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Solid Waste Facts

A Statistical Handbook

EPA is charged by Congress to protect the Nation's land, air and water systems. Under a mandate of national environmental laws focussed on air and water quality, solid waste management and the control of toxic substances, pesticides, noise and radiation, the Agency strives to formulate and implement actions which lead to a compatible balance between human activities and the ability of natural systems to support and nurture life.

This publication is a compilation of solid waste facts prepared by the Office of Solid Waste Management, U.S. Environmental Protection Agency. It is designed to provide basic data and statistical information on solid waste and its management, including Federal, State and local efforts.

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Overview

Volume of Solid Waste

Municipal solid waste (residential, commercial and institutional sources) amounted to about 130 million metric tons in 1976, enough to fill the New Orleans Superdome from floor to ceiling, twice a day, weekends and holidays included. Per capita generation amounts to 1,300 pounds a year. By 1985, the yearly total is projected to increase to 180 million tons.

Industrial waste generation is estimated at 344 million metric tons a year, with a growth rate of 3 percent per year. EPA estimates that 10-15 percent of industrial wastes will be classified as hazardous under the hazardous waste regulatory program.

Municipal wastewater treatment at 18,000 plants results in 5 million tons (dry weight) of sludge per year; the amount is expected to double in the next 8 to 10 years due to higher levels of treatment.

By 1985, flue gas cleaning equipment will be installed on 100,000 megawatts of power. Over 120 million metric tons of wet sludge will have to be disposed of annually, enough to cover an area of over 27 square kilometers (10 sq. mi) more than 2.7 meters (9 feet).

Agricultural wastes and mining wastes each amount to billions of tons yearly.

How the Wastes Are Being Managed

Municipal solid waste

About 227,000 people are employed in management of municipal solid waste, according to a 1973 study. About three-quarters of them are needed for collection of the waste. Slightly over half the work force is employed by private contractors, the rest by municipal and county agencies.

Direct costs of municipal solid waste collection and disposal are estimated to be \$30 per ton, or over \$4 billion a year in 1976.

Solid waste collection is a hazardous occupation; collection workers suffer injuries at 4 times the rate for all industry. Individual agencies report injury costs in excess of \$1,000 per man-year.

Municipal solid waste is disposed of on 18,500 sites covering a total of 500,000 acres, according to the 1976 EPA report to Congress on the effects of waste disposal on ground water.

Industrial and hazardous waste

Seventy to 80 percent of industrial waste is currently disposed of on the generator's property.

Surface impoundments for industrial waste total more than 100,000.

There are approximately 100 commercial facilities available for disposal of hazardous waste; studies indicate that their current capacity may be only 50 percent utilized given the availability of "cheap" alternatives.

Expenditures by industry for hazardous waste disposal is estimated at \$155 million annually, according to EPA studies.

Municipal sludge

About 25 percent of the municipal sludge generated is being landfilled, 25 percent is being spread on land surfaces (mainly agricultural land), 15 percent is disposed of in the ocean, and 35 percent is incinerated.

Municipal sludge disposal sites on land total about 23,000.

Costs of managing and disposing of municipal sludge are estimated to total \$635 million annually.

Effects on Health and the Environment

Among the various problems observed to result from inadequately managed disposal of waste on land, degradation of ground water is of greatest concern. Once polluted, an aquifer may not be usable as a drinking water source for decades. At present about half the U.S. population is served by ground water.

Numerous instances of ground-water contamination by leachate from waste disposal sites have been documented. For example, of 50 industrial waste sites evaluated by an EPA contractor in 1977, 43 showed migration of hazardous constituents into ground water.

Ground water contamination is the most common mechanism involved in documented cases of damage from hazardous waste disposal. Other major routes are: surface water contamination by runoff from disposal sites; air pollution via open burning, evaporation, sublimation, and wind erosion; poisoning through direct contact or via the food chain; and fire and explosions.

Up to 90 percent of industrial hazardous waste is being disposed of by the same methods that have produced the damages documented to date.

