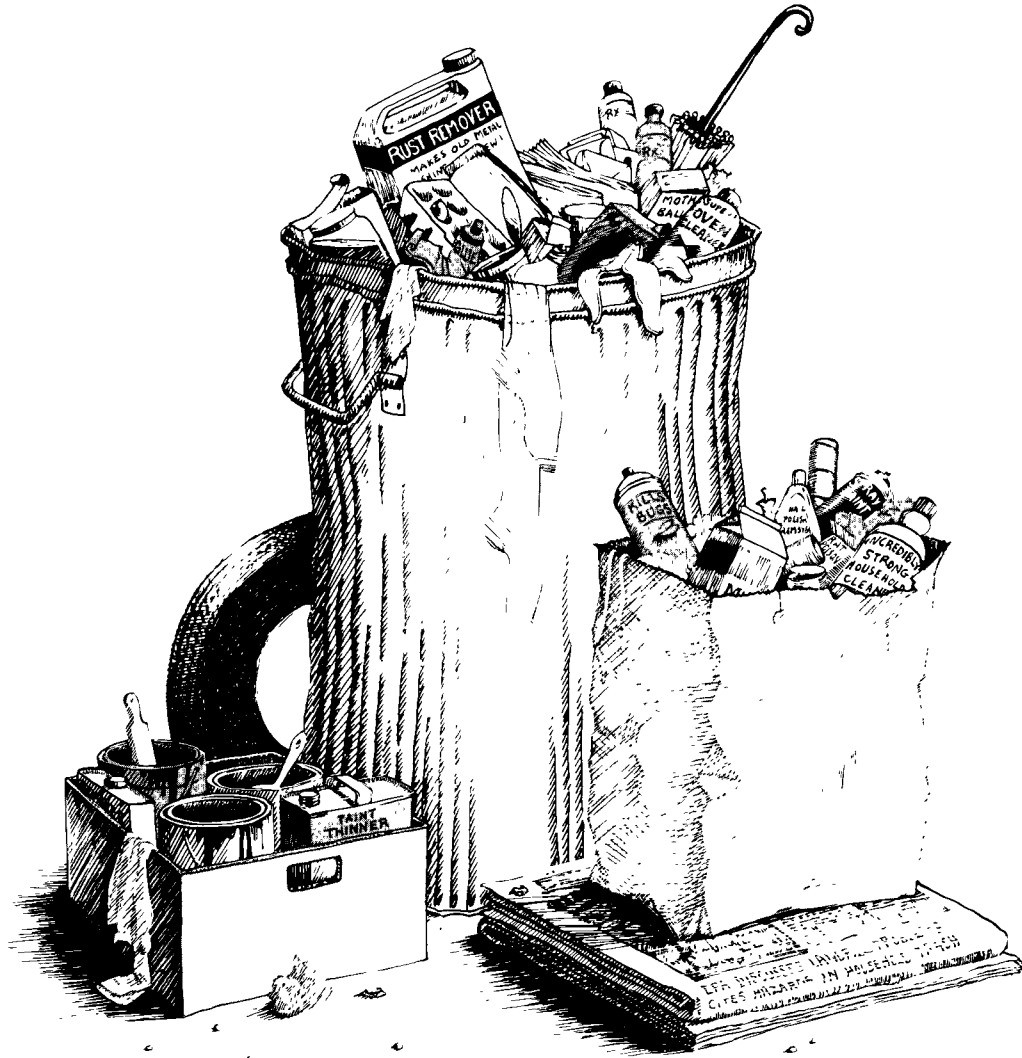
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RCRA: A Historical Perspective

Following World War II, our nation's phenomenal industrial growth was matched by a surge in consumer demand for new products. The country seized upon new "miracle" products, such as plastics, nylon stockings, and coated paper goods, as soon as industry introduced them. Our appetite

for material goods also created a problem: how to manage the increasing amounts of waste produced by industry and consumers alike.

In 1965 Congress passed the Solid Waste Disposal Act, the first federal law to



Common household trash, while primarily nonhazardous, can contain a variety of hazardous wastes.

require safeguards and encourage environmentally sound methods for disposal of household, municipal, commercial, and industrial refuse. Congress amended this law in 1970 by passing the Resource Recovery Act and again in 1976 by passing the Resource Conservation and Recovery Act (RCRA). The primary goals of RCRA are:

- To protect human health and the environment from the potential hazards of waste disposal.
- To conserve energy and natural resources.
- To reduce the amount of waste generated, including hazardous waste.
- To ensure that wastes are managed in an environmentally sound manner.

As our knowledge about the health and environmental impacts of waste disposal increased, Congress revised RCRA, first in 1980 and again in 1984. The 1984 amendments—referred to as the Hazardous and Solid Waste Amendments (HSWA)—significantly expanded the scope of RCRA. HSWA was created, in large part, in response to strongly voiced citizen concerns that existing methods of hazardous waste disposal, particularly land disposal, were not safe.

RCRA, including its 1984 amendments, is divided into sections called Subtitles. Subtitles C, D, and I set forth the framework for EPA's comprehensive waste management programs:

- EPA's Subtitle C program establishes a system for controlling *hazardous waste* from generation until ultimate disposal.
- EPA's Subtitle D program establishes a system for controlling *solid (primarily nonhazardous) waste*, such as household waste.

- EPA's Subtitle I program, established by HSWA, regulates *toxic substances and petroleum products stored in underground tanks*.

Problems associated with past mismanagement of hazardous wastes are covered by RCRA's companion law—the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) of 1980—which addresses the cleanup of inactive and abandoned hazardous waste sites.

The term "RCRA" is often used interchangeably to mean the law, the regulations, and EPA policy and guidance. The *law* describes the waste management program mandated by Congress and gives EPA the authority to develop it. The *regulations* carry out the Congressional intent by providing explicit requirements for waste management that are legally enforceable. EPA *guidance documents* and *policy directives* clarify issues related to implementation of the regulations. Together, these three elements are all essential parts of the RCRA program.

This booklet focuses on EPA's hazardous waste regulatory program under Subtitle C of RCRA and briefly discusses the Subtitle D and I programs. The booklet is intended to provide an overall perspective on how RCRA works, including the roles of EPA, the states, and the regulated community. Further information and publications on EPA's RCRA program can be obtained by calling the EPA toll-free RCRA/Superfund Hotline (1-800-424-9346 outside of Washington, D.C., and 382-3000 in D.C.), and from EPA Regional Offices (see inside back cover).

What is a Hazardous Waste?

Hazardous wastes come in all shapes and forms. They may be liquids, solids, or sludges. They may be the by-products of manufacturing processes, or simply commercial products—such as household cleaning fluids or battery acid—that have been discarded. Whatever their form, however, proper management and disposal of hazardous wastes are essential to protect our country's valuable resources.

The RCRA law provides a general definition of the term "hazardous waste" (see Inset). However, in order to regulate hazardous wastes, EPA first had to determine which *specific* wastes are hazardous. Since there are tens of thousands of wastes that can be hazardous for many different reasons, this was not a simple task. The definition of hazardous waste had important economic ramifications. Only wastes determined to be hazardous would be subject to RCRA's hazardous waste regulations.

EPA spent many months interacting with industry and the public to develop a definition of "hazardous waste" for its regulations. As a result of this work, RCRA regulations identify hazardous wastes based on their characteristics and also provide a list of specific hazardous wastes.

Characteristic Wastes

A waste is hazardous if it exhibits one or more of the following characteristics:

- **Ignitability.** Ignitable wastes can create fires under certain conditions. Examples include liquids, such as solvents that readily catch fire, and friction-sensitive substances.
- **Corrosivity.** Corrosive wastes include



According to EPA estimates, of the six billion tons of industrial, agricultural, commercial, and domestic wastes we generate annually, about 250 million tons are "hazardous" as defined by RCRA regulations.

those that are acidic and those that are capable of corroding metal (such as tanks, containers, drums, and barrels).

- **Reactivity.** Reactive wastes are unstable under normal conditions. They can create explosions and/or toxic fumes, gases, and vapors when mixed with water.
- **Toxicity.** Toxic wastes are harmful or fatal when ingested or absorbed. When toxic wastes are disposed of on land, contaminated liquid may drain (leach) from the waste and pollute ground water. Toxicity is identified through a laboratory procedure called the Extraction Procedure (EP) toxicity test.

Hazardous Waste: The Definition in the RCRA Law

To Be a Hazardous Waste, a Waste Must Be a "Solid Waste" . . .

