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Solid Waste and Emergency Response

EPA

The Waste System

U.S. Environmental Protection Agency
Office of Solid Waste and
Emergency Response

FOREWORD

In June 1987, The Hazardous Waste System report was issued by the Office of Solid Waste and Emergency Response. The primary focus of the report was on hazardous waste as defined in the Resource Conservation and Recovery Act (RCRA) and the Superfund program.

This report serves as an update to the original report. In addition to providing new information on the current hazardous waste system, the report includes a discussion of solid waste issues as well as several upcoming regulations and policies not previously discussed.

We hope that this report will serve as a starting point for consideration of hazardous and solid waste management issues as well as focusing on areas that may arise in the reauthorization of the Hazardous and Solid Waste Amendments.

J. Winston Porter
Assistant Administrator

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EXHIBITS

EXECUTIVE SUMMARY

This report provides an overview of the country's waste system. Included are descriptions of the sources and quantities of hazardous and solid wastes and the system for management, treatment, storage, and disposal (TSD) of these wastes. In addition, a discussion of upcoming regulatory efforts and other potential impacts on the waste system is provided in this report. It is hoped that this information will increase public and regulatory awareness of the cross-media implications of waste management practices.

Several functions are served by this report.

First, the report provides an overview of the hazardous and solid waste system. It serves as a beginning reference document for a more detailed study of the report topics at a later date. Information contained in this report can be supplemented by referring to the documents listed in the Bibliography.

Second, the report serves as a starting point for the 20 year state hazardous waste capacity assurance efforts currently being undertaken by states in accordance with the requirements of the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Third, the report offers an integrated approach to waste management that addresses the treatment, storage, and disposal of both hazardous and solid waste.

Fourth, the report provides an initial vehicle for discussion of possible impacts of various EPA regulatory efforts currently underway with respect to hazardous and solid waste.

Finally, the question of whether there is, in fact, a "capacity problem" is addressed in a very preliminary way.

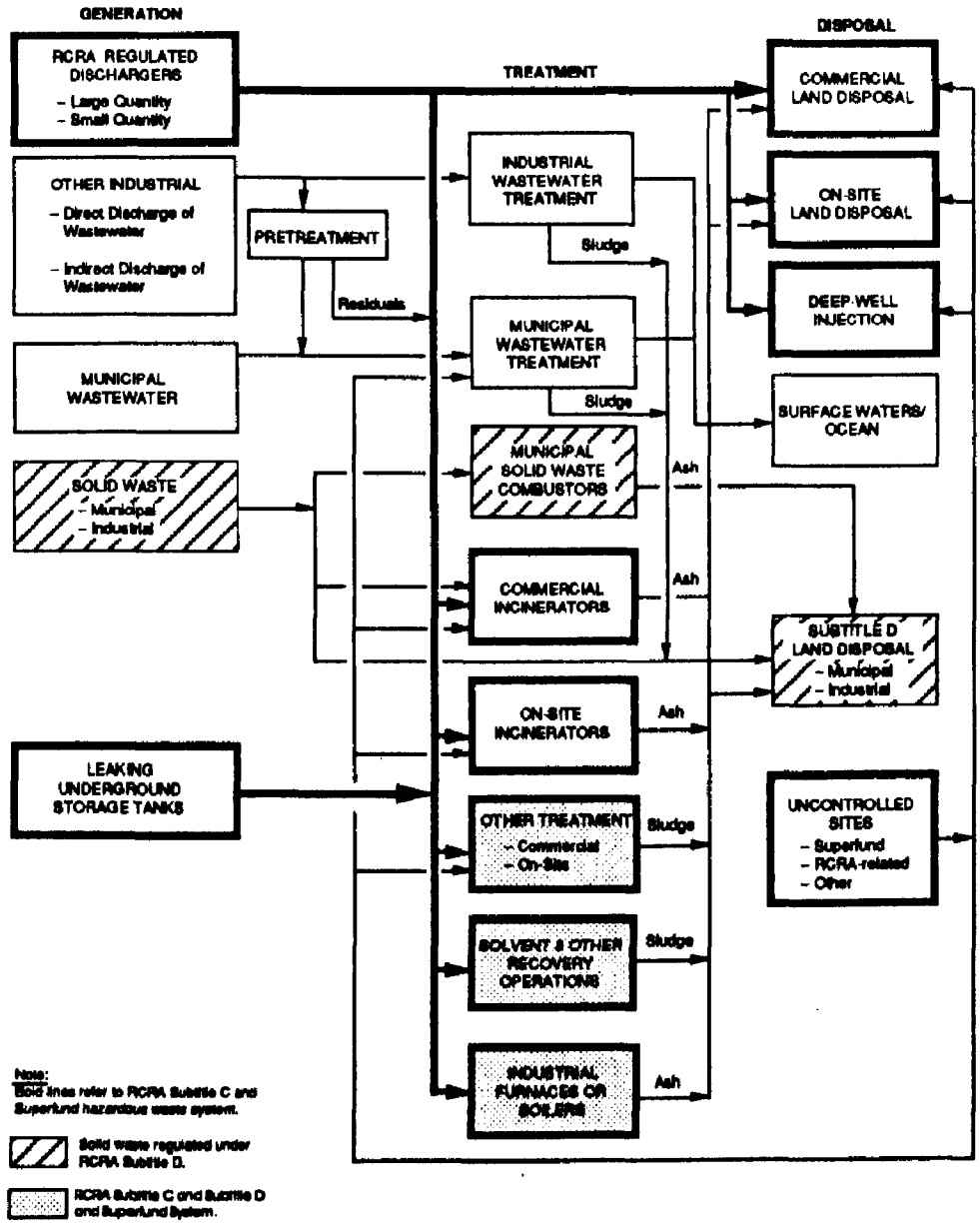
Rather than looking at waste issues from a single medium perspective, this report examines these issues through an integrated framework for addressing environmental problems.

The primary focus of this report is hazardous and non-hazardous solid waste as defined in the Resource Conservation and Recovery Act (RCRA) and by the Superfund program. However, the waste system does not exist in isolation. It is important to note that regulation of non-hazardous solid waste differs from regulation of hazardous solid waste. Non-hazardous solid waste is managed in accordance with Subtitle D of RCRA, while hazardous solid waste is managed in accordance with Subtitle C of RCRA. Further, Superfund regulates releases of "hazardous substances," which can encompass both hazardous and non-hazardous solid waste. These distinctions are explained in more detail in the body of the report. For purposes of this report, solid wastes that are defined as hazardous wastes under Subtitle C of RCRA are referred to as "hazardous waste," and non-hazardous wastes under Subtitle D of RCRA are referred to as "solid waste."

An overview of the waste system is provided in Exhibit 1, the Waste System Chart. RCRA and Superfund wastes are highlighted by bold lines. The chart illustrates the relationships among such items as hazardous wastes, municipal and industrial wastewaters, and non-hazardous solid wastes. This chart focuses attention on "where things go" in the waste management process. By implication, this chart also demonstrates the various waste system processes that can be affected by regulatory changes.

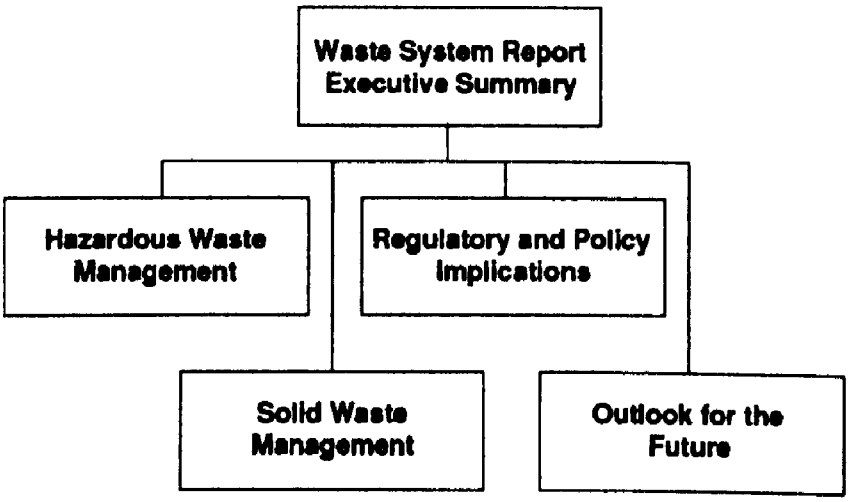
It is important to note that Exhibit 1 serves as an overview of the waste management system and is not intended to deal with every source or possible exposure route of wastes or toxic substances. For example, hazardous air emissions, pesticide applications, and many "non-point" sources of pollution are not included in Exhibit 1. These sources and others such as wastes discharged to surface waters through a National Pollutant Discharge Elimination System (NPDES) permit are not discussed in detail in this report. However, these wastes could be added to updated versions of this report.

Exhibit 1. Simplified Waste System Chart



Each section of the report is shown below in Exhibit 2, and is briefly summarized in the following paragraphs. More detail is provided in subsequent report sections.

Exhibit 2. Sections of Waste System Report



HAZARDOUS WASTE MANAGEMENT

The amount of hazardous waste managed under RCRA totaled about 275 million metric tons (MMT) in 1985. The overwhelming majority of this waste, well over 99 percent, was managed by "large quantity generators" who produced 1,000 kilograms or more of this waste per month.

Referring again to the bold print portion of Exhibit 1, about 96 percent of all RCRA hazardous waste is managed at the facility where the waste was generated (e.g., on-site). The remaining 4 percent goes to off-site commercial treatment and disposal facilities. An approximate breakdown of the hazardous waste treatment and disposal system follows in Exhibit 3.

Exhibit 3. Volumes of RCRA Hazardous Waste Treated and Disposed

	On-Site at Private Firms (MMT)	Off-Site at Commercial Firms (MMT)	Estimated Total (MMT)
Incineration	1.7	0.4	2.1
Other Treatment	204.0	1.6	205.6
Solvent & Other Recovery	*	*	57.0
Furnaces and Boilers	*	*	0.9
Land Disposal	8.0	5.0	13.0
Deep-Well Injection	*	*	~25.0
Total			303.6**

SOURCE: National Screening Survey, U.S. EPA, Office of Solid Waste (1986).
*Breakdown of on-site versus off-site waste volumes is not currently available.
**Total exceeds 275 MMT as deep-well injection, which is covered under the Safe Drinking Water Act, is included.
MMT=million metric wet tons per year.

Exhibit 3 relates to about 3,000 facilities which treat, store or dispose of RCRA hazardous waste. There are currently over 175 on-site incinerators and 16 commercial incinerators. A list of commercial incinerators is contained in Appendix A of this report. In addition to incineration, there are many other treatment practices including biological wastewater treatment, solidification, steam stripping, and treatment impoundments. Most current treatment systems consist of on-site impoundments handling relatively dilute wastewaters. There are about 320 operating land disposal facilities, approximately 49 of which are commercial facilities which accept a wide range of wastes. Appendix B of this report contains a list of commercial operating land disposal facilities. Finally, while the majority of deep-well injection systems are located on-site, a few commercial facilities also use deep-well injection systems. These facilities are identified in Appendix C of this report.

SOLID WASTE MANAGEMENT

Non-hazardous solid waste, as defined under RCRA, consists of many diverse types of wastes including municipal solid waste, municipal sewage sludge, industrial and commercial "non-hazardous" waste, as well as some semisolid and liquid wastes.

Presently, there are approximately 227,000 Subtitle D solid waste disposal units which receive solid waste not regulated as hazardous waste under Subtitle C for treatment, storage, disposal, or recycling. These facilities include surface impoundments, municipal sewage sludge land application units, and landfills. Treatment and disposal practices for solid wastes include incineration, recycling, source reduction, and landfilling. Currently, approximately 6,000 landfills are in operation. However, many of these landfills are in the process of closing or are nearing capacity.

REGULATORY AND POLICY IMPLICATIONS

Waste management practices are constantly changing due to the effect of new and proposed statutory and regulatory requirements. Some of the more significant regulations and policies affecting waste management are briefly outlined below. Innovative and alternative technologies are increasingly being considered to manage hazardous and solid wastes.

Land Disposal Restrictions

The Hazardous and Solid Waste Amendments of 1984 (HSWA) require EPA to ban the land disposal of over 400 hazardous chemicals and waste streams unless the wastes are treated, or it can be demonstrated that there will be no migration from the disposal unit as long as the wastes remain hazardous. EPA has recently published land disposal restrictions for some of these wastes. By 1990, EPA will have published regulations implementing land disposal restrictions for all RCRA wastes. At this time, it is difficult to estimate the effect these rules may have on the demand for additional treatment capacity.

HSWA further established minimum technology standards that require changes in the way new and existing landfills and surface impoundments are constructed and operated.

Pollution Prevention Policy

EPA strongly favors preventing the generation of waste rather than controlling it after it is generated. EPA's pollution preven-

tion program focuses on two main goals: to foster the use of waste minimization through technology and information exchange, and to report to Congress in 1990 on the need for regulations on pollution prevention.

A significant reduction in waste volume should be possible through process changes, product substitution, recycling and "good housekeeping" practices. Concerns over economic and liability issues are already driving firms to reduce the volume and toxicity of the wastes they produce. A number of states have aggressive waste minimization programs. EPA intends to continue encouraging such programs.

Deep-Well Injection Regulation

A large amount of dilute hazardous waste (about 20-35 MMT per year) is disposed of via deep-well injection. Most deep-well systems are located on-site and wastes are disposed of at the site where they are generated.

EPA regulations became effective in August 1988 which restrict specific hazardous wastes from deep-well injection. These wastes include certain solvents, dioxins, "California List" wastes and first third wastes. However, two year variances were granted for the underground injection of some of these wastes due to insufficient incineration capacity to handle these wastes. More wastes will be restricted in 1989 and 1990 as remaining land disposal restrictions come into effect.

Domestic Sewage Sludge Regulation

Under the Clean Water Act, municipalities are required to treat wastewater before discharging it to surface waters. This treatment process generates sludge which must be used or disposed. Very large amounts of non-hazardous sludge are produced each year. The overwhelming majority of this sludge is landfilled or applied to the land. RCRA contains an exclusion for mixtures of hazardous wastes and domestic sewage passing through a sewer to a publicly owned treatment works (POTW) for treatment. The EPA is scheduled to propose regulations on domestic sewage sludge by April 1989.

Ocean Incineration Regulation

In the early 1980s, EPA proposed regulations that would have allowed bulk liquid organic hazardous waste to be burned at sea. However, EPA suspended this program in February 1988. The extent to which ocean incineration is used in the future will depend upon need, cost and environmental considerations.

Ocean Dumping/Disposal Regulation

In November 1988, Congress passed legislation that establishes a framework for ending ocean disposal of sewage sludge and industrial waste by December 31, 1991. The Agency is currently in the process of developing proposed regulations, which are scheduled for publication in the Federal Register in late 1989.

Medical Wastes

Very recently, public attention has been dramatically focused on problems posed by unregulated medical wastes. Congress has responded by amending MPRSA and the CWA and by passing the Medical Waste Tracking Act of 1988 (MWTA). The amendments to MPRSA and the CWA pertain to ending the disposal of medical wastes into territorial seas and internal waters of the U.S. The MWTSA requires EPA, by May 1, 1989, to list medical wastes to be covered by a program to track listed medical wastes from point of generation to point of disposal.