In addition to pollution of water and air, problems at municipal solid waste disposal sites have included gas explosions, breeding of rats and flies, odors, litter, and traffic congestion. These problems can be avoided or controlled in the siting, design, and operation of disposal facilities.

The spreading of municipal sludge on agricultural land, if uncontrolled, poses a threat to public health

The Resource Conservation and Recovery Act

The Basic Objectives of RCRA

Improved practices in solid waste disposal to protect public health and environmental quality.

Regulatory control of hazardous waste from generation through disposal.

Establishment of resource conservation as the preferred solid waste management approach.

RCRA Provides the Following Means to Achieve These Objectives

Grants are authorized to State and local governments to develop their solid waste management programs: In fiscal year 1978, grants to states totalled \$14.3 million.

A Technical Assistance Panels program is required to assist State and local governments with their solid waste problems by making available panels of personnel consisting of Federal, State, and local employees and consultants. Requests for such assistance are being handled by the Regional Offices.

Regulations and guidelines are being developed to set standards for hazardous waste management and for all land disposal facilities. Guidelines for State programs, for citizen participation, and for procurement of goods containing recycled materials are also required by the Act.

EPA has authority to operate and enforce the hazardous waste regulatory program in States that do not establish an authorized program.

Research, development, and demonstrations are authorized to expand knowledge and technology relating to land disposal, hazardous waste management, and resource conservation.

The interagency Resource Conservation Committee is mandated to study and report on policies and proposals affecting resource conservation.

Public participation is required in the development of all regulations, guidelines, and programs under the Act; public education and information programs are also required to promote public understanding of the issues and enable constructive participation. Over 100 public meetings have been held to solicit public comment on RCRA issues, and educational programs are being sponsored around the country.

EPA Strategy in Implementing the Law Over the Next 5 Years Will Emphasize

Controlling waste disposal through hazardous waste regulation, land disposal provisions, and development of State programs.

Encouraging resource conservation through development of economic incentives, State and regional programs, and research, development, demonstrations, and evaluations.

Focusing priority attention on disposal of industrial wastes, because of their relatively greater toxicity and greater quantity; programs related to municipal wastes will be able to proceed more rapidly, however, due to already existing knowledge and institutional framework.

Maximizing State assumption of RCRA authorities through Federal assistance, regulations, guidelines, and public support.

Appropriations for EPA Activities Under RCRA (in millions)

Office	1977	1978	1979*
Office of Solid Waste	\$ 8.2	\$14.7	\$11.6
Regional Offices	1.8	2.2	7.1
Office of Research and Development	4.2	7.6	10.9
Office of Enforcement	0.1	1.0	1.1
Grants to States	2.9	14.3	26.2
Grants for resource recovery	—	—	15
Total	\$17.3	\$39.8	\$71.9

*Requested in the President's Budget

State Programs and RCRA

State government budgets for solid waste management totalled an estimated \$28 million in 1977. (EPA solid waste grants that year totalled \$3 million.)

There are now about 1,000 employees in State solid waste management programs, compared with fewer than 10 in 1965.

All States have some authority over disposal of municipal solid waste and should be able to move aggressively into the regulation of such disposal to meet RCRA requirements.

Many States have enacted legislation for regulation of hazardous waste in recent years. We expect 30-35 States to qualify for "interim authorization" to regulate hazardous waste in lieu of EPA.

Few States currently have authority over the disposal of sludges or industrial solid waste.

Few States have a resource conservation and recovery program; we would expect all States to have some form of a program in FY-1980.

Hazardous Waste Management

EPA Philosophy for Regulating Hazardous Waste

Hazardous wastes include reactive, corrosive, ignitable, infectious, radioactive, and toxic wastes. (Specific criteria are now under development.)

The desired management options are (in order of desirability):

- Reduce the generation of hazardous waste
- Separate out and concentrate hazardous waste
- Utilize the waste
- Destroy in special incinerators or detoxify and neutralize
- Disposal in secure landfills

Hazardous waste must be regulated from creation through final disposal ("cradle to grave") to assure that all of it is safely managed.

Regulation will close off indiscriminate disposal and stimulate use and expansion of hazardous waste management facilities.