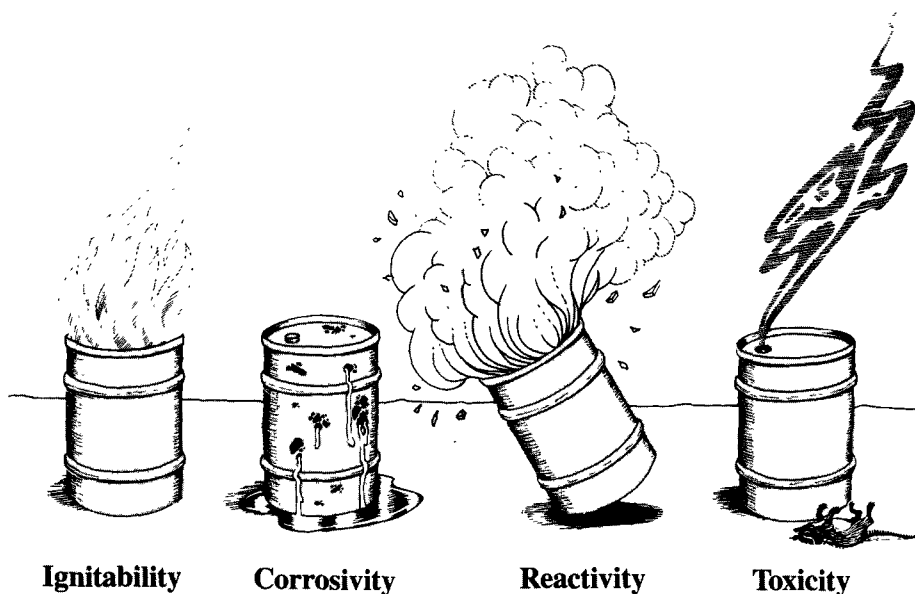
. . . defined in RCRA as "garbage, refuse, or sludge or any other waste material." According to RCRA, a solid waste can be a solid, a semi-solid, a liquid, or a contained gas.

. . . And It Must Meet These Criteria. . .

"Because of its quantity, concentration, or physical, chemical, or infectious characteristics, (it) may 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 and the environment when improperly treated, stored, transported, or disposed of, or otherwise managed."

Not Included in RCRA Hazardous Waste Regulations Are . . .

- Domestic sewage.
- Irrigation waters or industrial discharges permitted under the Federal Water Pollution Control Act.
- Certain nuclear material as defined by the Atomic Energy Act.
- Household wastes, including toxic and hazardous waste.
- Certain mining wastes.
- Agricultural wastes, excluding some pesticides.
- Small quantity wastes (that is, wastes from businesses generating fewer than 220 pounds of hazardous waste per month).



A waste is hazardous if it exhibits any of these four characteristics.

EPA regulations require that all waste generators evaluate their wastes to determine if any of the four hazardous characteristics are exhibited. Wastes exhibiting these characteristics are subject to EPA's Subtitle C hazardous waste regulations.

Listed Wastes

EPA has already determined that some specific wastes are hazardous. These wastes are now incorporated into lists published by EPA. The lists are organized into three categories:

- **Source-Specific Wastes.** This list includes wastes from *specific industries* such as petroleum refining and wood preserving. Sludges and wastewaters from treatment and production processes in these industries are examples of source-specific wastes.
- **Generic Wastes.** This list identifies wastes from common manufacturing and industrial *processes*. Generic wastes include solvents that have been used in degreasing operations in any industry.

- **Commercial Chemical Products.** This list includes specific commercial *chemical products* such as creosote and some pesticides.

All "listed" wastes are presumed to be hazardous regardless of their concentrations and must be handled according to EPA's Subtitle C hazardous waste regulations. However, if a company can demonstrate that its specific waste is not hazardous, the waste may be "delisted" and is then no longer subject to Subtitle C requirements. A delisted waste is still covered by Subtitle D solid waste management requirements.

Expanding Definitions

Determining which wastes are hazardous is a dynamic process, influenced by new concerns, research data, and test development. EPA is now adding certain types and classes of wastes to its hazardous waste lists, and is deciding whether to identify additional hazardous characteristics.

Examples of Hazardous Waste Generated by Businesses and Industries

Waste Generators

Waste Type

Chemical Manufacturers

Strong Acids and Bases
Spent Solvents
Reactive Wastes

Vehicle Maintenance Shops

Heavy Metal Paint Wastes
Ignitable Wastes
Used Lead Acid Batteries
Spent Solvents

Printing Industry

Heavy Metal Solutions
Waste Inks
Spent Solvents
Spent Electroplating Wastes
Ink Sludges Containing Heavy Metals

Leather Products Manufacturing

Waste Toluene and Benzene

Paper Industry

Paint Wastes Containing Heavy Metals
Ignitable Solvents
Strong Acids and Bases

Construction Industry

Ignitable Paint Wastes
Spent Solvents
Strong Acids and Bases

**Cleaning Agents and Cosmetics
Manufacturing**

Heavy Metal Dusts
Ignitable Wastes
Flammable Solvents
Strong Acids and Bases

**Furniture and Wood Manufacturing
and Refinishing**

Ignitable Wastes
Spent Solvents

Metal Manufacturing

Paint Wastes Containing Heavy Metals
Strong Acids and Bases
Cyanide Wastes
Sludges Containing Heavy Metals

Controlling Waste: From Generation to Disposal

The tragic consequences of hazardous waste mismanagement in the past are reflected in polluted ground water, streams, lakes, and rivers, and in areas now void of vegetation and wildlife.

Improper disposal of hazardous waste has been linked to elevated levels of toxic contaminants in humans, aquatic species, and livestock. Illegal dumping of hazardous waste on roadsides or in open fields has resulted in explosions, fires, contamination of underlying ground water, and generation of toxic vapors.

To prevent such tragedies, EPA designed the RCRA regulations to ensure proper management of hazardous waste from the moment the waste is generated until its ultimate disposal. This step-by-step management approach enables EPA and the states to monitor and control hazardous waste at every point in the waste cycle, thereby protecting human health and natural resources from the dangers of mismanagement. This approach has three key elements:

- A tracking system requiring that a uniform manifest document accompany any transported hazardous waste from the point of generation to the point of final disposal.
- An identification and permitting system that enables EPA and the states to assure the safe operation of all facilities involved in the treatment, storage, and disposal of hazardous waste.
- A system of restrictions and controls on the placement of hazardous waste on or into the land.

The Tracking System

Generators

The first step in the waste cycle is the generator, the person who actually produces the waste or first causes the waste to become subject to the RCRA regulations. Generators include large industries, small businesses, universities, and hospitals.

Under RCRA regulations, generators must determine if their waste is hazardous and must oversee the ultimate fate of the waste. Once a generator determines that a waste is hazardous, he or she must obtain an EPA identification number for each site at which hazardous waste is generated. According to EPA estimates, generators treat or dispose of about 96 percent of the nation's hazardous waste on site. Onsite treatment, storage, and disposal facilities generally are found at larger businesses that can afford treatment equipment and that possess the necessary space for storage and disposal. Smaller firms, and those in crowded urban locations, are more likely to transport their waste offsite where the waste is managed by a commercial firm or a publicly owned and operated facility. RCRA regulations apply to both onsite and offsite facilities.

If the generator chooses to dispose of the hazardous waste offsite, the generator must package and label the waste properly for transportation. Proper packaging ensures that no hazardous waste leaks from containers during transport. Labeling enables transporters and public officials, including those who respond to emergencies, to rapidly identify the waste and its hazards.

The Manifest

Although only a small percentage of the nation's hazardous waste is actually transported offsite to treatment, storage,

or disposal facilities, this still comprises a substantial volume: approximately 12 million tons per year. To track transported waste, EPA requires generators to prepare a Uniform Hazardous Waste Manifest. This one-page form, with carbon copies for participants in the shipment, identifies the type and quantity of waste, the generator, the transporter, and the facility to which the waste is being shipped. Generators must also certify on the manifest that they are minimizing the amount and toxicity of their waste, and that the method of treatment, storage, or disposal they have chosen will minimize the risk to human health and the environment. The certification requirement was added by the 1984 RCRA amendments. It reflects RCRA's new emphasis on reducing the volume of waste and providing higher levels of protection.

The manifest must accompany the waste wherever it travels. Each individual handler of the waste must sign the manifest and keep one copy. When the waste reaches its destination, the owner of that facility returns a copy of the manifest to the generator to confirm that the waste arrived.

If the waste does not arrive as scheduled, generators must immediately notify EPA or the authorized state environmental agency (see Inset) so that they can investigate and take appropriate action. Generators must retain copies of the manifest for three years after shipment. Every other year, generators also must provide information on their activities to their authorized state agency or to EPA. Some businesses that generate small quantities of hazardous waste are subject to lesser paperwork requirements.