Subtitle D Regulations

RCRA Subtitle D establishes a framework for managing non-hazardous solid waste. This framework includes voluntary implementation of solid waste management plans combined with minimum technical standards established by EPA for new and existing solid waste management facilities. EPA strongly supports state planning activities for the reduction of solid waste volume.

EPA proposed new criteria for municipal solid waste landfills in August, 1988. This criteria established engineering controls and

monitoring requirements for improved landfill operation. Currently, EPA is examining the status of municipal waste combustion ash as well as high volume, low toxicity special wastes such as mining waste.

Corrective Action Regulations

Corrective action involves taking corrective measures to address RCRA facilities which have been contaminated from solid waste management units. Leaking underground storage tanks are another potentially large universe for corrective action.

The volume of contaminated soils and sludges generated from corrective action cleanups could be large. While most of the waste will likely be treated and disposed of on-site, some concentrated wastes may require off-site handling. These wastes will compete for existing commercial incineration and land disposal capacity.

The EPA is currently preparing proposed corrective action regulations. In addition, the Agency is looking into state capability to implement corrective action requirements.

Superfund Off-Site Policy and Clean-up Standards

The Superfund Amendments and Reauthorization Act of 1986 (SARA) establishes standards for Superfund clean-up actions and identifies the conditions for disposing of Superfund wastes off-site. The impact of these provisions could change the proportions of hazardous wastes managed on-site and off-site. For example, new clean-up standards could increase the use of mobile treatment units and stabilization techniques to manage wastes on-site. Some of the more concentrated wastes will likely shift off-site for treatment and disposal.

Furthermore, the off-site disposal provisions of SARA restrict where Superfund wastes can be taken. Only those off-site facilities which are in compliance with RCRA and the Toxic Substances Control Act (TSCA) or other applicable Federal require-

ments and applicable state requirements are eligible to accept wastes from Superfund sites. In addition, the unit receiving Superfund wastes must not be releasing any hazardous wastes or hazardous constituents. In addition, releases from other units at the facility must be controlled by a corrective action program. Several Superfund sites have experienced difficulties locating a commercial facility eligible to accept their wastes. However, these situations have been resolved in relatively short periods of time as other facilities come into compliance with the off-site requirements.

Emergency Planning and Community Right-To-Know (Title III)

The Emergency Planning and Community Right-to-Know Act, created under Title III of SARA, focuses on improving public awareness of the presence and release of hazardous and toxic chemicals in the community. Title III applies to all chemicals present at a facility in amounts greater than the threshold quantity established for each chemical under Title III. Four sections of Title III are scheduled to be implemented in accordance with a phased schedule containing emergency planning provisions, emergency notification requirements, right-to-know reporting requirements, and toxic chemical release reporting requirements. The information obtained from the Title III reporting requirements will be used to improve the emergency response planning efforts of state and local governments.

Redefinition of RCRA Hazardous Waste

Currently, a waste is defined as hazardous under RCRA if it possesses certain characteristics or is listed in Subpart D, Part 261 of the Code of Federal Regulations (40 CFR). About half of RCRA hazardous waste possesses one of the four characteristic attributes: reactive, ignitable, corrosive, or EP toxic. The other half of the wastes are "listed" hazardous wastes.

In early 1987, EPA began examining alternative methods for defining RCRA hazardous waste. EPA is considering the use of

such criteria as waste concentration and management practices to define such wastes. Although no significant change in the definition of RCRA hazardous waste is foreseen in the immediate future, EPA is continuing its investigation of these alternative methods.

Superfund State Capacity Assurance Plans

SARA provides that EPA shall not provide remedial actions within any state unless that state assures that it has adequate hazardous waste treatment and disposal capacity for hazardous wastes generated in the state for the next twenty years. EPA is currently developing a guidance document to assist states in preparing capacity assurance plans.

OUTLOOK FOR THE FUTURE

It is highly likely that the hazardous and solid waste system of tomorrow will be different than the one of today. Regulatory impacts, costs of waste disposal, liability considerations, regional capacity constraints, and waste minimization efforts are already affecting waste management practices.

A number of factors could affect the volumes of wastes generated in the future. Factors such as economic and population growth will influence the amount of waste produced annually. As industrial production increases, the volume of industrial wastes produced could also increase. However, efforts to recycle and reuse wastes, as well as programs to minimize the amount of waste generated, are likely to temper increases in waste volumes.

As a result of the regulatory and other factors discussed above, a number of general observations about the waste management system become apparent.

- First, there will be increasing restrictions on land disposal without some type of treatment.

- Second, hazardous waste treatment and disposal will steadily increase in cost.

- Third, it will be important that the impacts of new regulations are carefully examined to ensure that additional problems are not created.

Having made these observations, let's briefly look at the initial implications that can be drawn from information provided in this report. These implications serve as a starting point in identifying national priorities as well as focusing on issues of concern to regions and states. The initial implications of the report are summarized below.

- First, more facilities are needed to incinerate certain hazardous wastes. This need is likely to increase as SARA's remedial action provisions and RCRA's corrective action and land disposal restriction programs are implemented.

- Second, a better understanding of on-site hazardous waste management activities is required. With 96 percent of all RCRA hazardous wastes managed on-site, it is important to understand and deal with likely industry responses to the various regulatory and other impacts.

- Third, waste management capacity is largely a regional and waste-specific issue. Some states and regions have inadequate capacity and must ship their wastes to other areas of the country. Since wastes can move freely in interstate commerce, it will be difficult to "tie down" specific capacity shortfalls.

- Fourth, EPA fully supports the concept of pollution prevention through waste minimization, recycling and reuse programs. It is far better to reduce the generation of hazardous and solid waste than manage waste after it is created.

- Fifth, there is a recognized need to site and permit new

hazardous and solid waste management facilities and to expand existing units. This is an important part of planning for the future. The 20 year state capacity assurance requirement in SARA is a major step in encouraging states to develop new capacity.

- Sixth, innovative and alternative technologies need to be developed to improve current waste management practices. Waste management techniques must continually respond to implement these new practices.

- Finally, integrated waste management planning is vital to ensure that hazardous and solid wastes are managed effectively.

This report provides a "big picture" look at emerging hazardous and solid waste issues. It offers a framework for strategic planning at the national, regional, and state levels. Furthermore, Exhibit 1 provides a conceptual tool for qualitatively evaluating the interrelationships among various parts of the waste system. However, for assessing the needs for regional or waste specific capacity, more detailed information is required than is presented in this report.

The information contained in this report is based on existing EPA surveys and studies as well as in-person interviews with several major hazardous waste generators and treatment and disposal facility operators. Some data are better than others, and not all data are comparable. At the conclusion of several on-going EPA and other studies, more detailed information on hazardous and solid waste generation, treatment, and disposal will be available.

SECTION 1

HAZARDOUS WASTE MANAGEMENT

In 1985, about 275 million metric tons (MMT) of hazardous waste, as the term is currently defined, were managed in units regulated under Subtitle C of the Resource Conservation and Recovery Act (RCRA). In this section, the important issue of hazardous waste definition is addressed. Also included in this section is a breakdown of the sources, locations, and quantities of hazardous waste managed in the RCRA-regulated system. The types of treatment and disposal technologies typically used are also discussed.

DEFINITIONS OF HAZARDOUS WASTE

Defining what constitutes a "hazardous waste" requires consideration of both legal and scientific factors. The basic definitions used in this report are derived from: The Resource Conservation and Recovery Act (RCRA) of 1976, as amended in 1978, 1980,1986, and by the Hazardous and Solid Waste Amendments (HSWA) of 1984, and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. Within these statutory authorities a distinction exists between a hazardous waste and a hazardous substance. The former is regulated under RCRA while the latter is regulated under the Superfund program.

> **Hazardous Waste** refers to "...a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may..." pose a "substantial present or potential hazard to human health or the environment when improperly...managed..." [RCRA, Section 1004(5)].

Under RCRA regulations, a waste is considered hazardous if it is reactive, ignitable, corrosive or toxic or if the waste is listed as a hazardous waste in Parts 261.31-33 of the Code of Federal Regulations (40 CFR). Currently, there are about 450 listed wastes.

In addition to hazardous wastes defined under RCRA, there are "hazardous substances" defined by Superfund. Superfund's definition of a hazardous substance is broad and grows out of the lists of hazardous wastes or substances regulated under the Clean Water Act (CWA), the Clean Air Act (CAA), the Toxic Substances Control Act (TSCA), and RCRA. Essentially, Superfund considers a hazardous substance to be any hazardous substance or toxic pollutant identified under the CWA and applicable regulations, any hazardous air pollutant listed under the CAA and applicable regulations, any imminently hazardous chemical for which a civil action has been brought under TSCA, and any hazardous waste identified or listed under RCRA and applicable regulations.

> **Hazardous Substance** means any substance designated in Section 311(b)(2)(A) of the Federal Water Pollution Control Act, any hazardous waste having characteristics identified or listed in Section 3001 of the Solid Waste Disposal Act, "any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act, ... any hazardous air pollutant listed under Section 112 of the Clear Air Act, and ... any imminently hazardous chemical substance or mixture" with respect to action taken under Section 7 of the Toxic Substances Control Act [CERCLA, Section 101(14)].

Accordingly, Superfund encompasses the following numerous substances:

- 297 hazardous substances designated under CWA Section 311(b)(4)
- 126 priority pollutants designated under CWA Section 307(a)
- 8 hazardous substances designated under CAA Section 112
- 341 hazardous wastes and 110 wastestreams designated under RCRA Section 3001.

This report focuses primarily on RCRA regulated processes for treating and disposing of solid and hazardous waste (e.g., incineration, impoundments, chemical and biological treatment technologies, and land disposal technologies). The implications of these processes on the waste system chart are also discussed. There are, however, other hazardous wastes or toxic substances which the report does not specifically address. Examples are:

- Wastes from non-point sources (e.g., storm or irrigation run-off)

- Wastes that are exempt from RCRA management, such as wastewaters treated in enclosed tanks and discharged subject to National Pollutant Discharge Elimination System (NPDES) permits

- Industrial and domestic wastewaters discharged to surface waters under NPDES permits or into underground injection systems

- Agricultural application of pesticides

- Polychlorinated biphenyls (PCBs) that are not mixed with hazardous wastes.

Although these wastes are not regulated under RCRA or Superfund, these wastes are covered under statutory authorities such as the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act , the Federal Insecticide, Fungicide and Rodenticide Act, and the Marine Protection, Research, and Sanctuaries Act. The various ways in which these acts interact with RCRA and Superfund are discussed briefly below.

- The **Clean Air Act** (CAA), under Section 112, authorizes EPA to list various hazardous air pollutants. Currently included are asbestos, beryllium, vinyl chloride, benzene, arsenic, radionuclides, mercury, and coke oven emissions. The CAA also sets certain emission standards for many types of air emission sources, including RCRA-regulated incinerators and industrial boilers or furnaces.

- The **Clean Water Act** (CWA) lists substances to be regulated by effluent limitations over 21 primary industries. The CWA substances are incorporated into both RCRA and CERCLA. In addition, the CWA regulates discharges from publicly owned treatment works (POTWs) to surface waters, and indirect discharges to municipal wastewater treatment systems (through the pretreatment program). Some hazardous wastewaters which would generally be considered RCRA regulated wastes are covered under the CWA because of the use of treatment tanks and a NPDES permit to dispose of the wastewaters. Sludges from these tanks, however, are subject to RCRA regulations when they are removed from these tanks.

- The **Safe Drinking Water Act** (SDWA) regulates underground injection systems, including deep-well injection systems. Prior to underground injection, a permit must be obtained which will impose conditions which must be met to prevent the endangerment of underground sources of drinking water.

- The **Federal Insecticide, Fungicide and Rodenticide Act of 1972** (FIFRA) contains registration and labeling requirements for pesticide products. The Agency must approve any use of a pesticide, and manufacturers must clearly state the conditions of that use on the pesticide label. Some pesticides are listed hazardous wastes and are subject to RCRA rules when discarded.

- The **Toxic Substances Control Act (TSCA)** regulates the production and distribution of new chemicals and governs the manufacture, processing, distribution, and use of existing chemicals. Among the chemicals controlled by TSCA regulations are: PCBs, chloroflurocarbons, and asbestos. In specific cases, there is an interface with RCRA regulations. For example, PCB disposal is generally regulated by TSCA. However, hazardous wastes mixed with PCBs are regulated under RCRA.

- The **Marine Protection, Research, and Sanctuaries Act of 1972** has regulated the transportation of any material for ocean disposal and prevents the disposal of any material in oceans which could affect the marine environment. Recent 1988 amendments will end ocean disposal of sewage sludge, industrial waste and medical wastes.

In addition, this report does not cover various exposure routes of hazardous waste, such as air emissions and discharges to surface waters and POTWs. In addition, this report does not address the industrial wastes which are exempt from RCRA regulation but covered under the Clean Water Act. These wastes are typically treated and then discharged to surface waters under an NPDES permit. These are important considerations which may be addressed in subsequent updates of this report.

GENERATORS OF HAZARDOUS WASTE

Once a RCRA hazardous waste is generated, it must be managed (i.e., stored, treated or disposed) in accordance with RCRA requirements. Currently, there are about 3,000 facilities managing 275 MMT of RCRA hazardous waste. Generators also produce over 300 MMT of waste which is exempt under RCRA but which is regulated by the CWA.

The overwhelming majority of the 275 MMT of RCRA hazardous waste is produced by large quantity generators. Large quantity generators are defined as those firms which produce 1,000 kilo-

grams or more of hazardous waste per month. These generators account for 99 percent of the hazardous waste produced and managed under RCRA.

Furthermore, it is possible to look at the industries that produce most of the hazardous waste generated each year. The chemical, petroleum, metals, and transportation industries stand out as major producers of hazardous waste. Exhibit 4 provides information on the number of facilities, the volume of hazardous waste managed, and the nature of waste handled by major industrial categories.

Exhibit 4. Hazardous Waste Managed by Industry

INDUSTRY	NUMBER OF FACILITIES	AMOUNT WASTE MANAGED (MMT)	GENERAL WASTE DESCRIPTION
Chemical	700	218	Contaminated wastewaters, spent solvent residuals, still bottoms, spent catalysts, treatment sludges, and filter cakes
Fabricated Metals	200	4	Electroplating wastes, sludges contaminated with metals and cyanides, degreasing solvents
Electrical Equipment	240	1	Degreasing solvents
Petroleum Refinery	100	20	Leaded tank bottoms, slop oil, emulsion solids, API separator sludge, DAF float
Primary Metals	150	4	Pickle liquor, sludge with metal contaminates
Transportation Equipment	150	3	Degreasing solvents, metals, sludges
National Security	100	1	All types of wastes
Other	1360	24	All types of wastes
Total	3000	275	

Source: National Screening Survey of Hazardous Waste Treatment, Storage, Disposal and Recycling Facilities, U.S. EPA, Office of Solid Waste, Office of Policy, Planning and Information, 1986.

A much smaller amount of waste, about one MMT per year, is generated by small quantity generators. These firms generate more than 100 kilograms but less than 1,000 kilograms of hazardous waste per month. The majority of the 100,000 small quantity generators are automotive repair firms, construction firms, laundromats and dry cleaners, photographic processors, equipment repair shops, laboratories, electroplaters and schools.