Generators of Hazardous Waste

Major generators among the 15 industries EPA has studied in detail are:

(Million tons per year)

Primary metals	8.3	Textiles	1.8
Organic chemicals	6.7	Petroleum refining	1.8
Electroplating	5.3	Rubber and plastics	0.8
Inorganic chemicals	3.4	Mics. (7 sectors)	0.7
Total			28.8

Ten States generate 65 percent of hazardous waste; these States are: Texas, Ohio, Pennsylvania, Louisiana, Michigan, Indiana, Illinois, Tennessee, West Virginia, and California.

Technology Options and Costs

Environmentally adequate technology options are feasible for treatment and disposal of hazardous wastes; their costs are substantially above those of inadequate practices (open dumping). Costs vary according to type and volume of waste handled.

	Cost per ton
Secure chemical landfill	\$30-55
Incineration (land-based)	75-265 (110 typical)
Landspreading	2-25 (6 typical)
Chemical fixation	10-30
Physical, chemical, biological treatment	Variable

Increased waste management costs to industry as a result of the hazardous waste regulations may amount to \$800 million a year, according to early EPA forecasts (current hazardous waste disposal costs is estimated at \$155 million per year). The affected industries have gross annual sales of about \$154 billion.

Federal Regulatory Program

Seven sets of regulations and guidelines are being developed under subtitle C, RCRA:

Identification and listing of hazardous waste

(Section 3001)

Standards for generators

(Section 3002)

Standards for transporters

(Section 3003)

Standards for facilities

(Section 3004)

Permit regulations

(Section 3005)

Guidelines for States

(Section 3006)

Notification system

(Section 3010)

Cradle-to-grave control via manifests and reporting is the keystone of the program; only permitted sites may receive hazardous wastes. EPA anticipates 25,000 permit applications nationally.

State Hazardous Waste Programs

EPA anticipates 30-35 States will apply and qualify for "interim authorization" to operate the program in lieu of EPA. Such authorization allows 2 years for upgrading the State program to standards for full authorization.

For "full authorization," State programs must be equivalent to the Federal program, consistent with other State and Federal programs, and provide for adequate enforcement.

EPA must operate the program in any State not gaining authorization.

State and Federal costs for implementing the program are expected to total about \$20 million a year.

FY-79 grants to States specifically for hazardous waste program development are expected to total \$15 million.

Public Aversion To Waste Processing and Disposal Facilities—a Key Problem

Local opposition to establishment of waste management facilities is a major obstacle not only for hazardous waste management but for solid waste management in general. Such opposition has often blocked siting that was desirable from environmental and economic viewpoints.

Several States and a number of localities have imposed bans and restrictions on the movement of waste into their jurisdictions. Restrictions on the movement of hazardous waste have caused especially difficult problems—many of the specialized facilities equipped to handle certain hazardous wastes must serve large areas in order to be economically viable.

Assurance of improved management of waste and incorporation of public education and participation measures should affect public attitudes, but whether they will reduce opposition enough to permit all the well-justified sitings that are needed is uncertain.

Land Disposal

The Criteria and Their Scope

EPA criteria for solid waste disposal facilities, now being developed under Section 4004 of RCRA, will define environmentally acceptable disposal.

Because of the broad definitions of "solid waste" and "disposal" in RCRA, the criteria will apply to almost all wastes and all forms of disposal on land, including dumps, landfills, land-spreading of sludge, and surface impoundments (pits, ponds, lagoons).

Main concerns are:

- Protection of the quality of ground water, surface water, and the air
- *Protection of environmentally sensitive areas, such as wetlands*
- Prevention of adverse health effects from spreading sludge on land used for food-chain crops
- Prevention of safety hazards and breeding of disease vectors

The Inventory Process To Identify Open Dumps

All land disposal sites (estimated at over 150,000) will be evaluated against the criteria by the States with Federal financial and technical aid.

These evaluations will result in an inventory of sites that fail to meet the criteria (open dumps).

The evaluations must be thorough since they may serve as the basis for enforcement actions. The total inventory process is expected to take much longer than the 1 year originally envisioned in RCRA.