Transporters

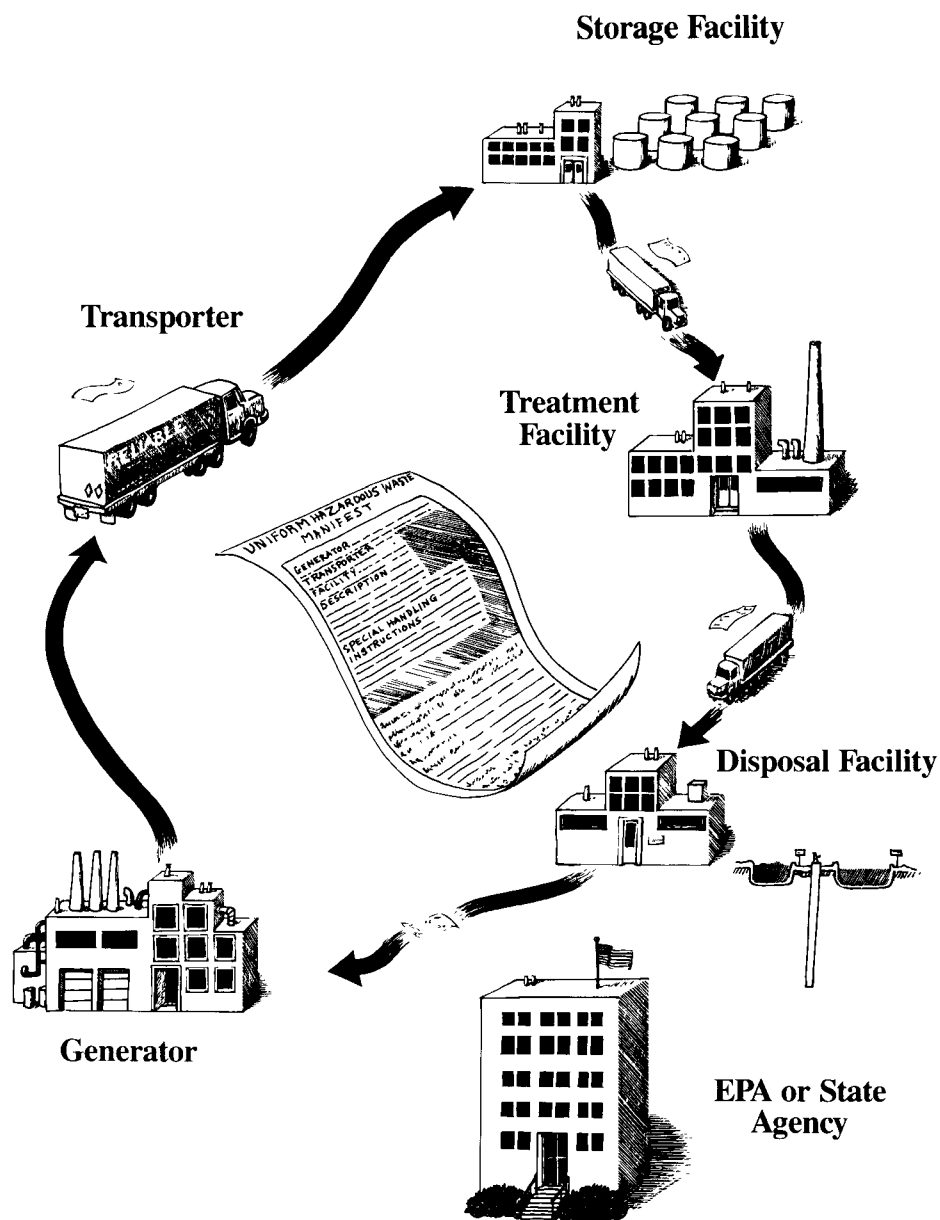
Transporters pick up properly packaged and labeled hazardous waste from generators and transport it to the designated facilities that treat, store, or dispose of the waste. Transporters must carry copies of the completed manifests and must put proper symbols on the transport vehicle to identify the type of waste being transported. These symbols, like the labels on the hazardous waste containers, enable firefighters, police, and other officials to immediately identify the potential hazards in case of an emergency. Like generators, transporters must obtain an EPA identification number. Because an accident involving hazardous waste could create very serious problems, EPA regulations also require transporters to comply with procedures for hazardous waste spill cleanup.

The Permitting System

Treatment, Storage, and Disposal Facilities (TSDFs)

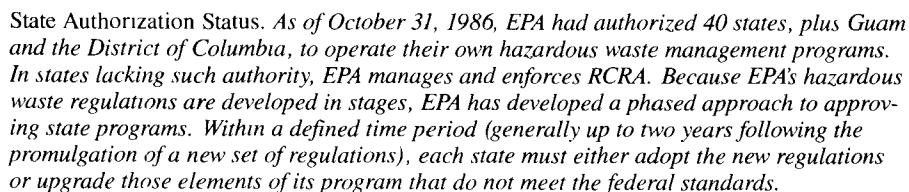
The treatment, storage, and disposal facilities that receive hazardous waste from the transporter are subject to an EPA permitting system that ensures their safe operation. *Treatment facilities* use various processes (see Inset) to alter the character or composition of a hazardous waste. Some treatment processes enable waste to be recovered and reused in manufacturing settings, while other treatment processes dramatically reduce the volume of waste to be disposed of. *Storage facilities* hold hazardous waste temporarily until it is treated or disposed of. Historically, most *disposal facilities* buried hazardous waste or piled it on the land.

Like generators and transporters, TSDFs must obtain an EPA identification number. They must also obtain a permit to operate. The permit system ensures that facilities meet the standards established by the RCRA program for proper waste manage-



A one-page manifest must accompany every waste shipment. The resulting paper trail documents the waste's progress through treatment, storage, and disposal. A missing form alerts the generator to investigate, which may mean calling in the state agency or EPA.

RCRA, like most federal environmental legislation, encourages states to develop and run their own hazardous waste programs as an alternative to direct EPA management. Thus, in a given state, the hazardous waste regulatory program described in this document may be run by the EPA or by a state agency. For a state to have jurisdiction over its hazardous waste program, it must receive approval from the EPA by showing that its program is at least as stringent as the EPA program. States that are authorized to operate RCRA programs oversee the hazardous waste tracking system in their state, operate the permitting system for hazardous waste facilities, and act as the enforcement arm in cases where an individual or a company practices illegal hazardous waste management. If needed, EPA steps in to assist the states in enforcing the law. EPA also acts directly to enforce RCRA in states that do not yet have authorized programs. EPA and the states currently act jointly to implement and enforce the regulations resulting from the 1984 RCRA amendments, however, most states soon will be assuming full responsibility for carrying out these newest sections of the EPA program.

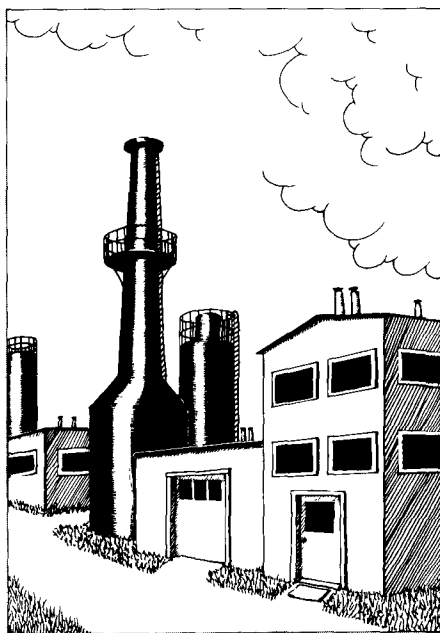


Selected Hazardous Waste Treatment Technologies

Biological treatment uses micro-organisms to degrade organic compounds in a waste stream.

Carbon adsorption is a process in which substances adhere to the surface of specially treated carbon. This method is particularly effective in removing organic compounds from waste liquids.

Dechlorination removes chlorine from a substance by chemically replacing it with hydrogen or hydroxide ions. This process is used to detoxify chlorinated substances.



Incineration

Incineration destroys or makes waste less hazardous through burning. Incineration is frequently used to destroy organic wastes.

Neutralization decreases the acidity or alkalinity of a substance by adding to it alkaline or acidic materials respectively.



Several processes exist for rendering hazardous wastes less hazardous. Neutralization, illustrated here, is the process of combining acidic and basic substances to produce a non-hazardous (or reduced hazard) substance.

Oxidation detoxifies a waste constituent by combining it with oxygen. This process is used to treat wastes such as cyanides, phenols, and organic sulfur compounds.

Precipitation removes solids from a liquid waste so that the hazardous solid portion can be disposed of safely.

Solidification and stabilization remove wastewater from a waste or change it chemically, thereby making it less permeable and less susceptible to transport by water.

ment. Many of these standards are designed to protect ground water (See Inset). For example, permitted TSDFs must:

- Analyze and identify wastes prior to treatment, storage, or disposal.
- Prevent the entry of unauthorized personnel into the facility by installing fences and surveillance systems and by posting warning signs.
- Periodically inspect the facility to determine if there are any problems.
- Adequately train employees.
- Prepare a contingency plan for emergencies and establish other emergency response procedures.
- Comply with the manifest system and with various reporting and recordkeeping requirements.
- Comply with technology requirements, such as installing double liners and leachate detection and collection systems.

Permits also contain requirements specific to the individual facility.