Prior to their being regulated in 1984, small quantity generators could legally dispose of hazardous waste outside of RCRA Subtitle C regulated facilities. Today, small quantity generators must treat, store, or dispose of their waste at RCRA Subtitle C facilities. Most small quantity generators do not manage their own waste but rely on the services of a commercial facility.

The wastes produced by small quantity generators span the full spectrum of RCRA hazardous wastes. According to EPA's "National Small Quantity Hazardous Waste Generator Survey," over 60 percent of small quantity generator waste is derived from used lead acid batteries. The remainder includes acids, solvents, photographic wastes, and dry cleaning residues.

Small quantity generator industries are widely dispersed across the country. While small quantity generators individually produce only a small volume of waste, their waste is hazardous and must be appropriately handled to protect human health and the environment. Frequently, geographic pockets of small quantity generators representing a collection of industries are concentrated in a few city blocks. While each firm individually generates only a small volume of waste, collectively these firms may constitute "hot spots" of hazardous waste generation. If small firms discharge their wastes to sewers, the combined industrial discharges from small firms can potentially upset the chemical or biological treatment processes at POTWs.

GEOGRAPHIC PROFILE OF HAZARDOUS WASTE MANAGED

Next, let's look at where hazardous wastes are managed. While most hazardous waste is treated and disposed of at the site where it is produced, some hazardous waste is transported hundreds of miles to an incinerator or secure landfill. Because waste is shipped interstate, it is important to understand where waste is produced in relation to where it is treated and disposed. For example, some states are net importers of hazardous waste (e.g., Alabama and Louisiana) while other states (e.g., Connecticut, Massachusetts, and Virginia) are net exporters of hazardous waste.

As might be expected, the large majority of hazardous waste is managed in the more highly industrialized areas of the country, particularly those areas with active chemical and petroleum industries. An approximate geographic breakdown by region of the number of Treatment, Storage, Disposal, and Recycling (TSDR) facilities, and the volumes of waste managed, is provided in Exhibit 5.

Exhibit 5. Hazardous Waste TSDRs and Waste Volumes by Geographic Sector

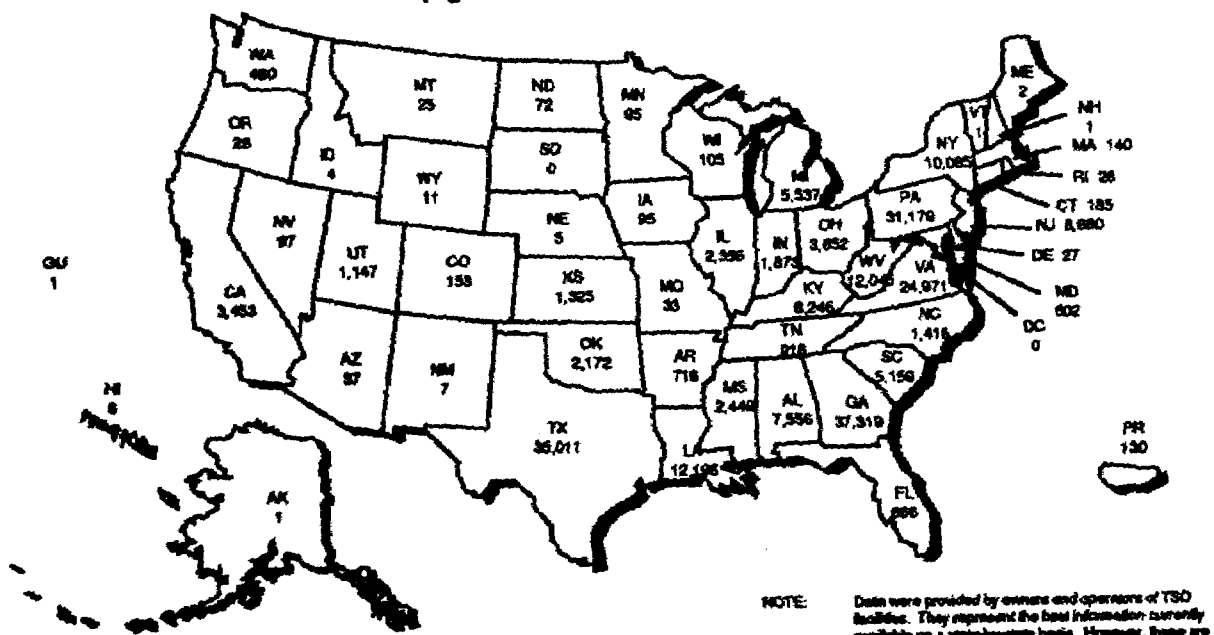
GEOGRAPHIC SECTOR	NUMBER OF TSDR FACILITIES	QUANTITY OF RCRA WASTE MANAGED (MMT)
Northeast	830	63
Southeast	440	84
Southwest	390	58
Mid-West	910	64
Rocky Mountains	90	1
Far West	340	5
Total	3,000	275

Source: National Screening Survey, U.S. EPA, Office of Solid Waste, 1986.

The exhibits on the following pages illustrate the approximate geographic breakdown of hazardous waste managed by state. Exhibit 6 contains estimates of total waste management for each state, while Exhibit 7 contains information on the quantity of RCRA waste generated and managed within each state as well as the volume of waste exported and imported into each state.

Exhibit 6. RCRA Hazardous Waste Managed in the U.S.

(Figures are in thousands of tons)*



* These figures represent the quantity of RCRA hazardous waste managed in TSD facilities in each state.

NOTE: Data were provided by owners and operators of TSD facilities. They represent the best information currently available on a state-by-state basis. However, these are subject to change as new data becomes available.

SOURCE: Draft 1995 National Biennial Report of Hazardous Waste Generators and Treatment, Storage and Disposal Facilities Regulated under RCRA, Jan. 1998.

Exhibit 7. State-By-State Profile of RCRA Hazardous Waste Managed, Imported and Exported

(Figures are in thousands of tons)

State	Quantity of RCRA Waste Generated	Shipped Out-of-State (Exported)	Received (Imported)	Quantity of RCRA Waste Managed
Alabama	7,403	66	146	7,556
Alaska	3	1		1
Arizona	66	16	3	37
Arkansas	57	53	29	716
California	3,385	4	33	3,453
Colorado	295	22	1	153
Connecticut	190	76	37	174
Delaware		70	9	:
District of Columbia	2	2	-	-
Florida	834	104	12	666
Foreign	-		-	-
Georgia	37,325	76	53	37,319
Guam	>1	-	-	>1
Hawaii	7	>1	-	6
Idaho	2	2	8	4
Illinois	2,141	118	676	2,356
Indiana	2,518	695	162	1,873
Iowa	121		5	96
Kansas	1,325	11	13	1,325
Kentucky	7,600	56	55	8,246
Louisiana	12,162	103	368	12,196
Maine	7	7		2
Maryland	698	103	90	602
Massachusetts	114	157	17	140
Michigan	4,077		267	5,537
Minnesota	61	30		96
Mississippi	2,507	83	25	2,449
Missouri	64	44	10	33
Montana	25	>1	-	25
Nebraska	543	14	1	5
Nevada		1	3	97

(Continued)

Exhibit 7 (cont.). State-By-State Profile of RCRA Hazardous Waste Managed, Imported and Exported

(Figures are in thousands of tons)

State	Quantity of RCRA Waste Generated	Shipped Out-of-State (Exported)	Received (Imported)	Quantity of RCRA Waste Managed
New Hampshire	20	12	14	1
New Jersey	8,653	311	152	8,071
New Mexico	9	2	3	7
New York	444	136	187	10,085
North Carolina	1,285		25	1,416
North Dakota	3	3	2	72
Ohio	2,986	263	340	3,852
Oklahoma	1,591		56	2,172
Oregon	31	9	64	26
Pennsylvania	31,307	261	383	31,179
Puerto Rico	149		-	130
Rhode Island		9	32	
South Carolina	5,033	18	120	5,159
South Dakota	1	>1	>1	-
Tennessee	33,199	53	24	916
Texas	38,006	197	99	35,011
Utah	1,135		9	1,147
Vermont	10	11	>1	1
Virginia	24,996	108	19	24,971
Washington	338		9	460
West Virginia	12,077	82	18	12,045
Wisconsin	85	40	20	105
Wyoming	16	>1	1	
Total	245,128	3,732	3,627	222,055

Notes: Data were provided by generators and owners and operators of TSD facilities. They represent the best information currently available on a state-by-state basis. However, these are subject to change as new data becomes available.

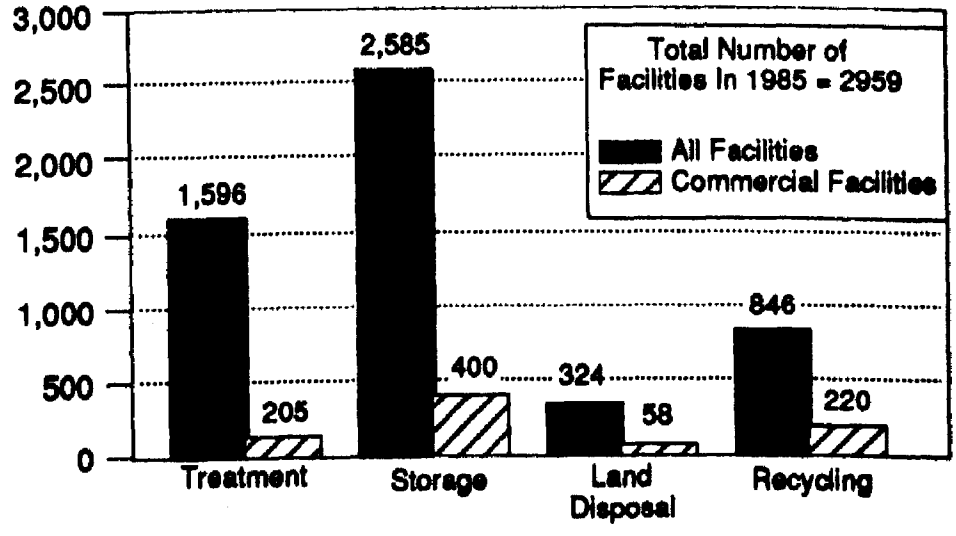
The figures presented in this exhibit are taken from the 1985 Biennial Report which uses a mass balance approach. Thus, the quantity of hazardous waste managed in TSD facilities in each state should equal the quantity of hazardous waste generated in each state plus imports minus exports. However, numbers may differ because of state-by-state variations in the definitions of wastes generated and wastes managed.

Source: Draft 1985 National Biennial Report of Hazardous Waste Generators and Treatment, Storage and Disposal Facilities Regulated under RCRA (January, 1988).

TREATMENT AND DISPOSAL PRACTICES

The Hazardous Waste System includes about 3,000 facilities that treat, store, or dispose of RCRA hazardous waste (see Exhibit 8). Because of economic factors and liability concerns, many firms prefer to store, treat, and dispose of hazardous waste on-site at the facility where the waste is generated. About 96 percent of all RCRA hazardous waste is managed on-site. The remaining waste is taken off-site to commercial facilities, which are in the business of managing other firms' waste. The Hazardous and Solid Waste Amendments of 1984 (HSWA) favor treatment technologies over disposal of certain wastes.

Exhibit 8. Number of Active Facilities by Type of Technology



Note: Some facilities have more than one process.
Source: National Screening Survey, U.S. EPA, Office of Solid Waste, 1986.

Treatment Technologies

Treatment refers to any process, including neutralization, designed to change the character of hazardous waste in order to render it less hazardous or reduce its volume. Although most treatment processes reduce the volume or toxicity of waste, residuals often result which must be further treated or disposed. A waste stream may go through several treatment processes to reduce its toxicity or volume. Typical treatment methods include incineration, biological and chemical wastewater treatment, steam stripping, and solidification. The most widely used treatment technologies are briefly described below.

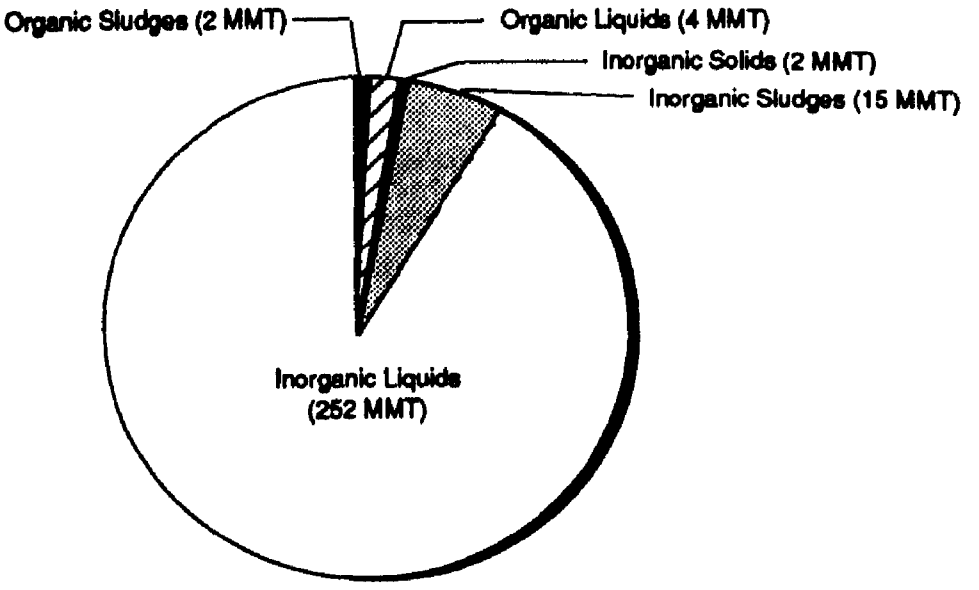
- Incineration - Used to burn primarily liquid organic hazardous waste. In addition, some incinerators are designed to burn solids and sludges as well as liquid wastes. Increasingly, regulatory decisions favor such practices as incineration over land disposal of certain wastes.

- Biological and Chemical Wastewater Treatment - The most widely used method of treating aqueous hazardous waste. Wastewaters are rendered less hazardous by biological decomposition, chemical neutralization, or precipitation. Treatment occurs in large settling ponds or tanks. Retention time in the treatment units varies from a few hours to several days depending on temperatures and the types of waste streams. A residual sludge is produced in the treatment process which is generally incinerated, treated or land disposed.

- Stream Stripping Technologies - Used in treating aqueous, hazardous wastewaters. Hazardous constituents in the water are converted into gas by means of heating. A non-hazardous gas is then emitted into the air and the hazardous constituents are captured through air pollution control equipment.

- Solidification - Involves mixing hazardous waste with a stabilizing agent to create a solid or impermeable material. The process requires a large area to combine the stabilizing agent (e.g., Portland cement) with the hazardous waste. Solidification is most effectively used on inorganic sludges.

Exhibit 9. Estimate of Physical Characteristics of RCRA Hazardous Wastes



Source: National Screening Survey, U.S. EPA, 1986.

Understanding the physical characteristics of waste is an important element in knowing what treatment and disposal practices can be use to manage waste. For each type of waste, there are appropriate treatment and disposal technologies. The physical characteristics of the 275 MMT of RCRA hazardous wastes managed in 1985 vary from dilute wastewater to metal bearing sludge to contaminated soil. Over 90 percent (by weight) of RCRA hazardous waste is in the form of wastewater.