Eliminating the Open Dumps

Open dumps are to be closed or upgraded within a reasonable time after the inventory (not to exceed 5 years) in accordance with State-established compliance schedules. States must implement this program to eliminate open dumps in order to continue eligibility for Federal financial aid for their solid waste management programs.

States are expected to establish the regulatory powers necessary to bring about the closing or upgrading of open dumps.

Enforcement actions may also result from suits brought by private citizens; citizen suits are authorized by RCRA. Furthermore, the law allows the EPA Administrator to intervene through the courts upon receipt of evidence that an imminent hazard exists due to solid waste management practices.

In addition to financial aid, the Federal role includes technical assistance, guidelines, development of improved methods, and promotion of public education and participation.

In order to overcome local opposition to the establishment of disposal facilities, development of public understanding and support will have to be an essential part of the effort to upgrade land disposal.

EPA's preliminary estimate of the additional costs to industry, municipalities, etc., of complying with the expected criteria and with existing State standards affecting land disposal (such as ground water protection laws) is \$1.7 billion a year (37 percent would be attributable to the criteria; 63 percent to State standards).

Resource Conservation

Resource Recovery

Resource recovery is being implemented primarily because cities badly need an alternative to land disposal due to local opposition to landfills and lack of available land.

Only 7 percent of the municipal solid waste stream was being recovered as of 1977:

- Six percent was recovered through source separation, the setting aside of recyclable material at the point of generation. Paper accounts for 90 percent of source-separated material.
- One percent was converted into energy.

Energy Recovery

Potential recovery of energy from municipal solid waste in urban areas is equivalent to:

- 400,000 barrels of oil per day, or
- Nation's commercial and residential lighting needs, or
- One-third the flow of the Alaskan pipeline

Progress in implementing resource recovery facilities:

	1972	1978	1985
Number of 1,000 tons-per-day equivalents	2	18	40-70
Population served (millions)	1	9	20-35
Percent of waste stream processed	0.5	3	10-15

Percent of solid waste converted to energy by country (1977):

Denmark	60	Germany	20
Switzerland	40	England	10
Netherlands	30	United States	1
Sweden	30		

Energy recovery technology is available to support a significantly greater rate of implementation in this country; however, there is limited commercial experience and, thus, technological risk. The four types of systems of greatest interest currently are:

- Waterwall combustion: the concept has been proven in over 200 plants in Europe and Japan; it is attracting rapidly growing interest here.
- Refuse-derived fuel: successfully demonstrated in the United States, but market reluctance is slowing implementation.
- Small modular incinerators: a promising approach to energy recovery suitable for very small communities.
- Codisposal of sewage sludge and municipal solid waste: the practice is prevalent in Europe and appears to be technically and economically feasible in this country.

Facility Locations

Locations of major U.S. resource recovery facilities:

Refuse-derived fuel

Ames, Iowa
Baltimore County, Md.
Bridgeport, Conn.*
Chicago, Ill.*
Lane County, Oreg.*
Milwaukee, Wis.*
Monroe County, N.Y.*

Small modular incinerators

Blytheville, Ark.
Crossville, Tenn.
Groveton, N.H.
North Little Rock, Ark.
Siloam Springs, Ark.

Waterwall combustion

Akron, Ohio*
Braintree, Mass.*
Chicago, Ill.†
Hempstead, N.Y.*
Nashville, Tenn.*
Niagara Falls, N.Y.*
Norfolk, Va. (USN)
Portsmouth, Va.
Saugus, Mass.

Codisposal

Duluth, Minn.*
Franklin, Ohio
Harrisburg, Penn.*

Economics of Resource Recovery

A rule of thumb is that, on the average, resource recovery costs from \$8 to \$15 a ton, a few dollars more than sanitary landfilling costs. However, resource recovery is competitive with landfilling in some locations, and is implemented out of necessity in others.

Typical capital cost for a 1,000-tons-per-day plant is \$25 to \$25 million.

Institutional factors related to planning and implementing resource recovery are a major barrier to implementation.