Approximately 4,000 hazardous waste TSDFs are currently authorized to operate under RCRA. Most of these facilities are operating under "interim status," which enables facilities that were in existence on November 19, 1980 and that meet certain technical requirements and standards for waste management to continue to operate until their permit applications are approved or denied. Congress established interim status in recognition of the fact that it would take many years for EPA and the states to issue permits. In order to continue to operate, facilities must receive final permits before October 1992.

Air emissions released during the treatment, storage, and disposal of hazardous

waste can present risks to human health and the environment. To control these emissions, EPA has established standards for hazardous waste incinerators and is developing standards to limit the emissions from all other hazardous waste treatment, storage, and disposal facilities. EPA will complete these new standards by late 1988.

As their capacity is used up and as new stringent operating requirements are imposed, many hazardous waste disposal facilities may decide to close. What happens to the facility after it closes is a long-term concern, with substantial health and environmental implications. For example, at Love Canal, disturbance of the hazardous waste landfill after the site had been closed caused the subsequent leakage of hazardous chemicals into the basements of nearby homes.

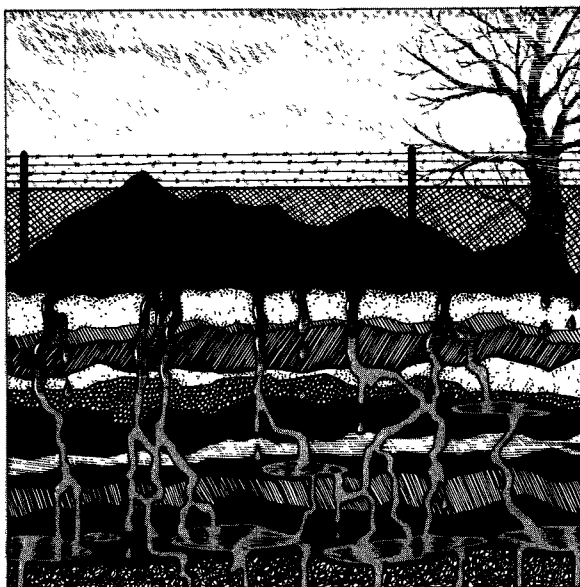
RCRA regulations are designed to prevent such tragedies by requiring TSDF owners to prepare carefully for the time when their facility will close. Owners must:

- Acquire sufficient financial assurance mechanisms (such as trust funds, surety bonds, or letters of credit) to pay for completion of all operations.
- Be prepared to pay for 30 years of ground-water monitoring, waste system maintenance, and security measures after the facility closes.
- Obtain liability insurance to cover third-party damages that may arise from accidents or waste mismanagement.

Land Disposal: Unacceptable Risks, Acceptable Alternatives

The tracking and permitting system for hazardous waste, from generation through treatment, storage, and disposal, applies to all hazardous waste, regardless of the disposal method employed. Most hazardous

Ground Water



What is it?

Ground water is water that naturally flows through and is stored in soil and rock bodies beneath the land. It is a major source of drinking water and of water used for agriculture in the United States. Almost half of this country's population depends upon ground water for some or all of its drinking water.

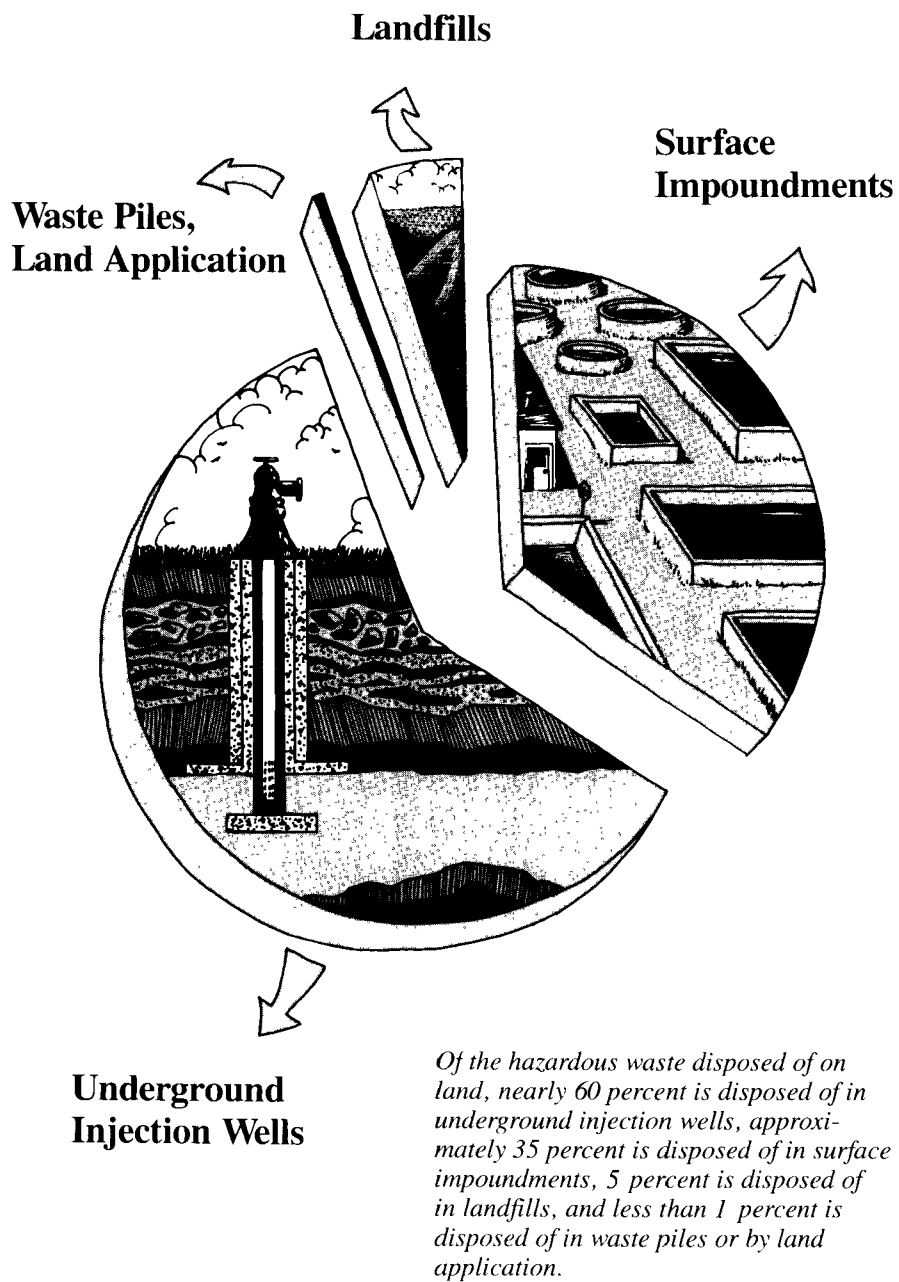
Contamination

Ground-water contamination can occur when liquids (usually rain-water) move through waste disposal sites and into the ground water, carrying pollutants with them. The resulting mixture of liquid and pollutant is called *leachate*; hazardous waste may leach through even well-designed and well-constructed disposal facilities and enter the soil or rock below. This waste may reach and contaminate ground water. Once

contaminated, ground water is expensive and difficult—sometimes impossible—to clean up.

Protection

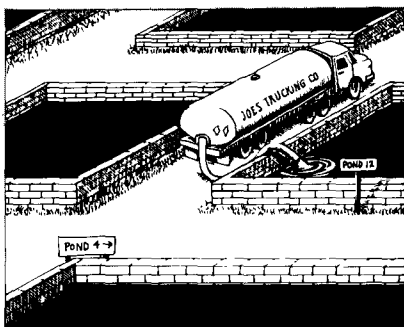
RCRA regulations require ground-water monitoring, which detects early signs of contaminants leaching from hazardous waste disposal facilities. The most common monitoring device is a well from which samples of water are taken and analyzed for hazardous constituents. A series of wells is installed at each disposal site. RCRA regulations also require hazardous waste landfill and surface impoundment facilities to install double liners to protect against ground-water contamination. Liners are continuous layers of natural or synthetic materials, such as clay or plastic, which restrict the downward or lateral escape of hazardous waste when placed beneath or on the sides of a landfill or surface impoundment.



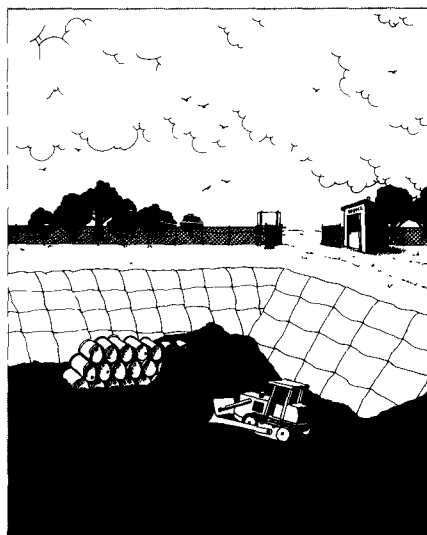
Types of Land Disposal

Landfills are disposal facilities where hazardous waste is placed in or on land. Properly designed and operated landfills are lined to prevent leakage and contain systems to collect potentially contaminated surface water run-off. Most landfills isolate wastes in discrete cells or trenches, thereby preventing potential contact of incompatible wastes.