The remaining wastes are organic and inorganic sludges and organic and inorganic solids. Exhibit 9 categorizes hazardous wastes by their physical characteristics.

As illustrated in Exhibit 10, for each type of waste there may be more than one appropriate treatment or disposal technology. The vast majority of hazardous waste is inorganic liquid waste which is generally treated in wastewater treatment plants or treatment impoundments. The waste is then discharged to surface waters subject to effluent limitations in NPDES permits. A residual sludge is also produced in this process which is generally treated or stabilized, and then land disposed.

Exhibit 10. Treatment Technologies

PHYSICAL CHARACTERISTICS	INCINERATION	WASTEWATER TREATMENT	TREATMENT IMPOUNDMENTS	SOLIDIFICATION	STEAM STRIPPING
Organic Liquids (4 MMT)	●	○	○		
Inorganic Liquids (252 MMT)	○	●	●	○	○
Organic Sludges (2 MMT)	○	○	○	○	
Inorganic Sludges (15 MMT)	○	○	○	●	
Inorganic Solids (2 MMT)	○			○	

● Widely Used ○ Sometimes Used

Source: U.S. EPA, Office of Solid Waste

The volume of incinerated hazardous waste is small and composed mainly of organic liquids and sludges. However, upcoming regulatory and policy actions may require incineration for other types of wastes. These additional wastes could include more sludges and solids, especially contaminated soils. Because of the strong interest in the incineration of additional wastes and the restriction on land disposal of certain chemicals, these two technologies are discussed in more detail in the remainder of this section.

Incineration Technologies

This section focuses on the growing importance of incineration in treating wastes and the types of incinerators operating today. The vast majority of the 275 MMT of hazardous waste managed annually is treated in impoundments and wastewater treatment plants. A very small amount of the waste, about 2 MMT, is presently incinerated. This incinerated waste is generally low volume, although highly concentrated or toxic. However, the volume of incinerated waste may increase significantly in response to the land disposal restrictions required under HSWA.

Incinerable wastes range from highly concentrated, organic liquids to sludges and low concentration, but hazardous, solids. Wastes with low levels of metals and high organic content burn most efficiently. Incineration is used for a specific waste if it is the most efficient and economically feasible treatment technology, or if the waste is restricted from land disposal under the land disposal restriction regulations.

Incinerable wastes include the following:

- Organic Sludges 2 MMT
- Organic Liquids 4 MMT
- Inorganic Sludges, Liquids, and Solids Unknown

The above wastes are burned in incinerators specifically designed and permitted to destroy a limited range of wastes. Organic liquid waste, for example, can be burned in liquid injection incinerators, rotary kilns, cement kilns, or used as fuel for industrial boilers and furnaces. Exhibit 11 shows the four major types of incinerators, the number of incinerators in each category, and the kinds of waste capable of being incinerated by a specific incinerator design category.

Exhibit 11. Incinerator Types and Incinerable Waste Descriptions

INCINERATOR DESIGN	ESTIMATED NUMBER OF UNITS	WASTE DESCRIPTIONS
Rotary Kiln	40	Liquid sludges, solids, drummed wastes
Liquid Injection	95	Pumpable hazardous wastes, no solids
Fume	25	Liquids
Open Hearth	30	Liquids, sludges, and some solids
Total	190	

Source: U.S. EPA, Office of Solid Waste

Most of the RCRA hazardous waste incinerators operating today are located on-site. There are over 175 on-site incinerators that burn 1.7 MMT of hazardous waste. In contrast, the commercial sector has 16 incinerators which burn 0.4 MMT of hazardous waste each year. These units are required to meet air emission and other performance standards. An incinerator permit restricts the type of wastes that can be burned in a specific unit. See Appendix A for a list of commercial incinerators.

While adequate capacity exists for some wastes, it appears that more commercial incinerators are needed to incinerate other hazardous wastes. In response to the potential increase in demand to burn solids, sludges and other wastes from Superfund clean-ups, RCRA corrective action measures, and wastes barred from land disposal under the land disposal restriction regulations, industry is looking into the siting of new incinerators and the expansion of existing incinerator capacity.

Land Disposal Technologies

Having discussed the major hazardous waste treatment technologies, let's now turn to land disposal technologies. Historically, many hazardous wastes were land disposed because landfilling was an economical and available means to dispose of wastes. As the land disposal restrictions imposed by HSWA become effective, the land disposal of certain wastes will be prohibited. Only wastes that meet specific standards or are treated to meet these standards will be allowed to be disposed on the land.

Land disposal is the depositing or injecting of solid or hazardous wastes on or into the land. A small percentage of the 275 MMT of hazardous waste generated each year is land disposed in landfills, land farms, or disposal surface impoundments. Currently, there are about 320 operating land disposal facilities. The various kinds of land disposal facilities are briefly described below:

- Landfills - Generally rectangular pits located below ground. A permitted hazardous waste landfill must be lined with layers of impermeable materials (e.g., synthetic or clay liners for new, replacement or lateral expansion units) and have a leachate collection system to detect ground-water contamination. Most residuals generated in treatment processes, such as incinerator ash or impoundment sludge, are ultimately landfilled. Landfills range in size from a few acres to hundreds of acres. Currently there are about 70 hazardous waste landfills in the country, 33 of which are commercial landfills.

- Land Treatment - Involves spreading hazardous waste on the land. Land treatment, particularly the form of treatment referred to as land farming, is most often used to dispose organic solids and sludges, such as the waste by-products of the petroleum industry.

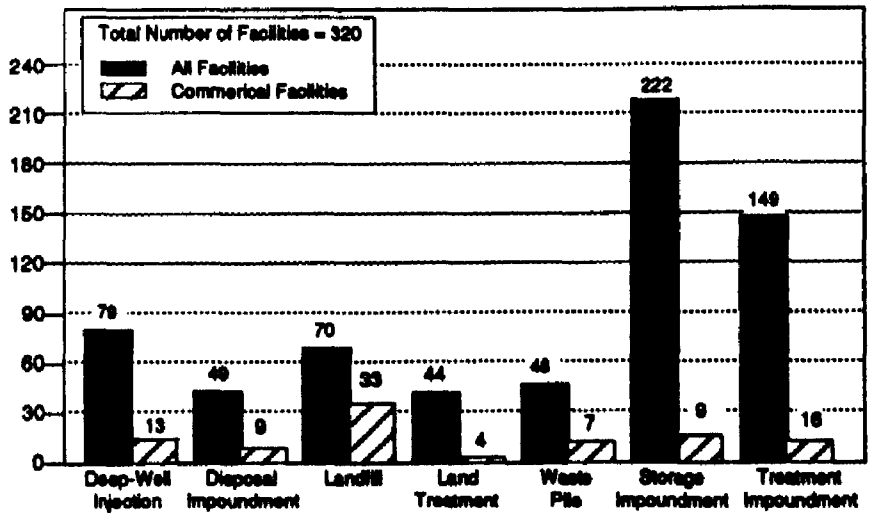
- Deep-Well Injection Systems - Used to dispose of aqueous waste. Approximately 35-50 MMT of dilute,

hazardous waste is disposed annually into deep-well injection systems.

- Surface Impoundments - Used to treat, store, and dispose of large quantities of aqueous wastes. Surface impoundments vary in size from a few hundred square feet to hundreds of acres. As much as 100 MMT of RCRA hazardous waste may be treated and disposed of in these impoundments. This practice handles a large amount of the wastes currently managed under RCRA. However, many surface impoundments are likely to close by the end of 1988 rather than bear the cost of re-design to meet HSWA's minimum technology requirements (e.g., a double liner system, monitoring wells, leachate collection system and, for surface impoundments treating banned wastes, annual dredging).

As shown in Exhibit 12, most land disposal facilities are impoundments located on-site at the plant. In comparison, about 49 commercial facilities have land disposal units and manage 5 MMT

Exhibit 12. Number of Land Disposal Facilities by Type of Process



Note: Some facilities have more than one process.
Source: National Screening Survey, U.S. EPA, Office of Solid Waste, 1986.
U.S. EPA Office of Solid Waste, 1986, for commercial facilities.

of hazardous waste. These units include: landfills, impoundments, land treatment, and waste piles. A list of of the commercial land disposal units is provided in Appendix B.

The nature of the wastes managed at commercial facilities may be vastly different from that of on-site wastes. Representatives from the commercial waste management industry indicate that they are now receiving more concentrated wastes than in the past. This is because firms are reusing waste, pretreating waste, and sending less aqueous waste off-site. This trend is likely to continue in the future as firms minimize the volume of waste they generate and comply with land disposal restriction regulations.

Since 1984, the number of operating land disposal facilities has decreased from 1500 to less than 325 today. Under HWSA, firms are required to meet certain financial tests and comply with ground-water monitoring and minimum technology standards. Many facilities chose to close rather than meet these standards.

It is believed that many of these facilities were at or near capacity and many others were small units. While the closing of these facilities has not significantly affected current land disposal capacity, the impact of land disposal restrictions on future land disposal capacity is uncertain. In 1988, EPA estimated that commercial landfills had approximately 12 years of useful life remaining.

SECTION 2

SOLID WASTE MANAGEMENT

Management of solid waste differs from the management of hazardous waste. In this section, the definition of solid waste is addressed. Also included is a breakdown of the sources, locations, and quantities of solid waste managed throughout the United States. Solid waste disposal practices are also discussed.

DEFINITION OF SOLID WASTE*

Defining what constitutes a "solid waste" requires consideration of technical and regulatory factors. The basic definition used in this report is derived from the Resource Conservation and Recovery Act (RCRA) as amended by the Hazardous and Solid Waste Amendments (HSWA).

> **Solid Waste** means "any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage...." [RCRA, Section 1004(27)]

Solid waste consists of such diverse items as municipal solid waste, municipal sewage sludge, industrial and commercial "non-hazardous" waste, and waste tires. Solid waste also consists of some semisolid, liquid and contained gaseous wastes that are also regulated under RCRA Subtitle D. On January 8, 1988, EPA published a proposed rule that would exclude from solid waste regulation certain materials that will be reused or recycled in an ongoing manufacturing process. However, these materials would be considered "solid waste" when they are discarded or cease to be reused in an ongoing manufacturing process. Solid waste also

*Throughout this document, solid waste refers to non-hazardous materials.

consists of such special wastes as infectious waste, construction waste, household hazardous waste, oil and gas waste, and large volume wastes such as mining waste.

The composition and volume of solid waste is affected by such factors as population increases, economics, and technological and social factors. EPA studies have revealed that more than 11 billion tons of solid waste are generated each year. A large portion of solid waste consists of municipal solid waste, with approximately 158 million tons of municipal solid waste generated in 1986. The annual production of such waste is expected to increase to 193 million tons by the year 2000.

A breakdown of the changing composition of municipal solid waste is provided in Exhibit 13. Since 1970, the amount of plastics, many of which are currently non-recyclable, in municipal solid waste has increased from approximately 3% in 1970 to approximately 7% in 1986. Also, paper products and yard wastes made up about 56% of municipal solid waste in 1986.

Exhibit 13.
Gross Discards of Materials in Municipal Solid Waste (in Millions of Tons)

Materials	1970	1986	2000
Paper and paperboard	36.5	50.1	66.0
Glass	12.5	11.8	12.0
Metals	13.5	12.6	14.4
Plastics	3.0	10.3	15.6
Rubber, leather, textiles, wood	9.0	12.5	13.2
Food wastes	12.8	12.5	12.3
Other nonfood product waste	0.1	0.1	0.1
Yard wastes	23.2	28.3	32.0
Misc. inorganics	1.9	2.6	3.2
Totals	112.5	140.8	168.8

Source: Characterization of Municipal Solid Waste in the United States, 1960 - 2000, U.S. EPA, Office of Solid Waste, 1986 and updated Draft Report, 1988.

The primary treatment and disposal methods for municipal solid waste include use of landfills and incinerators as well as recycling efforts. Exhibit 14 contains an analysis of the use of these methods in 1986.

Exhibit 14.
Current Municipal Solid Waste Management Practices, 1986

	Million ton/Yr	%
Landfilling, other	126	80
Incineration with energy recovery	10	6
Incineration without energy recovery	5	3
Materials recycling	17	11
Total	158	100

Source: Characterization of Municipal Solid Waste in the United States, 1960 - 2000, U.S. EPA, Office of Solid Waste, 1986 and updated Draft Report, 1988.

The Agency has determined that a comprehensive solid waste management system includes the use of source reduction, recycling and incineration, as well as the safe use of landfills. The Agency has established the goal of 25% source reduction and recycling by 1992. Increased source reduction and recycling will reduce the volume of the waste which requires incineration or disposal in landfills. Other methods to achieve this goal include improved waste treatment and disposal methods and proper waste management.

GENERATORS OF SOLID WASTE

Generators of solid waste vary. Municipal solid waste is generated by businesses and residents within the community as well as by the municipality itself in running the operations of the community. Other generators of solid waste include commercial and industrial facilities.

Municipal solid waste can contain small quantities of hazardous materials. Most of these materials are derived from household wastes or produced by commercial generators that dispose of less than 100 kilograms per month of hazardous waste.

Household hazardous waste consists of such items as some cleaning agents, lawn products, batteries, electronic devices, automotive products, and home maintenance items. Small quantity generator waste consists of such items as paint wastes, acids, photographic wastes, pesticides and dry cleaning residues.

Many states and communities are implementing household hazardous waste collection programs to collect and properly dispose of such waste. This is done in an effort to keep such waste out of the municipal solid waste stream.

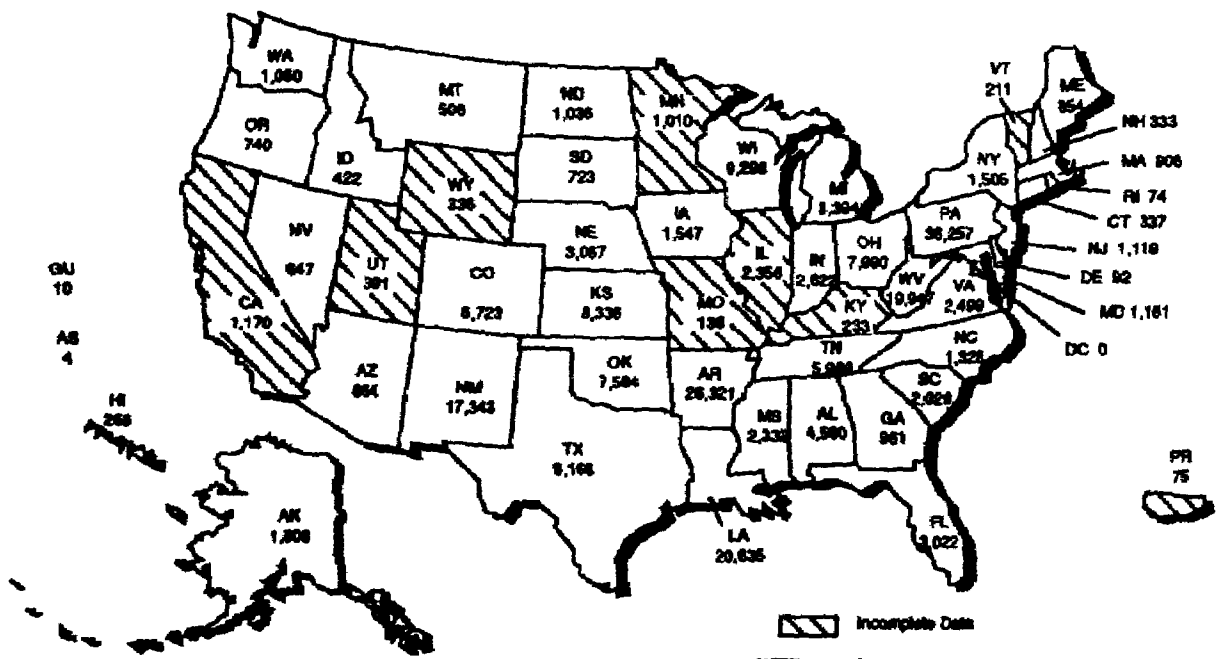
GEOGRAPHIC PROFILE OF SOLID WASTE MANAGEMENT FACILITIES

Presently, there are approximately 227,000 Subtitle D solid waste disposal units located throughout the United States. Of these units, 84% are surface impoundments, 8% are primarily municipal sewage sludge land application units, 6% are landfills and 2% are waste piles. An approximate geographic breakdown of the number of Subtitle D solid waste disposal units located within each state is contained in Exhibit 15.