Source Separation

Source separation accounts for 90 percent of materials recovery from solid waste:

- Recycling centers number about 3,000.
- Curbside collection of recyclable materials is practiced in 215 cities (multimaterial—40 cities; paper only—175 cities).
- Curbside newspaper collection may grow to 400 programs by 1985.
- Recycling programs are concentrated in the north-east and California.

Municipal waste materials recycling rates (1976):

	<u>Percent</u>
Paper	18
Aluminum cans	25
Ferrous cans	3
Glass containers	1

To create a "demand pull" for recycled materials, RCRA requires Federal agencies to procure items containing the highest percentage of recycled materials practicable, effective October 1978. State and local governments and contractors must also meet this requirement in purchasing with Federal funds. EPA is developing guidelines on how to comply with this requirement.

Source separation of office paper is rapidly growing due to 1976 EPA guidelines:

- Impact of guidelines on Federal agencies:

	1975	1977	1980 projections
Buildings	Less than 25	90	500
Employees	No involvement	114,000	500,500

- Savings amounting to about \$7 million per year are expected to result from wastepaper recovery from Federal facilities.
- Roughly 15 State governments and many private firms are also carrying out office wastepaper recovery.

Deposits on beverage containers could help maximize recovery of materials from municipal solid waste and greatly reduce litter.

Magnetic separation of ferrous metals is technically and economically practical. Mechanical separation of glass and aluminum are under development. Feasibility of glass recovery is questionable.

Reuse

Used lubricating oil is a potential resource and a potential hazard. Rerefining the oil for reuse as lubricant is the most energy-conserving method of utilizing the oil. About 10 percent of waste lube oil is being rerefined in this country, compared with about 50 percent reported for the European Economic Community. Unless properly managed, waste oil can cause environmental and health hazards; the lead content is of particular concern.

Industrial waste exchanges or clearinghouses are promoting awareness and use of waste materials among industries: one factory's waste can be another factory's raw material. About 17 waste exchanges have been established recently in the United States, stimulated by rising costs of materials and waste management.

EPA Role

Provide resource conservation as an alternative to disposal through:

- Technical assistance
- Financial assistance for State and local planning and implementation
- Development of economic incentives through the Resource Conservation Committee, which is studying beverage container deposits, product disposal charges, litter taxes, and other policies
- Research, development, demonstrations, and evaluations of technologies and systems for resource conservation

If you have suggestions, questions, or requests for further information, they may be directed to your nearest EPA Regional public information office.

EPA Region 1 • JFK Federal Bldg. • Boston MA 02203 • Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont • 617-223-7210

EPA Region 2 • 26 Federal Plaza • New York NY 10007 • New Jersey, New York, Puerto Rico, Virgin Islands • 212-264-2525

EPA Region 3 • 6th and Walnut Streets • Philadelphia PA 19106 • Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia • 215-597-9814

EPA Region 4 • 245 Courtland Street NE • Atlanta GA 30308 • Alabama, Georgia, Florida, Mississippi, North Carolina, South Carolina, Tennessee, Kentucky • 404-881-4727

EPA Region 5 • 230 S. Dearborn • Chicago IL 60604 • Illinois, Indiana, Ohio, Michigan, Wisconsin, Minnesota • 312-353-2000

EPA Region 6 • 1201 Elm Street • Dallas TX 75270 • Arkansas, Louisiana, Oklahoma, Texas, New Mexico • 214-767-2600

EPA Region 7 • 1735 Baltimore Avenue • Kansas City MO 64108 • Iowa, Kansas, Missouri, Nebraska • 816-374-5493

EPA Region 8 • 1860 Lincoln Street • Denver CO 80203 • Colorado, Utah, Wyoming, Montana, North Dakota, South Dakota • 303-837-3895

EPA Region 9 • 215 Fremont Street • San Francisco CA 94105 • Arizona, California, Nevada, Hawaii, Guam, American Samoa, Trust Territories of the Pacific • 415-556-2320

EPA Region 10 • 1200 Sixth Avenue • Seattle WA 98101 • Alaska, Idaho, Oregon, Washington • 206-442-1220