Surface impoundments are natural or man-made depressions or diked areas which can be used to treat, store, or dispose of hazardous waste. Surface impoundments may be any shape and any size (from a few hundred square feet to hundreds of acres in area). Surface impoundments are often referred to as pits, ponds, lagoons, and basins.



Underground injection wells are steel- and concrete-encased shafts placed deep in the earth into which hazardous wastes are deposited by force and under pressure. Liquid hazardous wastes are commonly disposed of in underground injection wells.



In a landfill, hazardous waste is often covered with soil before a cover system is installed. EPA's RCRA regulations require stringent landfill design and construction features such as double liners and leachate collection systems.

Waste piles are noncontainerized accumulations of solid, nonflowing hazardous waste. While some are used for final disposal, many waste piles are used for temporary storage until the waste is transferred to its final disposal site.

Land treatment is a disposal process in which hazardous waste is applied onto or incorporated into the soil surface. Natural microbes in the soil break down or immobilize the hazardous constituents. Land treatment facilities are also called land application or land farming facilities.

waste—about 80 percent—has been disposed of into or on land at a variety of disposal locations including landfills, surface impoundments, waste piles, lagoons, and underground injection wells (see Inset). Improper land disposal practices in the past have endangered public health and the environment and continue to pose a threat, particularly to ground water.

Faced with these concerns, Congress in the 1984 RCRA amendments provided substantial new protection by mandating EPA to develop regulations to:

- Minimize wastes by reducing, recycling, and treating them.
- Ban unsafe, untreated wastes from land disposal.
- Require that land disposal facilities are designed, constructed, and operated according to stringent standards.
- Require corrective action for releases of hazardous waste into the environment.

Waste Reduction, Recycling, and Treatment

The 1984 RCRA amendments require hazardous waste generators to certify that they have taken steps to reduce the volume of hazardous waste they generate. Generators may reduce their waste volume in several ways: manufacturing process changes, source separation, recycling, raw material substitution, and product substitution (see Inset). In many cases, waste reduction can benefit industry by decreasing the costs of waste management. When companies produce less waste, their disposal costs are lower. Further, companies may sell recovered materials at a profit.

In addition to reducing the volume of waste generated, companies may treat waste

prior to disposal to reduce the waste volume or eliminate the waste's hazardous constituents. Several different types of treatment are available, involving physical, chemical, and/or biological processes (see Inset, page 19). One or more processes may be used, depending on the characteristics of the waste. Nearly all treatment processes produce residues that ultimately must be disposed of.

The land ban provisions of the 1984 RCRA amendments have given considerable impetus to the development of more economic and more effective means of treating waste. As a result, treatment technologies are being improved rapidly. EPA is now sponsoring research on new treatment technologies to destroy, detoxify, or incinerate hazardous waste; on ways to recover and reuse hazardous waste; and on methods to reduce the volume of hazardous waste requiring treatment or disposal (see Inset).



Banning Unsafe Wastes from Land Disposal

The 1984 RCRA amendments require EPA to examine all hazardous wastes to determine if any should be banned from land disposal. The amendments prohibit the

Approaches to Waste Reduction

- *Source separation* (or segregation) keeps hazardous waste from contaminating nonhazardous waste through management practices that prevent the wastes from coming into contact. This is the cheapest and easiest method of reducing the volume of hazardous waste to be disposed of, and is widely used by industry. In addition to reducing disposal costs, source separation reduces handling and transportation costs.
- *Recycling* (also referred to as recovery and reuse) is also widely used by industry. Recycling is the process of removing a substance from a waste and returning it to productive use. Generators commonly recycle solvents, acids, and metals.
- *Substitution of raw materials* may offer the greatest opportunity for waste reduction. By replacing a raw material that generates a large amount of hazardous waste with one that generates little or no hazardous waste, manufacturers can substantially reduce the waste volume.
- *Manufacturing process changes* consist of either eliminating a process that produces a hazardous waste or altering the process so that it no longer produces the waste.
- *Substitution of products* also may eliminate use of a hazardous material. For example, by substituting concrete posts for creosote-preserved wood posts in construction operations, builders can remove any possibility that the hazardous creosote will leach from the posts and contaminate underlying ground water or surrounding soil.

land disposal of untreated hazardous waste unless EPA finds that there will be "no migration of hazardous constituents . . . for as long as the wastes remain hazardous." Waste that is determined not to pose a health or environmental threat may continue to be disposed of on land.

Establishing Standards for Treatment. If a waste is banned from land disposal, it must be treated and rendered less hazardous before it can be disposed of on the land. EPA is currently establishing treatment standards for banned wastes. These standards must specify a level or method of treatment which substantially reduces the toxicity or mobility of the hazardous con-

stituents so as to minimize long-term threats to human health and the environment. EPA is examining treatment technologies that meet this requirement and is basing treatment standards on the "best demonstrated available technology."

Meeting a Tight Schedule. The 1984 RCRA amendments set strict deadlines for determining whether wastes should be banned from land disposal and for developing treatment standards. EPA must complete its determination for dioxins and certain solvents—wastes of particular concern to the Agency and the public—by November 1986. By July 1987, EPA must make decisions about the so-called "California list" wastes, which include

liquid hazardous wastes containing certain metals, cyanides, PCBs, halogenated organic compounds, or acidic wastes. By August 1988, EPA must assess one-third of all other hazardous wastes; by June 1989, EPA must assess another one-third of all other hazardous wastes; and by May 1990, EPA must complete its assessment of all hazardous wastes.

If EPA fails to meet the deadline for any waste, that waste will automatically be banned from land disposal. Some hazardous wastes may continue to be disposed of on land for up to two years past the assessment deadline if EPA determines that sufficient or adequate treatment technology is not available to make the waste safe for land disposal. This is essentially a grace period that provides limited extra time for industry to develop acceptable treatment technologies or capacity. However, if sufficient treatment is still unavailable after two years, those wastes will be banned from land disposal unless, on a case-by-case basis, the Agency has granted a variance during the construction of new treatment capacity. EPA may grant up to two one-year extensions of the ban's effective date if contractual commitments for construction of treatment capacity exist and there is no suitable alternative capacity.

Stringent Standards for Land Disposal Facilities

RCRA standards for the operation of land disposal facilities have become increasingly stringent in response to the growing concern about adverse environmental impacts. While RCRA regulations strongly discourage land disposal of most hazardous wastes, it is very likely that there always will be some wastes that must be disposed of on land. The 1984 RCRA amendments provide several new restrictions and standards for land disposal facilities to ensure more thorough protection of

the environment, particularly ground water. These include:

- Banning liquids from landfills.
- Banning underground injection of hazardous waste within ¼-mile of a drinking water well.
- Requiring more stringent structural and design conditions for landfills and surface impoundments, including two or more liners, leachate collection systems above and between the liners, and ground-water monitoring.
- Requiring cleanup or corrective action if hazardous waste leaks from a facility.
- Requiring information from disposal facilities on pathways of potential human exposure to hazardous substances.
- Requiring location standards that are protective of human health and the environment, for example, allowing disposal facilities to be constructed only in suitable hydrogeologic settings.

Corrective Action Requirements for Hazardous Waste Releases

The 1984 RCRA amendments require that all Subtitle C facilities take corrective action for any release of hazardous waste or constituents into the environment. To enforce this requirement, the amendments provide a new type of administrative order that enables EPA or an authorized state to require corrective action (such as repairing liners or pumping to remove a plume of contamination at a facility) when there has been a release. EPA or the state may require corrective action beyond the facility boundary. They also may require corrective action regardless of when waste was placed at the facility. Thus, this mechanism may be used to clean up past problems. The 1984 RCRA amendments also require that Subtitle C facilities provide financial assurance that they can complete the corrective action.