With regard to municipal solid waste landfills, every State has minimum technology standards for the operation and maintenance of such facilities. Additional state requirements are as follows:

- 44 States and territories have implemented landfill location standards
- 51 States and territories have closure and 42 have post closure care requirements
- 42 States and territories require ground-water monitoring
- 23 States and territories require leachate monitoring
- 10 States require surface water monitoring

Exhibit 15. Number of Subtitle D Solid Waste Disposal Units



NOTE: Figures represent the number of landfills, surface impoundments, and land application units for each state. Waste piles are excluded from these figures. A few states did not report surface impoundments and land application units.

SOURCE: Draft Subtitle D Report to Congress, U.S. EPA, October, 1988.

Solid waste disposal capacity is declining in many areas of the country, particularly in the Northeast and other areas with high population densities. States such as Connecticut, Massachusetts and Florida are rapidly running out of landfill space. The siting of new Subtitle D disposal facilities is necessary to provide future disposal capacity.

TREATMENT AND DISPOSAL PRACTICES

The solid waste universe includes approximately 227,000 facilities that receive solid waste for treatment, disposal or recycling. In this section, solid waste capacity as well as the various types of solid waste treatment and disposal practices are briefly discussed.

Landfills

Landfills have historically been the least expensive way to dispose of solid waste. Approximately 83% of the municipal solid waste that is produced is deposited in landfills.

A study of municipal solid waste landfills demonstrated that such landfills receive household waste (72%), commercial waste (19%), construction/demolition waste (6%), and other wastes such as sewage sludge and industrial wastes (3%). Safe landfill management techniques include the use of liners; application of cover materials; leachate collection, removal and treatment; ground-water monitoring; and control over the materials placed in the landfill.

Landfill capacity throughout the United States is rapidly declining. Currently, approximately 6,000 operating municipal landfills exist throughout the United States. Many of these landfills are in the process of closing. This decline has occurred despite the continued increase in the amount of solid waste produced annually. The Agency anticipates that as many as 27 States may run out of landfill capacity for municipal solid waste within the next five years, with 70% of all municipal landfills expected to close within

15 years. Currently, approximately 184 landfills are either proposed or final sites on the National Priorities List (NPL) for Superfund cleanup.

With declining landfill disposal capacity, many communities and solid waste haulers must transport municipal waste great distances to dispose of the waste. This has resulted in increased disposal costs for many communities. The siting of new facilities to dispose of municipal waste will be a key factor in easing the municipal solid waste disposal crisis.

Of major concern to the Agency is the leachate that results from the mixing of materials in the landfill with rain water and other liquids within the landfill. The Agency is also concerned with the production of methane gas, which is generated naturally in most landfills. Landfill operators must ensure proper ventilation and control to prevent underground fires or explosions which can result from methane gas accumulation. Many operators collect and sell the methane gas.

Incinerators

Municipal waste combustors are used to burn municipal solid waste. Most solid waste incinerators are resource recovery or waste-to-energy facilities that convert the heat generated from the burning waste into either electricity or steam. Approximately 140 incinerators either exist in or are planned for 38 States at present. Of these facilities, 91 result in energy recovery from the burning waste. The volume of municipal solid waste that is incinerated is expected to increase from 10% in 1986 to approximately 20% by the year 1992. In many situations, incineration reduces the volume of solid waste by up to 90%.

In July, 1987, the Agency issued a Report to Congress on resource recovery facility emissions. The Agency concluded that the following mix of controls would ensure the safe operation of such facilities: scrubbers, particulate matter collection, and proper combustion.

Approximately 30 million tons of the municipal solid waste generated annually can not be incinerated. Such materials include construction waste, stones, concrete, old appliances, and bricks.

The siting of solid waste incinerators has been affected by air pollution concerns. Air emissions from such facilities are currently regulated under the Clean Air Act. Incinerator siting has also been affected by concerns over the characteristics of the ash that remains after incineration of materials.

Recycling

Recycling involves separating reusable materials such as glass, metals, and paper from solid waste. The recyclable materials are then processed and returned to the economy as parts of other products.

Recycling and source separation techniques are used to reduce the volume of solid waste requiring either landfill disposal or incineration. In addition, recycling reduces the need for raw materials and thereby conserves natural resources. In 1986, approximately 10% of the municipal solid waste stream was recycled. Approximately 80% of the material recycled in 1986 constituted newspapers, corrugated cardboard and office paper. Glass bottles and aluminum cans also play a role in municipal solid waste recycling. Also, the recycling of plastics is increasing.

Many States and communities are implementing mandatory as well as voluntary recycling programs. Such programs often include the curb-side pick up of recyclable materials. The success of these programs has varied. However, programs in New Jersey and Oregon have resulted in the recycling of approximately 20% of the waste stream. In addition, programs in such cities as Seattle, San Jose and San Francisco have resulted in the recycling of over 20% of the waste stream. Ten States have so-called "bottle bill" laws that require refunds to be issued for the return of beverage containers. These laws promote the recycling and reuse of such containers.

The issue faced by many in the recycling industry is the changing demand for materials recovered through recycling. This results in price fluctuations for such materials. Another issue is the difficulty of recycling several materials, such as some plastics and mixed materials.

Source Reduction

Source reduction involves the management of materials before end disposal to reduce the volume and toxicity of such materials. Source reduction can effectively increase the useful life of landfills as well as reduce the toxicity of waste streams destined for incineration or disposal.

Many manufacturers substitute alternative materials as a source reduction measure either to reduce the amount of waste produced during the manufacturing process or to create a product that can be easily disposed of after consumer use. Source separation and the redesign of product packaging are also being used to reduce the amount of wastes that require disposal.

Economic factors such as increasing waste disposal costs have significantly increased source reduction efforts. The need for increased waste disposal capacity has also influenced source reduction measures.

SECTION 3

REGULATORY AND POLICY IMPLICATIONS

There are a number of upcoming regulatory and policy initiatives which will change the way hazardous waste is currently managed. Many of these changes were mandated in the Hazardous and Solid Waste Amendments (HSWA) and the Superfund Amendments and Reauthorization Act (SARA).

These regulatory and policy initiatives are in various stages of development and their potential effects can only be estimated. This section outlines the issues and the potential implications of twelve proposed statutory and regulatory initiatives. The majority of the regulations and policies discussed in this section were mandated under RCRA. In addition, this section includes a discussion of several regulations and policies mandated under Superfund.

For more detailed information on a specific area discussed in this section, refer to the "Bibliography" listed in the Appendix of this report.

LAND DISPOSAL RESTRICTIONS

Restrictions

The Hazardous and Solid Waste Amendments use a phased approach to prohibit the land disposal of all untreated hazardous wastes. By 1990, any waste listed as hazardous on the date of enactment of HSWA will be prohibited from land disposal unless: (1) EPA has published treatment standards for the waste or (2) a petition has been approved that demonstrates that there will be no migration of hazardous constituents from the disposal unit for as long as the waste remains hazardous. EPA must set treatment standards for wastes listed after the date of enactment of HSWA within six months of listing; however, no automatic prohibitions apply to these wastes. Exhibit 16 contains the effective dates of the land disposal restriction regulations by waste category.

Exhibit 16. Effective Dates of Land Disposal Restriction Regulations

CHEMICALS	EFFECTIVE DATE OF BAN	STATUS (as of Sept. 1988)
Solvents and Dioxins	November 8, 1986	Promulgated
California List	July 8, 1987	Promulgated
Scheduled Wastes:		
First Third	August 8, 1988	Promulgated
Second Third	June 8, 1989	Pending
Third Third	May 8, 1990	Pending

Source: U.S. EPA, Office of Solid Waste

On November 7, 1986, EPA promulgated its first land disposal restriction regulations which addressed solvent and dioxin bearing wastes. In developing that rule, the Agency found there was insufficient capacity nationwide to treat dioxin and solvent contaminated soils and dilute wastewaters contaminated with solvents. Two year extensions of the effective dates were granted for these wastes; these extensions expired November 8, 1988. However, extensions were not granted for liquid solvent wastes as sufficient capacity was found to treat these wastes.

On July 8, 1987, the Agency published a second series of regulations, which address wastes known as "California List" wastes. These regulations prohibit the land disposal of certain liquid hazardous wastes containing metals, free cyanides and PCBs, low pH wastes, and liquid and non-liquid hazardous wastes containing halogenated organic compounds (HOC) above specified levels. The Agency also specified treatment standards for the PCB and HOC containing wastes. A two year extension of the effective date of the prohibitions was provided for certain wastes containing HOC compounds due to a perceived lack of incinerator capacity for these wastes. However, a recent rule issued by EPA removed this variance effective November 8, 1988.

All other listed hazardous wastes (approximately 450) were divided into thirds based on volume and toxicity. Treatment standards for certain of the "First Third" wastes were promulgated on August 8, 1988. Wastes in the First Third schedule for which the Agency did not set treatment standards may continue to be land disposed, under certain circumstances, until EPA sets treatment standards or until May 8, 1990, whichever is earlier. However, the treatment standards specified in this rule do not apply to First Third wastes disposed by deep-well injection. It currently appears that insufficient capacity may exist to treat some of these wastes. The Agency therefore granted a two-year variance for some of the high volume wastes without adequate disposal capacity.

The full impact of land disposal restrictions on treatment capacity is uncertain at present. It is anticipated that use of incineration techniques will increase as a result of the treatment requirements of the land disposal restriction regulations. Stabilization of metal containing wastes will also increase.

Technology Standards and Implications

HSWA's minimum technology standards require improving the ways existing and new landfills and surface impoundments are constructed and operated. These standards include: installing two or more liners, a leachate collection system, and a ground-water monitoring system. Also, EPA regulations require firms to meet certain financial tests for liability coverage. Wastes that have been granted capacity variances under the land disposal restriction regulations can only be disposed in facilities that meet the minimum technology requirements. Exhibit 17 illustrates the specific minimum technology requirements for surface impoundments and landfills.

Exhibit 17. HSWA Minimum Technology Requirements

TYPE OF UNIT	STATUS OF UNIT	
	NEW UNITS	EXISTING UNITS (by 11/8/88)
SURFACE IMPOUNDMENTS	• 2 or more liners • Leachate collection system between liners • Ground water monitoring system	• 2 liners • Ground water monitoring system • Leachate collection system between liners
LANDFILLS	• 2 liners • Leachate collection system above top liner and between liners • Ground water monitoring system	• Not required to retrofit • Ground water monitoring system

Source: U.S. EPA, Office of Solid Waste

As a result of the minimum technology requirements, it appears that many operating surface impoundments may close rather than retrofit. Some of these facilities are building new units or treatment tanks to replace closed surface impoundments. Much of these wastes, which consist mainly of hazardous wastewaters, may shift to treatment tanks. The sludges from the treatment tanks are subject to RCRA when removed from the tanks if they are listed as a hazardous waste or exhibit a hazardous characteristic. However, the wastewater treatment tanks are exempt from RCRA regulations if the treated wastewaters are discharged under NPDES permits into surface waters or under the National Pretreatment Program to publicly owned treatment works (POTWs). In either case, the discharge is subject to the Clean Water Act rather than RCRA. Therefore, tank treatment may effectively remove a significant amount of waste from RCRA regulation. Also, these discharges could have a significant impact on the wastewater permitting and pretreatment programs.

Sludges resulting from these treatment tanks, and subject to RCRA Subtitle C, would still be subject to the HSWA land disposal restrictions. Such sludges could require incineration or other treatment.

Location Standards

In addition to minimum technology standards, the Agency is currently developing hazardous waste facility location standards

that will impact the types of treatment technologies that can be utilized at each site. New location standards could also require corrective action measures to be implemented at existing land disposal facilities.

POLLUTION PREVENTION POLICY

EPA strongly favors preventing the generation of waste rather than controlling waste after it is generated. It is a national policy that the generation of hazardous waste be reduced or eliminated as expeditiously as possible. EPA's pollution prevention program has two main objectives. First, to foster source reduction through technology and information dissemination, and second, to report to Congress by 1990 on the need for regulations on waste minimization.

The 275 MMTs of hazardous waste managed annually in the United States is expected to increase unless firms adopt serious waste reduction and recycling programs. At present, the 1984 Hazardous and Solid Waste Amendments to RCRA outline three statutory requirements relating to pollution prevention. The requirements are summarized below:

- Generators must certify on their manifests that they have a program in place to reduce the volume and toxicity of wastes [Section 3002(b)].

- Any treatment, storage or disposal permit issued after September 1, 1985 must include a waste minimization certification statement [Section 3005(h)].

- As part of the generator's biennial report, generators must describe the efforts undertaken during the year to reduce the volume and toxicity of waste generated [Section 3002(a)(6)] and document actual reduction achieved.

Within the private sector, strong incentives already exist to promote a pollution prevention program. These incentives include:

- High costs of corrective action at current facilities
- Large increases in the price of treating and disposing of hazardous wastes
- Difficulties in siting and permitting new facilities
- Concern with liability associated with managing hazardous waste
- Public pressure on industry to reduce waste generation

A few states currently either require or promote a policy that encourages pollution prevention. Many firms are already working towards reducing the amount of hazardous waste produced through a variety of waste minimization techniques, including:

- Process modification
- Input material substitutes
- Recycling
- Technology modification
- Product substitution

EPA's pollution prevention program focuses on addressing multimedia opportunities to minimize wastes through research and technology transfer, an information clearinghouse, a national data base and support for state programs. The Agency has recently established the Office of Pollution Prevention to coordinate such efforts among EPA programs.

In conclusion, economic and liability issues are driving a reduction in the volume and toxicity of hazardous wastes generated. As a pollution prevention technique, source reduction can alleviate the capacity problem by reducing the volume of waste requiring costly treatment and disposal.

DEEP-WELL INJECTION REGULATION

Over 1,000 MMT of dilute, aqueous wastes are deep-well injected each year. About 35-50 MMT of this waste may be RCRA hazardous wastes.

The majority of deep-wells are located on-site so that wastes are disposed of at the plant where they are generated. A small number of commercial firms operate deep-well systems (refer to Appendix C for a list of deep-well injection systems). Most deep-well systems are concentrated along the Gulf Coast of Texas and Louisiana.

The Hazardous and Solid Waste Amendments (HSWA) required EPA to determine by August 8, 1988 whether to further restrict the deep-well injection of hazardous wastes. On August 27, 1987, EPA outlined plans for prohibiting the underground injection of certain solvents, dioxins, and California List wastes under the Land Disposal Restriction regulations. On July 26, 1988, EPA promulgated the framework for implementing land disposal restrictions for the underground injection of these wastes. A final rule establishing effective dates for land disposal restrictions on the underground injection of California List wastes and certain first third wastes became effective August 8, 1988. Specifically, this rule prohibits the underground injection of PCBs and concentrated HOC wastes. However, this rule grants a two year extension for the underground injection of certain cyanides, metals, corrosives, dilute HOCs, and chromium wastes due to insufficient alternative capacity to treat the wastes. Additional wastes will be restricted in 1989 and 1990.

If deep-well injection were prohibited, most of these wastes would probably shift to wastewater treatment plants. Firms could

obtain or modify NPDES permits in order to discharge treated wastes from a wastewater treatment plant to surface waters. Some of these wastes may also be discharged to sewers, treated at POTWs and then discharged to surface waters. It is likely that most firms would continue to treat their waste on-site rather than transport large volumes of dilute, aqueous waste to a commercial facility.

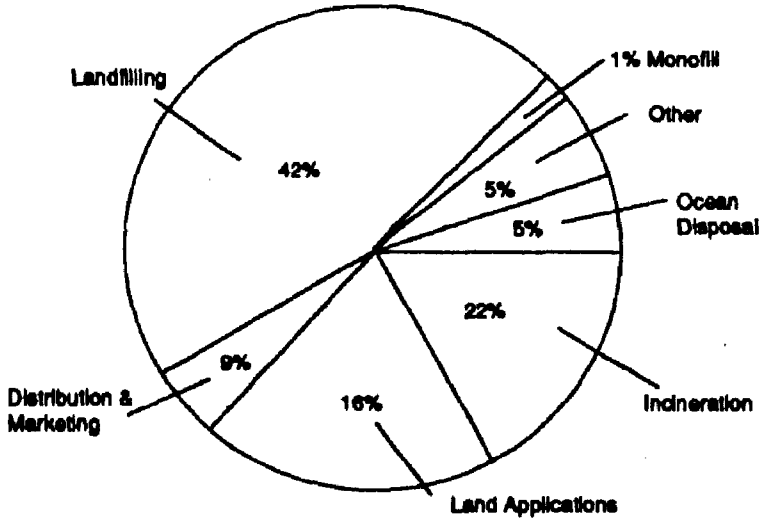
In summary, large volumes of RCRA hazardous and non-hazardous wastewaters are currently deep-well injected. Making deep-well injection regulations more stringent may affect wastewater treatment capacity. There is likely to be minimal impact on incineration capacity because it is usually not economically feasible to incinerate dilute, aqueous wastes.

DOMESTIC SEWAGE SLUDGE REGULATION

The Clean Water Act requires municipalities to treat wastewater to meet discharge standards, before discharging it to surface waters. Each year, approximately 37 billion metric tons of municipal (domestic) and industrial wastewaters are treated in POTWs.

In treating these wastes to meet discharge standards, vast quantities of sludges are generated which can contain varying amounts of toxic pollutants. The quantity of municipal wastewater treatment sludges produced annually has almost doubled over the past 15 years. Municipalities now generate about 7.7 million metric tons of sewage sludge a year, the majority of which is landfilled or applied to the land. Exhibit 18 shows the proportions of municipal sludge managed by type of management practice.

Exhibit 18.
Distribution of Municipal Sludge by Management Practice



Source: U.S. EPA, Office of Water, 1988

By the year 2000, municipal sludge production is expected to increase to 12 million dry metric tons a year. This increase is attributed to (1) a growing population, and (2) more advanced wastewater treatment systems which remove more pollutants and, therefore, generate more sludges. During this same period, more municipal landfills are expected to close. This may place greater demand on other sludge disposal practices.

In a February, 1986, "Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works," the Agency recommended that the RCRA exemption for regulating hazardous wastes which mix with domestic sewage sludge discharged to POTWs be continued. The report also indicated that improvements were needed to ensure pretreatment of industrial hazardous wastes. EPA expects to publish regulations to carry out this recommendation.

There is increasing concern that some hazardous wastes, which are prohibited from land disposal under HSWA, may be redirected to POTWs. Such wastes are exempt from regulation under RCRA if they are subject to control by a discharge permit issued under the Clean Water Act. This may cause some municipal sludges to become contaminated with high concentrations of toxic constitu-

ents. If municipal sludges fail the Extraction Procedure Toxicity Test, the sludges would be subject to RCRA Subtitle C management requirements. Regulation of sludges as hazardous waste could further strain existing disposal capacity.

In 1987, Congress further amended the Clean Water Act to direct that the disposal of sewage sludge be regulated. Regulations to carry out this program are expected to be proposed by EPA in April, 1989. EPA is also developing technical standards for the land application, distribution and marketing, landfilling, incineration, and land surface disposal of domestic sewage sludge. These standards are also expected to be proposed in April, 1989, with final regulations expected to be issued in October, 1991.

The sewage sludge technical standards could affect hazardous industrial wastes disposed of in municipal treatment systems. Annually, approximately 160,000 industrial and commercial facilities discharge in excess of 100,000 metric tons of hazardous waste constituents to POTWs.

OCEAN INCINERATION REGULATION

In the early 1980s, EPA proposed regulations that would allow bulk liquid organic hazardous waste to be burned at sea under an ocean incineration program. Solid wastes were excluded from the ocean incineration regulations. In early February, 1988, the ocean incineration program was suspended.

OCEAN DUMPING/DISPOSAL REGULATION

Prior to 1972, ocean disposal of sludges and industrial wastes was unregulated. In 1972, the Marine Protection, Research, and Sanctuaries Act (MPRSA) was created to regulate the transportation of any material for ocean disposal and to prevent the disposal of any material in oceans which could affect the marine environment. In November 1988, MPRSA was amended to establish a framework for ending ocean disposal of sewage sludge and industrial waste by December 31, 1991.

Since the enactment of MPRSA in 1972, the amount of industrial waste deposited in the ocean declined from approximately 6 million tons to approximately 0.3 million tons per year in 1986. However, the MPRSA regulations have been the focus of several legal challenges. Additionally, the amount of sewage sludge disposed of in the ocean has increased from approximately 4.9 million tons in 1973 to 7.9 million tons in 1986. The increase in volume is mainly a result of upgrading existing wastewater treatment facilities to comply with the Clean Water Act requirements.

The Agency is currently in the process of developing proposed regulations which will update the current regulations to respond to the new statutory amendments and address remaining legal issues. The proposed regulations are scheduled for publication in the Federal Register in late 1989.

The new legislation has several key elements. It prohibits new entrants, that is, any person who was not ocean dumping sewage sludge and industrial waste as of September 1, 1988, from beginning to dump. Existing dumpers must cease dumping sewage sludge and industrial wastes as of August 15, 1989, unless the dumper has received a permit and has entered into a compliance or enforcement agreement with EPA which, among other things, includes a schedule for development and implementation of an alternative system for the management of sewage sludge and industrial waste. In any event, it is unlawful to dispose of sewage sludge and industrial waste in the ocean after December 31, 1991. EPA is required to report to Congress on the progress in implementing the Act and the results of a monitoring program also required by the Act.

Additionally, the newly amended MPRSA now imposes fees for ocean dumping prior to the 1991 deadline and civil penalties for dumpers who continue ocean dumping after the 1991 deadline. A portion of each individual dumper's fees and/or penalties must be deposited in a trust account which the dumper must establish.

The trust accounts can be used by dumpers to implement land based alternatives. After the dumper ceases dumping, remaining trust account funds will be returned to the dumper to comply with the CWA, to reduce debt incurred for compliance with MPRSA and the CWA and for matching Federal grants. Other portions of the fees are allocated to EPA, and such programs as the State Clean Oceans Fund and the Clean Water Act Title VI Revolving Fund.

The States of New York and New Jersey are required to contribute funds during fiscal years 1990 and 1991 to assist dumpers to develop alternatives to ocean dumping. The funds are to constitute 10% of Federal and state contributions to CWA Title VI Revolving Fund Grants.

Garbage barges are also addressed in the new legislation. The law contains provisions to regulate garbage barge operations. The disposal of medical wastes is addressed as well. A discussion of medical wastes follows.

MEDICAL WASTES

Very recently, public attention has been dramatically focused on problems posed by unregulated medical wastes. Fear of the spread of highly infectious, life threatening diseases by contaminated medical wastes has been one factor that has influenced the movement for regulation of these wastes. The now all too familiar beach scene strewn with medical debris and the beach closings have played their part in the call for regulations to manage medical wastes. Congress has responded by: (1) amending MPRSA and the CWA and (2) passing the Medical Waste Tracking Act of 1988, which was signed into law on November 1, 1988, to address medical wastes.

The amendments to MPRSA and the CWA: (1) amend the MPRSA to prohibit transportation for the purpose of dumping medical waste into ocean waters, effective the date of enactment; (2) amend the Clean Water Act to prohibit the disposal of medical waste into the territorial sea and internal waters, also effective on the date of enactment; and (3) prohibit the disposal of potentially

infectious medical waste in ocean waters by public vessels with certain narrow exceptions, effective six months after the date of enactment. Substantial penalties, including jail sentences and property forfeiture are included in the new Act for violations of the new provisions.

The Medical Waste Tracking Act of 1988 (MWTA) has several key provisions. The MWTA requires EPA to list medical wastes to be covered by the program by May 1, 1989. The MWTA also requires EPA's Administrator to establish a demonstration program by May 1, 1989 to track listed medical wastes from point of generation to point of disposal; the demonstration program is to last two years. The program is to be applicable to medical wastes that EPA will list. Wastes are to be segregated by type of waste and placed in labeled containers that protect waste handlers and the public from exposure. The program will require the tracking of the waste from the generator to the disposal facility; waste that is incinerated, however, need not be tracked after incineration. For those incinerated wastes disposed of at the site of generation, the Act imposes certain recordkeeping and reporting requirements. The MWTA contains inspection and enforcement authority. EPA may establish an exemption for generators of less than 50 pounds per month.

Not all states are covered by the demonstration program, although any state can participate if it petitions EPA to be included and EPA includes the state in the program. However, the MWTA does specify that the medical waste generated in the states of New York, New Jersey, Connecticut and states contiguous to the Great Lakes is covered by the demonstration program with the following exception. If New York, New Jersey or Connecticut choose not to participate in the program, the state (or states) must demonstrate that it has implemented a medical waste tracking program that is no less stringent than EPA's demonstration program. Other states "opt out"simply by notifying EPA. Federal facilities located in a state participating in the demonstration program are required to meet program requirements and local and state medical waste requirements.

The MWTA requires two reports to Congress on the impact of medical wastes. First, the Administrator of the Agency for Toxic Substances and Disease Registry must report on the quantitative health effects' impacts of medical wastes by November 1, 1990. Second, EPA is required to submit a report within three months after the end of the demonstration program on the effectiveness of the program. The EPA report will contain other information, such as: (1) types, number and sizes of medical waste generators; (2) the present or potential threat to human health and the environment posed by medical waste; (3) the present or potential costs to local economies, persons and the environment that are associated with the improper handling, storage, transportation, treatment or disposal of medical waste; and (4) the present or potential costs to generators, transporters and treatment, storage and disposal facilities that are associated with regulatory requirements dealing with medical wastes.

SUBTITLE D REGULATION

Regulation of non-hazardous solid waste differs from regulation of hazardous waste. Solid waste is managed in accordance with Subtitle D of RCRA, while hazardous waste is managed in accordance with Subtitle C of RCRA.

Under Subtitle D of RCRA, a framework has been established for Federal, State, and local governments to manage solid waste. This framework includes voluntary implementation of solid waste management plans combined with minimum technical standards established by the Agency for new and existing solid waste management facilities. All "open dumps" were to be either closed or upgraded to meet the technical standards established under Subtitle D.

The universe of solid waste regulated under RCRA Subtitle D includes municipal solid waste as well as industrial and commercial non-hazardous waste. In addition, Subtitle D includes non-hazardous sludges from water supply and wastewater treatment plants and "special" wastes such as some mining wastes, oil and gas waste, and infectious waste.

In 1986, approximately 158 million tons of municipal solid waste was generated. The amount is expected to increase to 190 million tons by the year 2000. Approximately 95% of the solid waste that is produced consists of non-hazardous industrial waste, municipal solid waste, oil and gas waste, and mining waste. Not only is the gross volume of solid waste increasing, but the relative volumes of the different types of waste are changing.

Approximately 85% of municipal solid waste is disposed of in landfills. There are about 6,000 currently operating municipal solid waste landfills, with approximately 184 of these landfills either proposed or final sites on the National Priorities List (NPL). An estimated one-third of all existing landfills will be full by 1994, thereby decreasing available solid waste disposal capacity.

Currently, some hazardous wastes are being disposed of in municipal landfills along with non-hazardous, solid wastes. These hazardous wastes include toxic constituents in household waste and very small quantity generator hazardous wastes (e.g., paint wastes, dry cleaning residues, corrosive wastes, and pesticides). Also, used lead acid batteries are a large source of hazardous waste in municipal landfills. EPA is currently examining the use of authorities under TSCA to control the manufacture and disposal of products containing certain hazardous constituents.

On August 30, 1988, EPA published a proposed rule which addresses new criteria for solid waste disposal facilities. The proposed rule contains revisions to the minimum criteria for municipal solid waste landfills, including containing provisions which would establish facility design and operating criteria, groundwater monitoring requirements, location criteria, corrective action provisions, methane gas controls, financial assurance, and closure and post-closure care requirements for municipal landfills. The proposed rule also contains provisions which would establish notification and exposure information requirements for industrial solid waste disposal facilities and construction/demolition waste landfills.

In addition, the Agency is examining the status of municipal waste combustion ash. Guidance is being developed for sampling and analysis of incinerator ash under the EP-Toxicity test and technical guidance is being prepared for handling ash residues. More stringent standards may be proposed for fly ash since fly ash has been shown to contain higher concentrations of toxic metals than bottom ash.

Another source of solid waste is large volume, low toxicity special wastes, such as mining waste. In the 1985 Report to Congress on Mining Waste (waste from extraction and beneficiation of ores and minerals), it was noted that less than 1% of all mining waste appeared to be hazardous. Alternatives for regulating these mining wastes under Subtitle D of RCRA are being examined. Standards for mining waste will address stability, ground water, surface water and direct human contact. In accordance with the July 3, 1986 mining waste regulatory determination, EPA is examining the components of current federal and state mining waste programs. EPA is currently considering whether regulation under Subtitle C is warranted for mining wastes from the processing of ores and minerals.

In February, 1988, the Agency established the Municipal Solid Waste Task Force. This Task Force is currently developing a national strategy for the management of municipal solid waste. The final report of the Task Force is expected to be issued in January 1989.