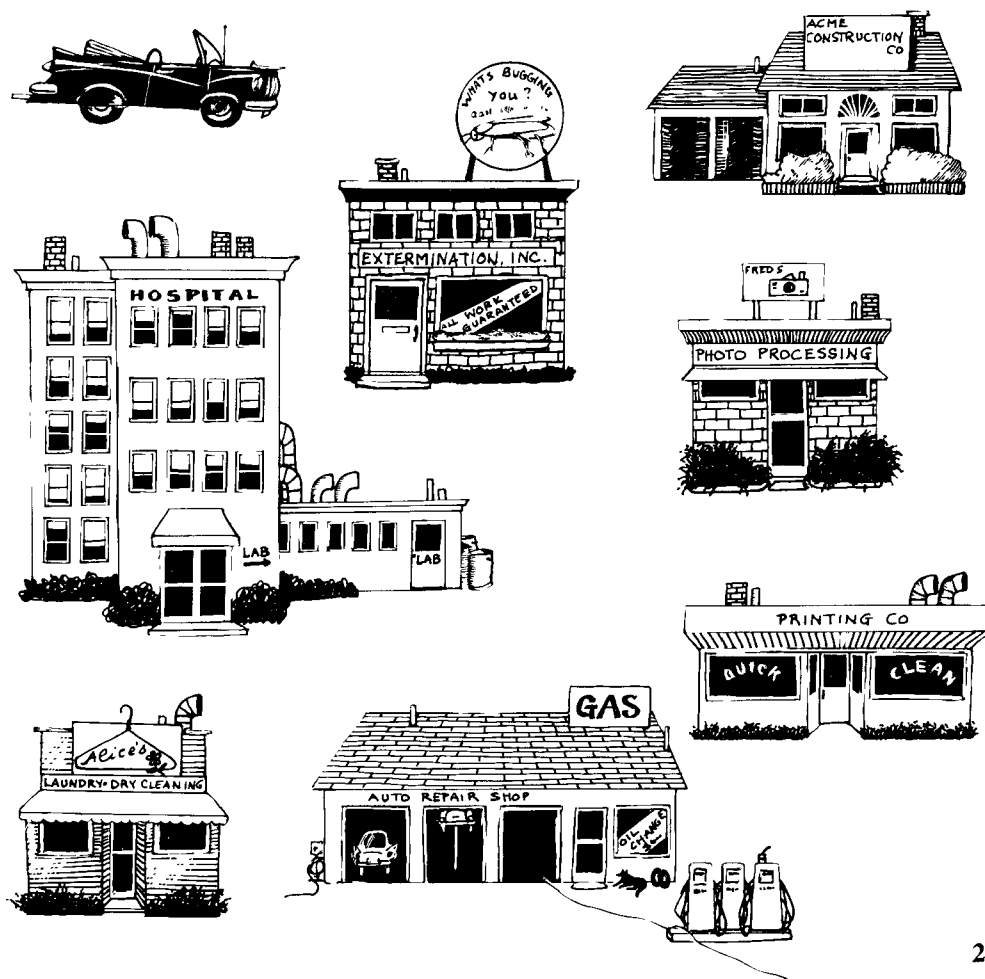
Expansion of the RCRA Program

Small Quantity Generators

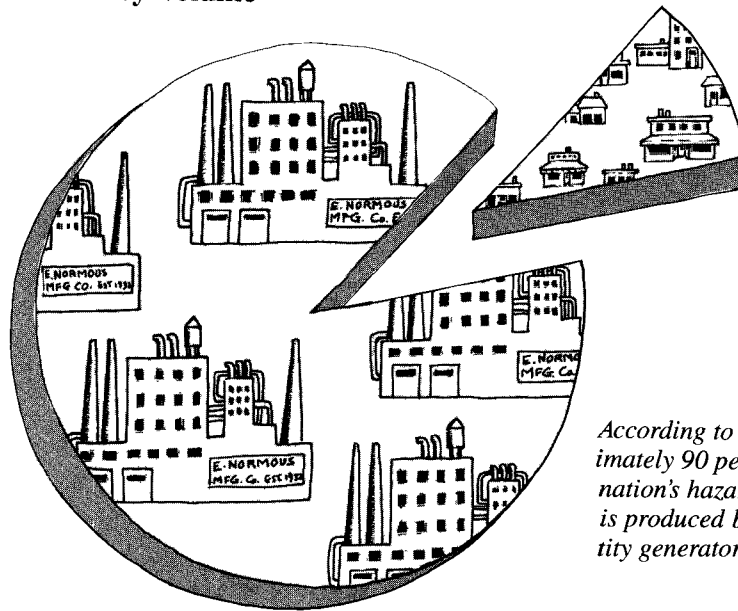
When EPA first issued hazardous waste regulations under RCRA, the Agency focused on those companies that generated the largest amounts of waste—more than 2,200 pounds (or about five full 55-gallon drums) per month. This regulated community included about 15,000 companies that produced approximately 90 percent of the nation's hazardous waste. "Small quantity generators"—businesses that generate less than 2,200 pounds (1,000 kilograms) of

hazardous waste in a calendar month—were exempted from most of the federal hazardous waste requirements. Some states had more stringent regulations that did cover small quantity generators.

In the 1984 RCRA amendments, Congress closed this gap by requiring EPA to regulate those small quantity generators who produce between 220 and 2,200 pounds (100 to 1,000 kilograms) of hazardous waste in a calendar month. There are about 100,000 of these 220 to 2,200 pounds per month generators, including businesses such as vehicle repair shops, metal manufacturing and finishing opera-

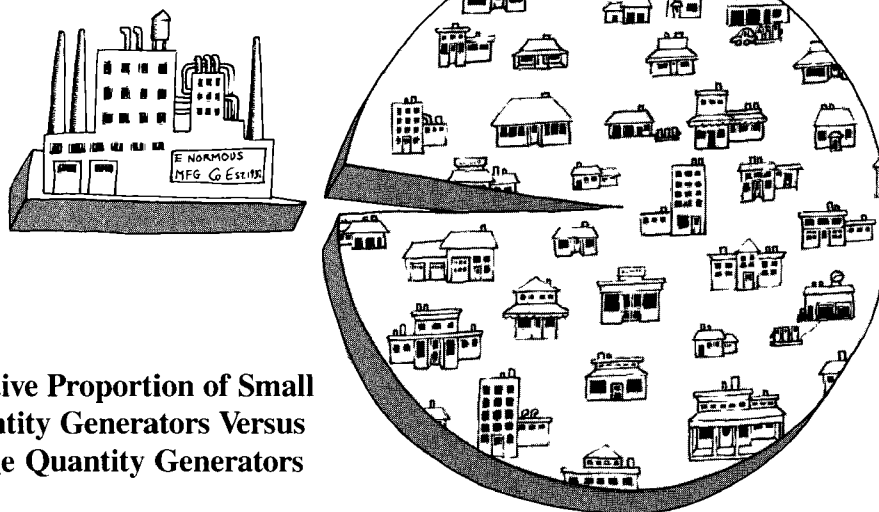


Percentage of Hazardous Waste Generated by Volume



According to EPA, approximately 90 percent of the nation's hazardous waste is produced by large quantity generators . . .

. . . However, these generators constitute only about 2 percent of the companies covered by RCRA. The remaining 98 percent are small quantity generators.



Relative Proportion of Small Quantity Generators Versus Large Quantity Generators

tions, laboratories, printers, laundries, and dry cleaners. "Conditionally-exempt" generators—businesses that generate less than 220 pounds per month—will remain exempt from most of the hazardous waste requirements.

Effective September 22, 1986, 220 to 2,200 pounds per month generators must meet most of the key requirements of the RCRA program for hazardous waste management. For example, they must:

- Obtain an EPA identification number.
- Use the fully completed manifest when shipping waste offsite.
- Use only hazardous waste transporters and authorized facilities with EPA identification numbers to transport, treat, store, or dispose of their hazardous wastes.
- Not store hazardous waste on site for longer than 180 days (270 if the waste is to be shipped more than 200 miles) without a permit.

To assist small businesses in understanding and complying with RCRA, EPA has developed guidance publications on the new requirements, including industry-specific assistance on completing the manifest form.

Underground Storage Tanks

In the South Bay area of San Francisco, California, leaks and spills of toxic solvents from underground tanks and their associated piping systems have severely contaminated the ground water. On the other side of the country, in the small community of Truro on Cape Cod, Massachusetts, residents discovered their drinking water wells were contaminated with gasoline that had leaked from a nearby underground storage tank. The courts ordered the company responsible to provide resi-



dents with bottled water and to spend millions of dollars to restore the water supply. Thousands of other communities across the country are facing similar problems. These problems have focused national attention on the issue of leaking underground storage tanks.

Both accidental releases and the slow seepage of toxic chemicals or petroleum products from buried storage tanks can contaminate ground water. Most of the single-wall steel tanks in the ground eventually corrode and leak. Nearly one-quarter of the estimated 1.5 million underground storage tanks (excluding farm and heating oil tanks) in the United States that contain hazardous substances or petroleum products are either leaking now or are expected to leak in the next five years. These facts led Congress, in the 1984 RCRA amendments, to require EPA to regulate underground tanks containing hazardous substances and petroleum products.

Assessing the Problem—UST Notification. Prior to the 1984 amendments, only a few states had programs to monitor underground storage tanks (USTs). Therefore, one of the first steps in the new EPA program is to require tank owners to notify and register their tanks with state or local

agencies. The notification form asks owners to specify the tank's age, size, type, location, and uses. To assist in this effort, the EPA's UST program requires anyone who deposits petroleum or regulated hazardous substances in an underground storage tank—for example, the driver of the gasoline tank truck who refills the storage tanks at local gasoline service stations—to inform the tank owner of his or her responsibilities to fill out a notification form.

Preventive Measures and Future Regulations. To prevent leakage due to corrosion, RCRA regulations require that new tanks feature certain construction precautions.