On October 18, 1988, the Subtitle D Report to Congress was sent to Congress. This report evaluates the adequacy of the current Federal solid waste regulatory program. In preparing the report, the Agency collected data on Subtitle D waste and facility characteristics as well as State Subtitle D program components. Among other things, the report addresses the perceived capacity shortage among municipal solid waste landfills.
Currently, state and local governments have the basic responsibility for management of Subtitle D wastes. Continuing focus will be placed on encouraging State planning activities, including en-

couraging the promotion of increased use of product separation, source reduction, and recycling to reduce the volume of solid waste requiring disposal in Subtitle D facilities.

CORRECTIVE ACTION REGULATIONS

Corrective action involves cleaning up soils, surface water and ground water contaminated with hazardous wastes at hundreds of RCRA facilities. Specific corrective action requirements are determined by the Agency based on the types of waste involved, the risk of human exposure, the hazard to the environment, and the likely future uses of the facility.

Corrective actions may be required for hazardous waste releases to any media, including air. Corrective action requirements apply to Regulated Units (RUs) at hazardous waste management facilities, treatment, storage and disposal facilities (TSDs), and solid waste management units (SWMUs). Leaking underground storage tanks under Subtitle I represent another potentially large universe for corrective action projects. In addition, publicly owned treatment works (POTWs) that accept hazardous waste by truck or rail may be subject to corrective action requirements.

The focus of corrective action is to identify and address sites that present significant environmental problems. Currently, the Agency is preparing proposed corrective action regulations. In addition, the Agency is looking into state capability to implement corrective action requirements.

The volume of waste that will be generated from corrective action projects could be large. Although most waste probably will be treated on-site, some concentrated wastes may require off-site treatment. These wastes will likely compete for existing commercial treatment and land disposal capacity. Capacity problems could occur in those regions of the country with limited disposal space.

SUPERFUND OFF-SITE POLICY AND CLEAN-UP STANDARDS

SARA establishes standards for Superfund clean-up actions and also stipulates the conditions for disposing of Superfund wastes off-site. These provisions could change the proportions of hazardous waste managed on-site and off-site.

The clean-up standards provided for in SARA require Superfund remedies to be protective of human health and the environment as well as cost-effective. The remedies must also utilize permanent solutions, alternate treatment technologies, and resource recovery to the maximum extent practicable. The on-site remedies must also meet applicable or relevant and appropriate requirements (ARARs) of other federal statutes including: RCRA, TSCA, SDWA, CAA, and CWA. Also, where state standards are more stringent than federal standards, state standards must be met. (The Federal and state ARARs may be waived in certain circumstances.) For hazardous wastes that remain on-site and exceed protective health-based levels, the remedial actions are reviewed no less than every 5 years. The new clean-up standards are expected to increase the use of mobile treatment units and stabilization techniques for on-site waste management.

SARA restricts off-site disposal of Superfund wastes to those facilities in compliance with applicable Federal and State requirements. In addition, the unit receiving Superfund wastes must not be releasing any hazardous wastes or hazardous constituents. Furthermore, releases from other units at RCRA land disposal facilities must be controlled by a corrective action program. The purpose of these requirements is to ensure that hazardous wastes from Superfund sites are not moved to other facilities that could potentially become Superfund sites in the future. A revised off-site policy will be proposed in the near future.

Several Superfund sites have experienced difficulties in locating a commercial facility acceptable to handle their waste. However, these situations have been resolved in relatively short periods of time as additional facilities achieve compliance with requirements.

EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW (TITLE III)

In October 1986, Congress enacted Title III of SARA which focused on emergency planning and the community's right-to-know about chemicals stored, processed, used, and released in its boundaries. The intent of Title III is to improve public awareness of the presence of hazardous and toxic chemicals within communities, and of the releases into the environment of such chemicals. This information will be used to improve the emergency response planning efforts of state and local governments. Title III accomplishes this intent by establishing requirements for emergency planning, emergency release notification, community right-to-know reporting, and toxic chemical release reporting.

Title III applies to certain listed chemicals present at a facility in amounts greater than the threshold quantity established for each chemical under each section of Title III. This applies to chemicals regardless of their designation as raw material, inventory, work-in-process, product, chemical mixtures, chemicals stored on-site to be recycled, or waste.

The provisions of Title III require a phased approach to implementation. Under the emergency planning provisions of Sections 301-303, an emergency response commission is to be established within each state. The state commissions are responsible for creating local committees within areas designated by the state as emergency planning districts. Currently, 35 states have established districts according to existing local government subdivisions; 10 states have designated existing regional response or planning districts as the emergency planning district; and 15 states have designated the individual state to be the entire district.

It is anticipated that Title III will assist in waste management efforts through toxic release inventory reporting and community right-to-know requirements. The availability of Title III information might result in reductions in the amount of chemicals present within communities as well as assist in source reduction efforts. However, the effect on waste disposal capacity is uncertain at present.

REDEFINITION OF RCRA HAZARDOUS WASTE

In early 1987, EPA started to examine alternative methods for defining waste as a RCRA hazardous waste. Presently, a waste is defined as hazardous under RCRA if it possesses certain characteristics or is listed in Part 261 of the Code of Federal Regulations (40 CFR). About half of RCRA hazardous waste possesses one of four hazardous characteristic attributes: reactivity, ignitability, corrosivity, or EP toxicity. There are now over 450 listed hazardous wastes. New substances are added to the list of wastes as they are tested.

Approximately 275 MMT of RCRA hazardous waste are generated by about 40,000 large quantity generators and about 100,000 small quantity generators. Changing the criteria for defining a hazardous waste could significantly affect the volume of waste currently regulated by RCRA as well as the number of regulated facilities.

SUPERFUND STATE CAPACITY ASSURANCE PLANS

SARA provides that EPA shall not provide remedial actions within any state unless that state assures EPA by October 17, 1989 that it has adequate hazardous waste treatment and disposal capacity for wastes generated in the state for the next twenty years. This assurance must also provide that the available capacity will be in compliance with RCRA. These requirements seek to ensure that Superfund money is only utilized in states that are actively engaged in efforts to avoid the creation of future hazardous waste disposal sites.

Currently, EPA is preparing a guidance document to assist states in preparing their capacity assurance plans (CAPs). States will utilize the information obtained during the assurance process to plan for their future hazardous waste treatment and disposal needs. Such planning will require accurate assessments of the amount, type and disposition of the hazardous wastes that will be generated within the state, exported to other states, and imported into the state.

The effect of waste minimization efforts upon the volume of waste requiring treatment and disposal will play a role in determining the amount of disposal capacity needed by a state. Also, siting and RCRA compliance issues will be important factors in determining state treatment and disposal needs.

POTENTIAL REGULATORY IMPACT

Each of the above regulatory and policy decisions has the potential to shift waste from one medium to another or from one location to another. The various impacts of the regulations discussed in this section are summarized in Exhibit 19.

Exhibit 19.
Regulations and Policies and Their Potential Effects on Capacity

REGULATION OR POLICY	WASTE TRANSFER DESCRIPTION	AMOUNT OF WASTE	CAPACITY OUTLOOK
Land Disposal Restrictions	• Shift organic liquids and sludges to incineration.	Moderate	Constrained
	• Solidify inorganic sludges prior to land disposal.	Moderate	Available for a short-term
	• Redirect wastewaters from surface impoundments to treatment tanks and surface waters. Treat and dispose of residual sludge under RCRA.	Unknown but potentially large	May be constrained in short term
Pollution Prevention Policy	• Likely to result in concentration of hazardous wastes prior to treatment and disposal.	Reduce volume 25-35%	Increase the longevity of land disposal units. May increase demand for treatment capacity.
Deep-Well Injection Regulation	• Potentially restrict disposal of RCRA hazardous, aqueous wastes from deep-wells; shift wastes to POTWs and industrial wastewater treatment plants.	Moderate to Large	Constrained
Domestic Sewage Sludge Regulation	• Large volumes of non-hazardous, municipal sludge are produced annually. RCRA contains an exclusion for hazardous wastes mixed with domestic sewage.	Unknown but may be potentially significant	Sludge currently landfilled, used for land application or incinerated.
Ocean Dumping/ Disposal Regulation	• Ocean disposal of sewage sludge, medical wastes and industrial waste will be banned after December 31, 1991.	Moderate	Not applicable
Subtitle D Regulation	• Focus on recycle and reuse may reduce some solid waste. However large volumes will continue to be land disposed or incinerated.	Unknown but potentially large	Capacity for landfills constrained in long-term

(continued)

Exhibit 19 (cont.).
Regulations and Policies and Their Potential Effects on Capacity

REGULATION OR POLICY	WASTE TRANSFER DESCRIPTION	AMOUNT OF WASTE	CAPACITY OUTLOOK
Corrective Action Regulations	• UST and SARA may result in some wastes transferred off-site to RCRA commercial facilities. • Increase the volume of solids and sludges requiring treatment and disposal.	Moderate to significant	Incineration capacity is limited in the short-term. Could improve in the long-term given successful siting programs. Land disposal capacity may be constrained in long-term unless successful siting occurs.
Superfund Off-Site Policy and Clean-Up Standards	• Encourages on-site treatment and disposal of Superfund waste. Will minimize the volume of untreated waste transferred to commercial facilities.	Moderate	Could be increased through use of innovative, mobile treatment technology.
Emergency Planning and Community Right-To-Know (Title III)	• May result in firms reducing the amount of hazardous waste stored on-site.	Moderate	Unlikely to affect capacity
Redefinition of RCRA Hazardous Waste	• Potentially change the amount of waste defined as hazardous. It is unknown if specific categories of waste would increase more than others or the impact on particular waste management practices.	Unknown but may be potentially significant	Capacity constrained already for particular wastes such as some solvents and dioxins.
Superfund State Capacity Assurance Plans	• Should result in a better understanding of interstate waste shipments and on-site capacity needs .	Potentially significant	Capacity requirements for 20 years will be planned and implemented.

SECTION 4

OUTLOOK FOR THE FUTURE

The regulatory actions discussed in the previous section will significantly influence the ways waste is managed in the future. It is difficult to predict the exact interaction among future regulatory actions, generators' response to regulations, and the commercial waste industry reaction. It is also difficult to predict the specific hazardous and solid waste system of tomorrow. However, several preliminary conclusions emerge from information provided in this report which apply to hazardous as well as solid waste.

First, the report makes it apparent there is a need to develop more integrated waste management planning at both the Federal and state levels of government as the country approaches the twenty-first century. Second, successful siting and permitting is need to increase waste management capacity. Third, pollution prevention must become a primary goal for waste generators through the use of recycling, source reduction and reuse efforts. Fourth, more innovative and alternative technologies need to be developed to treat, store, recycle and dispose of waste. Lastly, a more focused effort on enforcement of waste management statutes and regulations is needed.

INTEGRATED WASTE MANAGEMENT PLANNING IS NEEDED

Both the Federal government and states must plan integrated approaches to both hazardous and solid waste management and disposal. Pollution prevention, recycling, reuse, resource recovery and other techniques must be utilized to effectively reduce waste production and to safely manage the waste that is produced. Implementation of a single waste management method alone will not resolve complex hazardous and solid waste management issues.

At the heart of waste mangement planning is the need to ensure adequate waste management and disposal capacity while ensuring the protection of human health and the environenment. In addition, planning is necessary to anticipate the impact of changing regulations on future capacity needs. It is important to note that requirements contained in such regulations as the land disposal restriction regulations and the corrective action regulations may shift wastes normally treated in one type of facility to another type of facility. Furthermore, changing regulations may alter the methods of treatment and disposal recommended for particular wastes. In addition, our evolving environmental regulations could also shift wastes that are currently regulated under RCRA to coverage under another Act. Integrated waste management planning efforts are needed to ensure that adequate capacity is available in the future. Potential capacity problem areas are noted in Exhibit 20.

To accomplish this end, EPA strongly encourages the use of such techniques as recycling, source reduction, and reuse. Incineration is favored for certain types of waste, and landfilling must be used sparingly to preserve the limited capacity that is currently available.

Everyone has a role in integrated waste management planning, including the Federal government, state and local governments, manufacturers, consumers, and commercial waste management firms. Most importantly, the public must accept that waste needs to be managed locally to ensure that wastes produced at the local level are managed efficiently.

SUCCESSFUL SITING AND PERMITTING IS NEEDED

There are a number of factors within the waste management system, such as regulations, statutes and economics, which affect the availability of capacity in the waste management system for the future. The regulatory and statutory initiatives have changed the focus from landfilling and off-site treatment and disposal to permanent treatment whenever feasible.

Exhibit 20. Potential Capacity Problem Areas

CAPACITY PROBLEM AREAS	LIKELY CAPACITY PROBLEM AREAS	UNLIKELY TO BE PROBLEM AREAS FOR CAPACITY
Incineration • Limited excess capacity currently exists commercially for certain liquid organic wastes. On-site capacity is uncertain. • Siting and permitting delays slow capacity expansion. • More sludges and solids could be brought into hazardous waste system (e.g., RCRA and Superfund corrective action), some of which will be incinerated. Capacity problem exists.	**Wastewater Treatment in Tanks or Double Lined Surface Impoundments** • Large volumes of RCRA hazardous waste are currently treated and disposed of in surface impoundments. • Some shift from surface impoundments to tanks could occur (exempt from RCRA, but regulated under the Clean Water Act). • Potential increase in demand for tank treatment. Capacity problem will occur if conversion to tanks or retrofit does not take place.	**Solidification** • Many inorganic solids and sludges are potential candidates for solidification. Limiting factor is availability of landfills. • Set up time and costs are low to stabilize wastes. • Technology is not a limiting factor. • Some wastes may need to be stabilized in tanks. Capacity should be available. **Recycling, Reuse, Fuel Distillation** • Most wastes currently going to land disposal would not require these technologies. More likely the wastes would require incineration in a hazardous waste incinerator. • Major permit modifications are not necessary (RCRA exempt processes). • Use of these alternatives may be affected by regulations on waste minimization, fuel specifications, and air emissions. Capacity should not be a problem.

Note: The reader should note that this chart focuses on national, physical capacity. However, economic, transportation, regulatory and legal considerations may constrain the practical availability of capacity. Moreover, regional and state capacity problems may exist.

An important program in the next few years will be the state assurance of twenty years of adequate hazardous waste treatment and disposal capacity which is required under SARA. Failure of a state to assure adequate capacity will result in the loss of Superfund remedial action funding for the state.

In addition, economic factors have combined with regulatory and statutory factors to produce a limited amount of disposal and treatment capacity. What capacity is available is expensive due to the significant increase in landfill and other disposal costs since 1984.

With the regulatory and statutory goals for decreasing the amount of hazardous wastes requiring management and disposal, generators are generally managing their wastes on-site, and shipping off-site the more concentrated and toxic wastes for treatment and disposal. The result has been a need for more on-site and off-site treatment and disposal capacity to manage these wastes.

To address the need for more waste management capacity in the future, the siting and subsequent permitting of waste management facilities must be promoted. First, communication and cooperation must be created among the siting parties. Second, creativity and compromise must be used to develop thorough siting and permitting options. Third, care should be taken to consider the economic and environmental needs of local communities and states. Finally, use of a structured negotiation process which ensures public participation is necessary to facilitate siting and permitting.

RECYCLING, SOURCE REDUCTION AND REUSE EFFORTS MUST BE IMPROVED

The Agency's goal for the future is to ensure the implementation of pollution prevention techniques by generators of waste in this country. Recycling, source reduction and reuse are the current methods in use to achieve this goal. Use of recycled waste saves resources; source reduction refines production methods to reduce

pollution at the source; and reuse again focuses on production to find ways of reusing wastes to reduce the quantities of wastes requiring disposal.

At present and in the future, recycling, source reduction and reuse efforts could become more prevalent in the waste management system. Two market factors which may function as the impetus of these efforts are the economics of waste management and liability issues. The current economic factor that looms large for waste management is rising costs of waste disposal (i.e., land disposal, treatment, and incineration). The liability concerns center on the regulatory and statutory penalties associated with wastes which are hazardous that are improperly disposed.

INNOVATIVE AND ALTERNATIVE TECHNOLOGIES NEED TO BE DEVELOPED

The key to future waste management rests with the development of innovative and alternative technologies. Innovative technologies are needed to continue the development of techniques for the handling, transportation, treatment and disposal of waste. The Superfund Innovative Technology Evaluation (SITE) program is one such program which has been developed by EPA to foster and encourage the development of new and innovative hazardous waste treatment technologies. It is possible that a parallel program will be developed for solid waste in the near future. Alternative technologies, many available and proven effective, are needed to promote more permanent solutions to waste problems over those used in the past.

MORE ENFORCEMENT IS NEEDED

The enforcement of regulations and statutes is key to a viable waste management system operating. Improvement in the enforcement area could translate into better waste management practices throughout the country.

More enforcement efforts should be focused on frequent and comprehensive inspections to ensure TSD compliance with land disposal restriction requirements, corrective action requirements, and the requirements of other statutes and regulations. In addition, a stronger enforcement presence is needed to encourage responsible parties to assume the costly clean-up responsibilities mandated under RCRA and Superfund. Lastly, the Agency is encouraging implementation of increased state enforcement measures for the aforementioned areas.

In conclusion, waste management is everyone's responsibility. Safe waste management can only be achieved through the active cooperation of the public, private industry, and state and Federal governments. Such cooperation is currently underway, and efforts to reduce waste generation as well as efforts to effectively manage the wastes that are produced must continue.

APPENDIX A

Commercial Incinerator Facilities

OWNER	LOCATION	TYPE OF UNIT	TYPES OF WASTES
Environmental Systems Company	El Dorado Arkansas	Rotary Kiln	PCB, Acids, Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics
Chemical Waste Management Inc.	Sauget Illinois	Liquid Injection and Fixed Hearth	Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics
Chemical Services Inc.	Chicago Illinois	Liquid Injection and Rotary Kiln	PCB, Halogenated & Non- Halogenated Solvents, Halogenated & Non-Halogenated Organics, Non-Metallic Inorganics
Olin Corp.	Brandenburg Kentucky	Liquid Injection	Not available at this time
LWD, Inc.	Calvert City Kentucky	Liquid Injection	Acids, Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics, Metallic Organics
LWD, Inc.	Clay Kentucky	Rotary Kiln	Acids, Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics, Metallic Organics
Rollins Environmental Services	Baton Rouge Louisiana	Liquid Injection and Rotary Kiln	Acids, Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics, Metallic Organics, Metallic & Non-Metallic Inorganics
Stauffer	Baton Rouge Louisiana	Not Available	Not available at this time
Rollins Environmental Services	Bridgeport New Jersey	Liquid Injection and Rotary Kiln	Acids, Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics, Metallic Organics, Metallic & Non-Metallic Inorganics
Rollins Environmental Services	Deer Park Texas	Liquid Incineration and Rotary Kiln	PCB, Acids, Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics, Metallic Organics, Metallic & Non-Metallic Inorganics
Stauffer Chemical Corp.	Houston Texas	Not Available	Not available at this time
Caldwell Systems, Inc.	Lenoir North Carolina	Liquid Injection and Solid Incineration	Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics, Metallic and Non-Metallic Organics
Ross Incineration	Grafton Ohio	Liquid Injection and Rotary Kiln	Acids, Halogenated and Non-Halogenated Solvents, Halogenated and Non-Halogenated Organics
Stablex South Carolina Inc.	Rock Hill South Carolina	Fixed Hearth	Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics, Metallic Organics
GSX Thermal Oxidation Corp.	Roebuck South Carolina	Liquid Injection	Halogenated & Non-Halogenated Solvents, Halogenated & Non-Halogenated Organics
B.D.T. Inc.	New York	Not Available	Metals

- In addition, there are four TSCA commercial incinerators permitted to burn PCB wastes.

Source: EPA Office of Solid Waste and Office of Toxic Substances, 1988.

APPENDIX B

Operating Commercial Land Disposal Facilities

OWNER	LOCATION	TYPES OF FACILITIES	WASTE
Chemical Waste Management Inc.	Emelle, Alabama	Landfill, Storage Impoundments, Treatment Impoundments	Metals, Cyanides, Acidic Corrosives, PCBs, Halogens
IT Corp. Benecia	Benecia, California	Landfill, Disposal Impoundments, Storage Impoundments	Metals, Cyanides, Solvents
IT Corp. Vine Hill	Martinez, California	Treatment Impoundments	Metals
IT Corp. Imperial	Westmoreland, California	Disposal Impoundments, Treatment Impoundments	Metals, Solvents
Casmalia Resources	Casmalia, California	Landfill,Disposal Impoundments Treatment Impoundments	Acidic Corrosives, Metals, Cyanides, Halogens
ACME Fill Corp.	Martinez, California	Landfill	Other
IT Corp. Baker Facility	Martinez, California	Disposal Impoundments, Treatment Impoundments	Metals, Acidic Corrosives
Chemical Waste Management, Inc.	Kettleman City, California	Landfill, Treatment Impoundments	Acidic Corrosives, Metals
CECOS International Inc.	Bristol, Connecticut	Waste Piles	Metals, Cyanides
City of Danbury	Danbury, Connecticut	Landfill	Metals
Torrington Landfill	Torrington, Connecticut	Landfill	Metals
Envirosafe Services of Idaho	Grand View, Idaho	Landfill, Waste Piles	Acidic Corrosives, Metals, Cyanides, Solvents, PCBs, Halogens
SCA Chemical Services Inc.	Chicago, Illinois	Storage Impoundments, Treatment Impoundments	Other
Peoria Disposal Co.	Peoria, Illinois	Landfill	Metals
CID-Landfill	Calumet City, Illinois	Landfill	Acidic Corrosives, Metals, Cyanides, Solvents, Halogens
CECOS International Inc./BFI	Zion, Illinois	Landfill	Metals, Solvents, Halogens
Four County Landfill	Rochester, Indiana	Landfill	Materials
Adams Center Landfill Inc.	Fort Wayne, Indiana	Landfill	Acidic Corrosives, Metals, Cyanides, Solvents, Halogens

Source: EPA Office of Solid Waste and Office of Toxic Substances, 1986.

(continued)

Operating Commercial Land Disposal Facilities (cont.)

OWNER	LOCATION	TYPES OF FACILITIES	WASTE
CECOS International Inc.	Westlake, Louisiana	Storage Impoundments	Acidic Corrosives, Metals, Solvents, Halogens
CECOS International, Inc.	Livingston, Louisiana	Landfill	Acidic Corrosives, Cyanides, Solvents, Halogens
Chemical Waste Management, Inc.	Carlyss, Louisiana	Landfill	Metals, Cyanides, Solvents, Halogens
Rollins Environmental Services	Baton Rouge, Louisiana	Landfill, Storage Impoundments, Treatment Impoundments	Metals, Solvents, Cyanides, Acidic Corrosives
Maryland Environmental Service	Baltimore, Maryland	Landfill	Not available at this time
Wayne Disposal, Inc.	Belleville, Michigan	Landfill	Acidic Corrosives, Metals
Environmental Waste Control	Inkster, Michigan	Treatment Impoundments	Acidic Corrosives, Metals
B.H.S., Inc.	Wright City, Missouri	Landfill	Solvents, Halogens
Rogers Rental Landfill	Centerville, Mississippi	Land Treatment	Not available at this time
US Ecology, Inc.	Beatty, Nevada	Landfill	Metals, Cyanides, Solvents, PCBs, Halogens
SCA Chemical Services	Model City, New York	Landfill	Not available at this time
Frontier Waste Chemical Process	Niagra Falls, New York	Waste Piles	Metals
CECOS International Inc.	Niagra Falls, New York	Landfill	Acidic Corrosives, Metals, PCBs
F.E.I. Landfarming	Oregon, Ohio	Land Treatment	Metals
Chemical Waste Management, Inc.	Vickery, Ohio	Storage Impoundments	Acidic Corrosives, Metals
Fondessy Enterprises, Inc.	Oregon, Ohio	Landfill	Metals, Cyanides, Solvents, Halogens
Erieway Pollution Control, Inc.	Bedford, Ohio	Waste Piles	Acidic Corrosives, Metals, Halogens
CECOS International, Inc.	Williamsburg, Ohio	Landfill	Metals, Cyanides, Solvents, PCBs, Halogens

Source: EPA Office of Solid Waste and Office of Toxic Substances, 1988.

(continued)

Operating Commercial Land Disposal Facilities (cont.)

OWNER	LOCATION	TYPES OF FACILITIES	WASTE
Eagle Picher Industries, Inc.	Quapaw, Oklahoma	Disposal Impoundments	Metals, Solvents
USPCI	Waynoka, Oklahoma	Landfill, Disposal Impoundment,Waste Piles, Storage Impoundments, Treatment Impoundments	Acidic Corrosives, Metals, Cyanides
Chem-Security Systems, Inc.	Arlington, Oregon	Landfill, Storage Impoundments, Treatment Impoundments	Acidic Corrosives, Metals, Solvents, PCBs, Halogens
Mill Service Inc.	Yukon, Pennsylvania	Disposal Impoundments, Waste Piles	Metals
Mill Service Inc.	Bulger, Pennsylvania	Disposal Impoundments, Waste Piles	Metals
GSX Services of South Carolina	Pinewood, South Carolina	Landfill, Treatment Impoundment	Acidic Corrosives, Metals, Cyanides
Gibraltar Chemical Resources	Winona, Texas	Treatment Impoundments	Cyanides, Halogens
Gulf Coast Waste Disposal	Texas City, Texas	Landfill, Land Treatment	Metals, Cyanides
Chemical Waste Management, Inc.	Port Arthur, Texas	Landfill, Disposal Impoundments, Storage Impoundments, Treatment Impoundments	Acidic Corrosives, Metals, Cyanides, Solvents, Dioxins, Halogens
Rollins Environmental Services	Deer Park, Texas	Landfill, Storage Impoundments,Treatment Impoundments	Metals, Cyanides, Solvents, Halogens
Malone Service Company	Texas City, Texas	Landfill, Storage Impoundments, Treatment Impoundments	Metals, Cyanides, Acidic, Corrosives
Texas Ecologists, Inc.	Robstown, Texas	Landfill	Metals, Cyanides, Solvents, Halogens
USPCI	Knowles, Utah	Landfill, Land Treatment, Storage Impoundment	Metals, Acidic Corrosives, Solvents, PCBs, Halogens

Source: EPA Office of Solid Waste and Office of Toxic Substances, 1988.

APPENDIX C

Commercial Deep-Well Injection Systems

OWNER	LOCATION	WASTE
CECOS International	Lake Charles Louisiana	Acids, Caustics, Cleaning Solutions, Organic and Inorganic Wastewaters, Leachate, Contaminated Soils.
Rollins Environmental Services	Baton Rouge Louisiana	Acids, Chromic Acids, Pickling Acids, Caustics, Cyanides, Paints and Inks, Non-Halogenated Solvents, Halogenated Solvents, Waste Oil, Commercial Chemical Products, Non-metallic Inorganics, Metallic Inorganics, Non-Halogenated and Halogenated Organics, Pesticides, PCB Liquids <50 ppm, PCB Solids <50 ppm, Contaminated Soil, Lab Packs.
Chemical Waste Management Inc.	Vickery Ohio	Acids, Chromic Acids, Pickling Acids, Caustics, Waste Oil, Non-metallic Inorganics, Metal Inorganics, Non-Halogenated Organics.
Chemical Resources, Inc.	Tulsa Oklahoma	Acids, Pickling Acids, Cyanides, Paint and Inks, Non-Halogenated Solvents, Waste Oil, Metallic Inorganics, Metallic Organics, Pesticides.
Disposal Systems, Inc.	Houston Texas	Acids, Chromic Acids, Caustics, Cyanides, Paints and Inks, Non-Halogenated Solvents, Halogenated Solvents, Waste Oil, Commercial Chemical Products, Non-Metallic Inorganics, Metallic Inorganics, Metallic Organics, Non-Halogenated Organics, Halogenated Organics, Pesticides, Contaminated Soil, Texas Class I Hazardous Wastes.
BFI	Houston Texas	Not Available

(continued

Source: EPA Office of Solid Waste and Office of Toxic Substances, 1986.

Commercial Deep-Well Injection System (cont.)

OWNER	LOCATION	WASTE
Chemical Waste Management, Inc.	Corpus Christ Texas	Acids, Chromic Acids, Pickling Acids, Caustics, Cyanides, Paints and Inks, Non-Halogenated Solvents, Halogenated Solvents, Waste Oil, Non-metallic Inorganics, Metallic Inorganics, Non-Halogenated Organics, Halogenated Organics.
Malone Service Co.	Texas City Texas	Acids, Chromic Acids, Pickling Acids, Caustics, Cyanides, Paints and Inks, Non-Halogenated Solvents, Halogenated Solvents, Waste Oil, Commercial Chemical Products, Non-Metallic Inorganics, Metallic Inorganics, Metallic Organics, Non-Halogenated Organics, Pesticides.
EMPAK, Inc.	Deer Park Texas	Acids, Chromic Acids, Pickling Acids, Caustics, Cyanides, Paints and Inks, Non-Halogenated Solvents, Halogenated Solvents, Waste Oil, Commercial Chemical Products, Non-Metallic Inorganics, Metallic Organics, Non-Halogenated Organics, Pesticides.
Gibraltar Chemical Resources	Winona Texas	Acids , Chromic Acids, Pickling Acids, Caustics, Cyanides, Paints and Inks, Non-Halogenated Solvents, Halogenated Solvents, Waste Oil, Texas Class I Waste.
Chemical Waste Management	Port Arthur Texas	Acids, Chromic Acids, Pickling Acids, Caustics, Cyanides, Paints and Inks, Non-Halogenated Solvents, Halogenated Solvents, Waste Oil, Commercial Chemical Products, Non-Metallic Inorganics, Metallic Organics, Non-Halogenated and Halogenated Organics, Pesticides, Contaminated Soil.
CECOS International, Inc.	Odessa Texas	Acids (pH >5), Chromic Acids, Pickling Acids, Caustics, Metallic Organics, Flammable Liquids, Cyanide Waste Stream.
Wastewater, Inc.	Guy Texas	Organic, Brine, Acid.

Source: EPA Office of Solid Waste and Office of Toxic Substances,1988.

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