EPA's RCRA regulations require that new underground storage tanks meet highly protective construction and installation standards.

For example, underground tanks cannot be installed unless the material used to construct the tank or its lining is compatible with the substance to be stored. Tank

owners also must show that they are financially able to take corrective action if a leak occurs and to compensate anyone who is injured or whose property is damaged by a leak. EPA is currently developing regulations for leak detection, leak prevention, recordkeeping, tank closure, reporting, and corrective action in case a leak occurs. In addition, EPA is developing new tank performance standards and regulations for approving state programs.

Informing the Public. EPA is developing an extensive public outreach program to communicate with all sectors affected by the UST regulations. EPA is also working closely with the states to develop the UST program and to gather information from the industrial community on the potential dangers and remediation techniques for leaking tanks.

Burning of Hazardous Waste and Used Oil Fuel Mixtures

In the past, facilities often mixed hazardous waste or used oil with fuels to increase the heating value of the fuels and to reduce the costs of waste disposal. When burned, fuels containing used oil contaminated with toxic constituents or hazardous waste may emit toxic fumes and can cause fires and explosions. In one incident, residents



of a building in New York City complained of respiratory problems, headaches, nausea, and digestive problems. An investigation revealed that a fuel blending facility had mixed hazardous wastes containing PCBs and chlorinated solvents with the building's heating fuel supply. Incidents such as this prompted Congress to require EPA to regulate the burning of hazardous waste and used oils.

Prior to 1986, utilities, industries, commercial facilities, schools, government institutions, and apartment and home owners across the country burned about 1 to 2 million tons of hazardous wastes and about 500 to 600 million gallons of used oils per year for energy recovery purposes. Used oils include automotive crankcase oil and oils used in industrial processes. Used oils are often contaminated with toxic metals (such as arsenic, cadmium, chromium, and lead) and chlorinated organic compounds (such as cleaning solvents).

EPA's RCRA regulations now prohibit non-industrial facilities, such as homes and apartment buildings, from burning hazardous waste fuel or used oil that contains significant levels of hazardous contaminants. In addition, EPA requires all producers, distributors, and marketers of contaminated used oil fuel to place a label on the bill of sale indicating that the fuel is subject to EPA regulation. Marketers and burners of contaminated used oil fuel also must notify EPA of their activities, obtain EPA identification numbers, and keep certain records. Facilities that burn or blend hazardous waste fuel also must comply with these notification and recordkeeping requirements, comply with hazardous waste storage and facility standards, and fill out a manifest form if they ship the waste fuel. In the future, EPA plans to regulate the burning of hazardous waste and used oil in boilers and industrial furnaces.

Solid Waste Disposal Facilities

Solid wastes covered under Subtitle D of RCRA are primarily nonhazardous. The 227,000 solid waste disposal facilities regulated under Subtitle D fall into four general categories: landfills, surface impoundments, land application facilities, and waste piles. Currently, EPA has minimum requirements—also referred to as criteria—for Subtitle D facilities. These criteria are designed to:

- Protect endangered species, food crops, ground water, surface water, air, and floodplains.
- Prevent disease transmission.
- Ensure the safety of employees and nearby residents.

Facilities must comply with the criteria or EPA classifies them as “open dumps,” which must close or upgrade their operations.

EPA currently is considering whether the existing criteria for Subtitle D facilities are adequate to protect ground water from contamination. EPA also is exploring various mechanisms for further regulating solid waste disposal facilities. One approach being considered is a flexible permitting process that would enable each permit to include site-specific environmental considerations. EPA is also exploring ways to extend the useful life of municipal landfills and to better utilize sites that are already filled or closed. Approaches being considered include reducing waste volume and landfilling waste more efficiently. Both approaches would allow a larger volume of waste to be disposed of per unit volume of landfill.

About 36,000 of the 227,000 Subtitle D solid waste disposal facilities accept household hazardous waste and waste from small quantity hazardous waste generators. The

Making RCRA Work

Monitoring

For EPA's RCRA program to substantially reduce the adverse effects caused by hazardous waste, all regulated groups must comply. To ensure compliance, program personnel inspect and monitor facilities and take enforcement measures when necessary.

One of the program's most important monitoring tools is the site inspection, which is required of all treatment, storage, and disposal facilities at least once every two years. During an inspection, regulatory personnel review the company's records, take waste samples, and assess the facility's operating methods. In particular, inspectors check for compliance with ground-water monitoring requirements, proper handling and labeling of wastes, and assurance of financial responsibility. If a facility is not complying with the RCRA regulations, EPA or the state takes enforcement action.

Enforcement

Enforcement may include civil and criminal penalties, orders to correct the violations, fines, and/or imprisonment. For minor violations, EPA or the state agency often lets the facility know, through a letter or phone call, that it is not in compliance and that legal actions will be taken if the owner does not comply within a certain time period. For severe or recurrent violations, EPA or the state can levy a penalty of up to \$25,000 per day for each day the facility fails to comply past the specified deadline. EPA or the state can also suspend the facility's permit to operate or bring a criminal suit against a facility. Examples of potential criminal violations of RCRA include falsifying information on a manifest, report, or permit, or transporting a waste

either without a manifest or to a facility without a permit. Fines of \$250,000 per person or \$1 million per corporation can be assessed in these cases.

Citizen Action and Participation

Citizen participation is vital to solving the hazardous waste problem. RCRA and its 1984 amendments provide ongoing opportunities for public participation in all facets of implementation, enable citizens to take legal action against any individual or group involved in the mismanagement of hazardous waste, and require that citizens be notified about hazardous waste issues. RCRA includes provisions that:

- Citizens have access to information obtained by EPA or the states during a facility inspection.
- Citizens are allowed to participate in the permitting process from the beginning.
- Citizens may bring suits against anyone whose hazardous waste management activities may constitute an imminent hazard or substantial endangerment.
- Citizens may bring suits against anyone who may be violating a RCRA permit, standard, or requirement.
- EPA or the state must notify local officials and post a sign at sites that pose an imminent and substantial threat to human health and the environment.

Coordinating Environmental Laws

RCRA is one of a series of laws regulating hazardous substances in the environment (see Inset). These laws were developed at various points in time and reflect concerns about particular issues such as ground-water protection, water quality, air quality, or worker safety. Some laws address the same hazardous substances at different points in their existence. For example,



RCRA may regulate the disposal of a particular hazardous waste, while the Occupational Safety and Health Act protects workers who are exposed to that same substance in the workplace. Because the concerns addressed by these laws sometimes overlap, EPA works with the states and other federal agencies to help ensure that all aspects of environmental protection are well coordinated. EPA, in conjunction with other federal and state agencies, also attempts to identify and address areas not covered by existing laws.

Public participation is key to successful implementation of EPA's RCRA program. Through public hearings and meetings, citizens have an opportunity to voice concerns and take an active role in shaping the future of the nation's hazardous waste management policies and directions.

Looking Ahead

The management of hazardous waste is a continually evolving process, reflected in research and technology development, new regulations, and amendments to the law. Since RCRA was enacted in 1976, we have seen substantial progress in solving perhaps the most difficult environmental problem facing the nation. The climate for productive future action is promising. Public interest in the problems associated with hazardous waste has steadily increased over the past several years and is likely to remain high. Scientific knowledge and technical capabilities will continue to grow with time. As our experience and expertise increase, many issues will require further attention, including:

- *Increasing the Nation's Capacity for Treating Waste.* Efforts must be made to increase the treatment capacity of existing facilities and to encourage the construction of new facilities.
- *Encouraging New and Improved Waste Control Technologies.* More comprehensive, efficient, and inexpensive technologies are required to render hazardous waste nonhazardous and to reduce its volume.

RCRA is a response to a complex environmental problem—one that is intimately connected to the way our country operates, its heavy reliance on industrial production, and our technologically sophisticated lifestyles. As long as we demand the products that generate these wastes, we will need well-designed and well-operated facilities and sound alternatives for waste management. Technological change, population expansion, and economic growth will present new environmental challenges. The cooperation and participation of industry, government, and the public will ensure that these challenges are met.

Environmental Laws Controlling Hazardous Substances

- *Clean Air Act* (EPA)—regulates the emission of hazardous air pollutants.
- *Clean Water Act* (EPA)—regulates the discharge of hazardous pollutants into the nation's surface waters.
- *Marine Protection, Research, and Sanctuaries Act* (EPA)—regulates waste disposal at sea.
- *Occupational Safety and Health Act* (U.S. Occupational Safety and Health Administration)—regulates hazards in the workplace, including worker exposure to hazardous substances.
- *Resource Conservation and Recovery Act* (EPA)—regulates hazardous waste generation, storage, transportation, treatment, and disposal.
- *Safe Drinking Water Act* (EPA)—regulates contaminant levels in drinking water.
- *Toxic Substances Control Act* (EPA)—regulates the manufacture, use, and disposal of chemical substances.
- *Hazardous Materials Transportation Act* (U.S. Department of Transportation)—regulates the transportation of hazardous materials.
- *Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)* (EPA)—provides for the cleanup of inactive and abandoned hazardous waste sites.
- *Atomic Energy Act* (Nuclear Regulatory Commission)—regulates nuclear energy production and nuclear waste disposal.
- *Surface Mining Control and Reclamation Act* (U.S. Department of the Interior)—regulates the environmental aspects of mining (particularly coal) and reclamation.

State Hazardous Waste Agencies

ALABAMA

Alabama Department of Environmental Management
Land Division
1751 Federal Drive
Montgomery, AL 36130

ALASKA

Department of Environmental Conservation
Air and Solid Waste Management
Pouch O
Juneau, AK 99811

AMERICAN SAMOA

Environmental Quality Commission
Government of American Samoa
Pago Pago, American Samoa 96799

ARIZONA

Arizona Department of Health Services
Office of Waste and Water Quality Management
2005 North Central Avenue
Phoenix, AZ 85004

ARKANSAS

Department of Pollution Control and Ecology
Solid and Hazardous Waste Division
P.O. Box 9583
8001 National Drive
Little Rock, AR 72219

CALIFORNIA

Department of Health Services
Toxic Substances Control Programs
714 P Street
Sacramento, CA 95814

State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95801

California Waste Management Board
1020 Ninth Street, Suite 300
Sacramento, CA 95814

COLORADO

Colorado Department of Health
Waste Management Division
4210 E. 11th Avenue
Denver, CO 80220

COMMONWEALTH OF NORTHERN MARIANA ISLANDS

Division of Environmental Quality
Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

CONNECTICUT

Department of Environmental Protection
Hazardous Material Management Unit
State Office Building
165 Capitol Avenue
Hartford, CT 06106

Connecticut Resource Recovery Authority
179 Allyn Street, Suite 603
Professional Building
Hartford, CT 06103

DELAWARE

Department of Natural Resources and Environmental Control
Solid Waste Management Branch
P.O. Box 1401
Dover, DE 19903

DISTRICT OF COLUMBIA

Department of Consumer and Regulatory Affairs
Pesticides and Hazardous Waste Materials Division
5010 Overlook Avenue, S.W.
Washington, DC 20032

FLORIDA

Department of Environmental Regulation
Solid and Hazardous Waste Section
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32301

GEORGIA

Land Protection Branch
Industrial and Hazardous Waste Management Program
Floyd Towers East
205 Butler Street, S.E.
Atlanta, GA 30334

GUAM

Guam Environmental Protection Agency
P.O. Box 2999
Agana, Guam 96910

HAWAII

Department of Health
Environmental Health Division
P.O. Box 3378
Honolulu, HI 96801

IDAHO

Department of Health and Welfare
Bureau of Hazardous Materials
450 West State Street
Boise, ID 83720

ILLINOIS

Environmental Protection Agency
Division of Land Pollution Control
2200 Churchill Road
Springfield, IL 62706

INDIANA

State Board of Health
Division of Land Pollution Control
1330 West Michigan Street
Indianapolis, IN 46206

IOWA

U.S. EPA Region VII
Hazardous Materials Branch
726 Minnesota Avenue
Kansas City, KS 66101

KANSAS

Department of Health and Environment
Bureau of Waste Management
Forbes Field, Building 321
Topeka, KS 66620

KENTUCKY

Cabinet for Natural Resources and
Environmental Protection
Department of Environmental Protection
Division of Waste Management
Ft. Boone Plaza, Building #2
18 Reilly Road
Frankfort, KY 40601

LOUISIANA

Office of Solid and Hazardous Waste
Hazardous Waste Division
Department of Environmental Quality
P.O. Box 44307
Baton Rouge, LA 70804

MAINE

Department of Environmental Protection
Bureau of Oil and Hazardous Materials Control
State House Station #17
Augusta, ME 04333

MARYLAND

Maryland Waste Management Administration
Office of Environmental Programs
Department of Health and Mental Hygiene
201 W. Preston Street
Baltimore, MD 21201

MASSACHUSETTS

Department of Environmental Quality
Engineering
Division of Solid and Hazardous Waste
One Winter Street
Boston, MA 02108

MICHIGAN

Environmental Protection Bureau
Hazardous Waste Division
Box 30028
Lansing, MI 48909

MINNESOTA

Pollution Control Agency
Solid and Hazardous Waste Division
1935 West County Road B-2
Roseville, MN 55113

MISSISSIPPI

Department of Natural Resources
Bureau of Pollution Control
Division of Solid and Hazardous Waste
Management
P.O. Box 10385
Jackson, MS 39209

MISSOURI

Department of Natural Resources
Waste Management Program
117 East Dunklin Street
P.O. Box 1368
Jefferson City, MO 65102

MONTANA

Department of Health and Environmental
Sciences
Solid and Hazardous Waste Bureau
Cogswell Building
Helena, MT 59620

NEBRASKA

Department of Environmental Control
Hazardous Waste Management Section
State House Station
P.O. Box 94877
Lincoln, NE 68509

NEVADA

Department of Conservation and Natural
Resources
Division of Environmental Protection
Waste Management Program
Capitol Complex
201 South Fall Street
Carson City, NV 89710

NEW HAMPSHIRE

Department of Health and Welfare
Division of Public Health Services
Office of Waste Management
Health and Welfare Building
Hazen Drive
Concord, NH 03301

NEW JERSEY

Department of Environmental Protection
Division of Waste Management
32 E. Hanover Street, CN-027
Trenton, NJ 08625

NEW MEXICO

Health and Environment Department
Environmental Improvement Division
Groundwater and Hazardous Waste Bureau
P.O. Box 968
Santa Fe, NM 87504-0968

NEW YORK

Department of Environmental Conservation
Division of Solid and Hazardous Waste
50 Wolf Road
Albany, NY 12233

NORTH CAROLINA

Department of Human Resources
Division of Health Services
Solid and Hazardous Waste Management
Branch
P.O. Box 2091
Raleigh, NC 27602

NORTH DAKOTA

Department of Health
Division of Hazardous Waste Management and
Special Studies
1200 Missouri Avenue
Box 5520
Bismarck, ND 58502-5520

OHIO

Ohio EPA
Division of Solid and Hazardous Waste
Management
361 East Broad Street
Columbus, OH 43215

OKLAHOMA

Oklahoma State Department of Health
Waste Management Service
P.O. Box 53551
1000 N.E. 10th Street
Oklahoma City, OK 73152

OREGON

Department of Environmental Quality
Hazardous and Solid Waste Division
P.O. Box 1760
Portland, OR 97207

PENNSYLVANIA

Pennsylvania Department of Environmental
Resources
Bureau of Solid Waste Management
P.O. Box 2063
Harrisburg, PA 17120

PUERTO RICO

Environmental Quality Board
P.O. Box 11488
Santurce, Puerto Rico 00910-1488

RHODE ISLAND

Department of Environmental Management
Solid Waste Management Program
204 Cannon Building
75 Davis Street
Providence, RI 02908

SOUTH CAROLINA

Department of Health and Environmental
Control
Bureau of Solid and Hazardous Waste
Management
2600 Bull Street
Columbia, SC 29201

SOUTH DAKOTA

Department of Water and Natural Resources
Office of Air Quality and Solid Waste
Foss Building
Pierre, SD 57501

TENNESSEE

Tennessee Department of Public Health
Division of Solid Waste Management
701 Broadway
Customs House
Nashville, TN 37219-5403

TEXAS

Texas Department of Health
Bureau of Solid Waste Management
1100 West 49th Street, T-601A
Austin, TX 78756-3199

Texas Water Commission
Hazardous and Solid Waste Division
1700 North Congress
P.O. Box 13087, Capitol Station
Austin, TX 78711

UTAH

Department of Health
Bureau of Solid and Hazardous Waste
Management
P.O. Box 45500
State Office Building
Salt Lake City, UT 84140

VERMONT

Agency of Environmental Conservation
Waste Management Division
State Office Building
Montpelier, VT 05602

VIRGIN ISLANDS

Department of Conservation and Cultural
Affairs
P.O. Box 4399, Charlotte Amalie
St. Thomas, Virgin Islands 00801

VIRGINIA

Virginia Department of Health
Division of Solid and Hazardous Waste
Management
Monroe Building
101 North 14th Street
Richmond, VA 23219

WASHINGTON

Department of Ecology
Solid and Hazardous Waste Management
Division
Mail Stop PV-11
Olympia, WA 98504

WEST VIRGINIA

Division of Water Resources
Solid and Hazardous Waste/Ground Water
Branch
1201 Greenbrier Street
Charleston, WV 25311

West Virginia Department of Natural Resources
1800 Washington Street, East
Charleston, WV 25305

WISCONSIN

Department of Natural Resources
Bureau of Solid Waste Management
P.O. Box 7921
Madison, WI 53707

WYOMING

Department of Environmental Quality
Solid Waste Management Program
122 West 25th Street
Herschler Building
Cheyenne, WY 82002