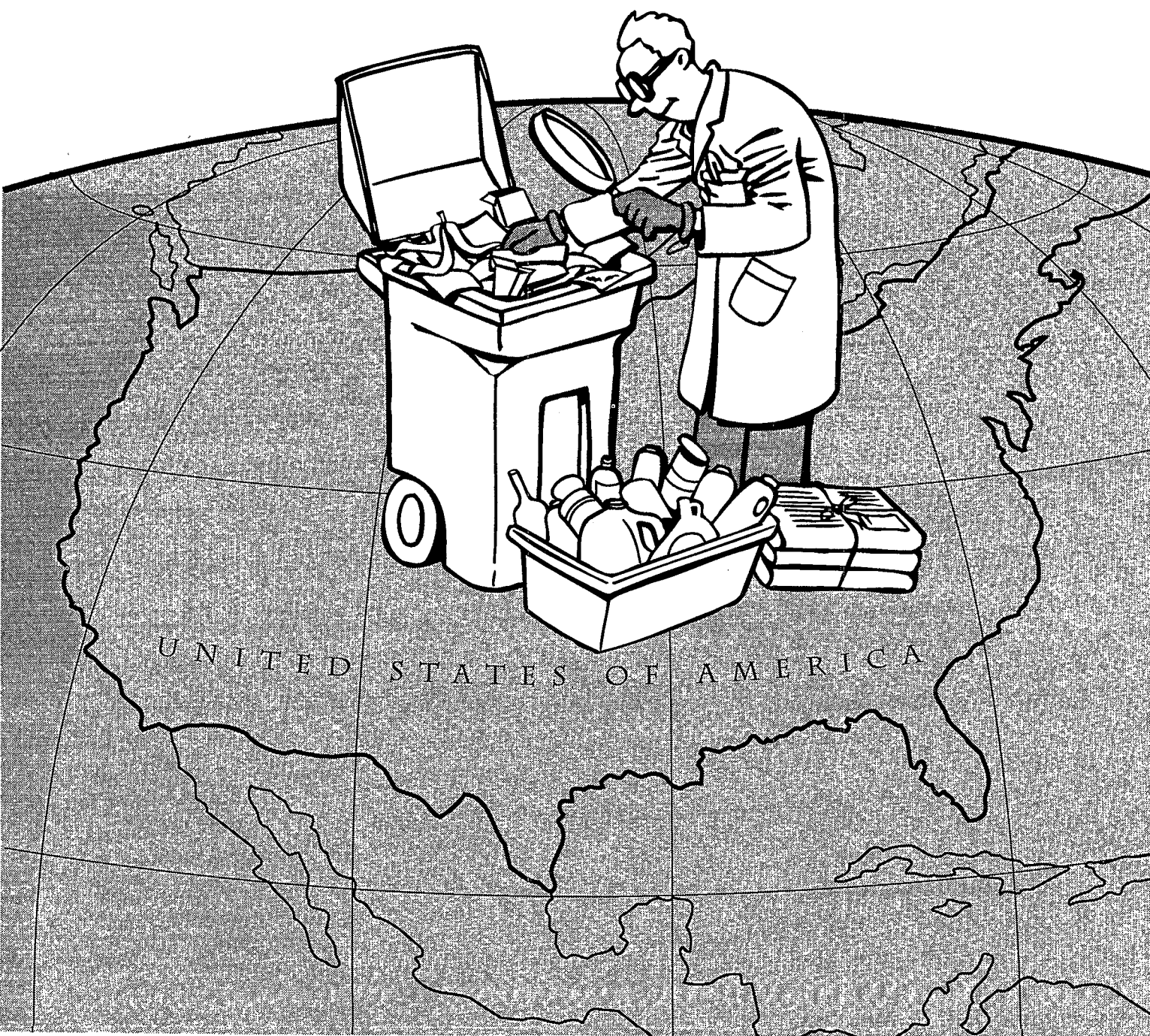
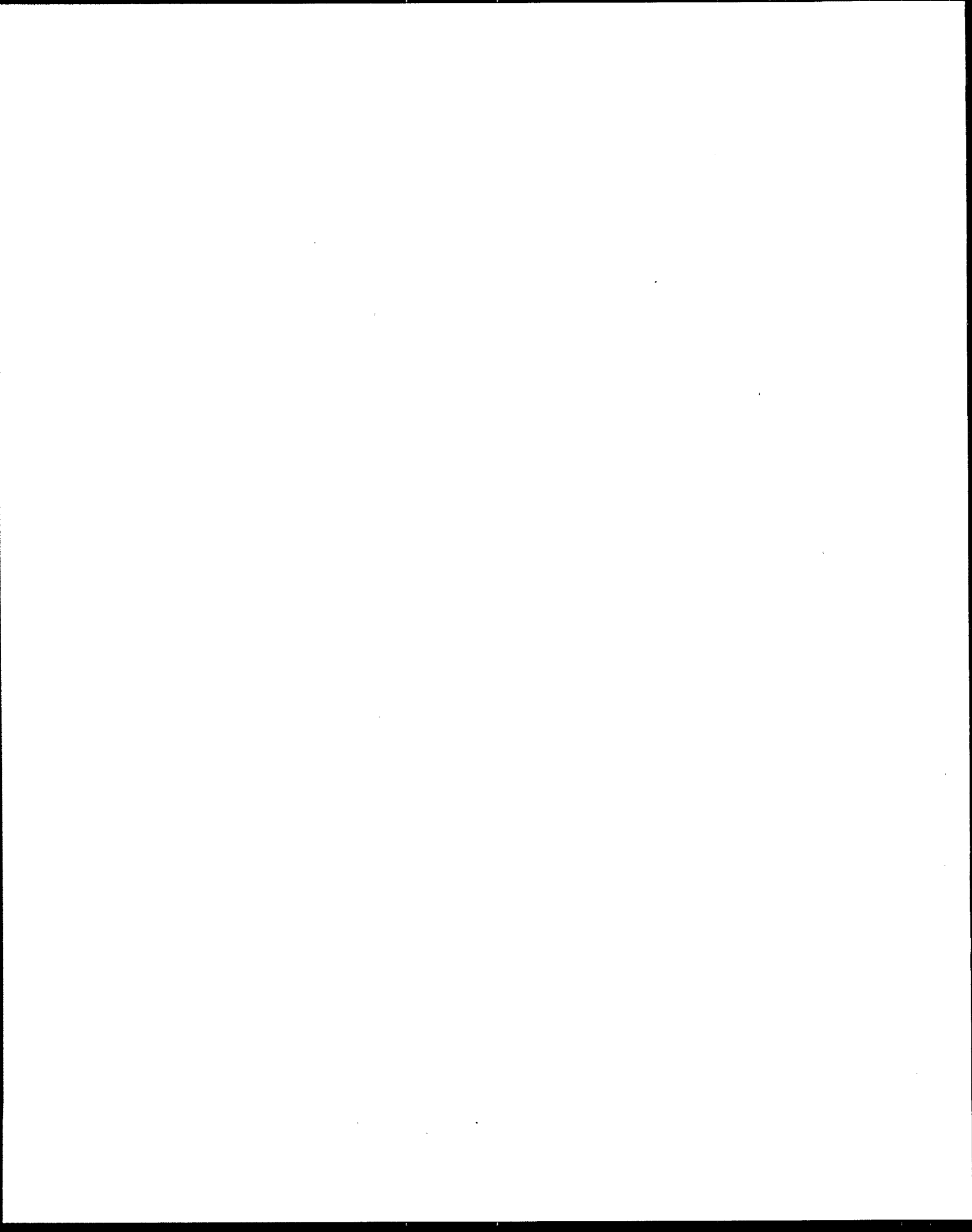




Characterization of Municipal Solid Waste in The United States: 1996 Update Executive Summary





**CHARACTERIZATION OF
MUNICIPAL SOLID WASTE
IN THE UNITED STATES**

1996 UPDATE

EXECUTIVE SUMMARY

Prepared for

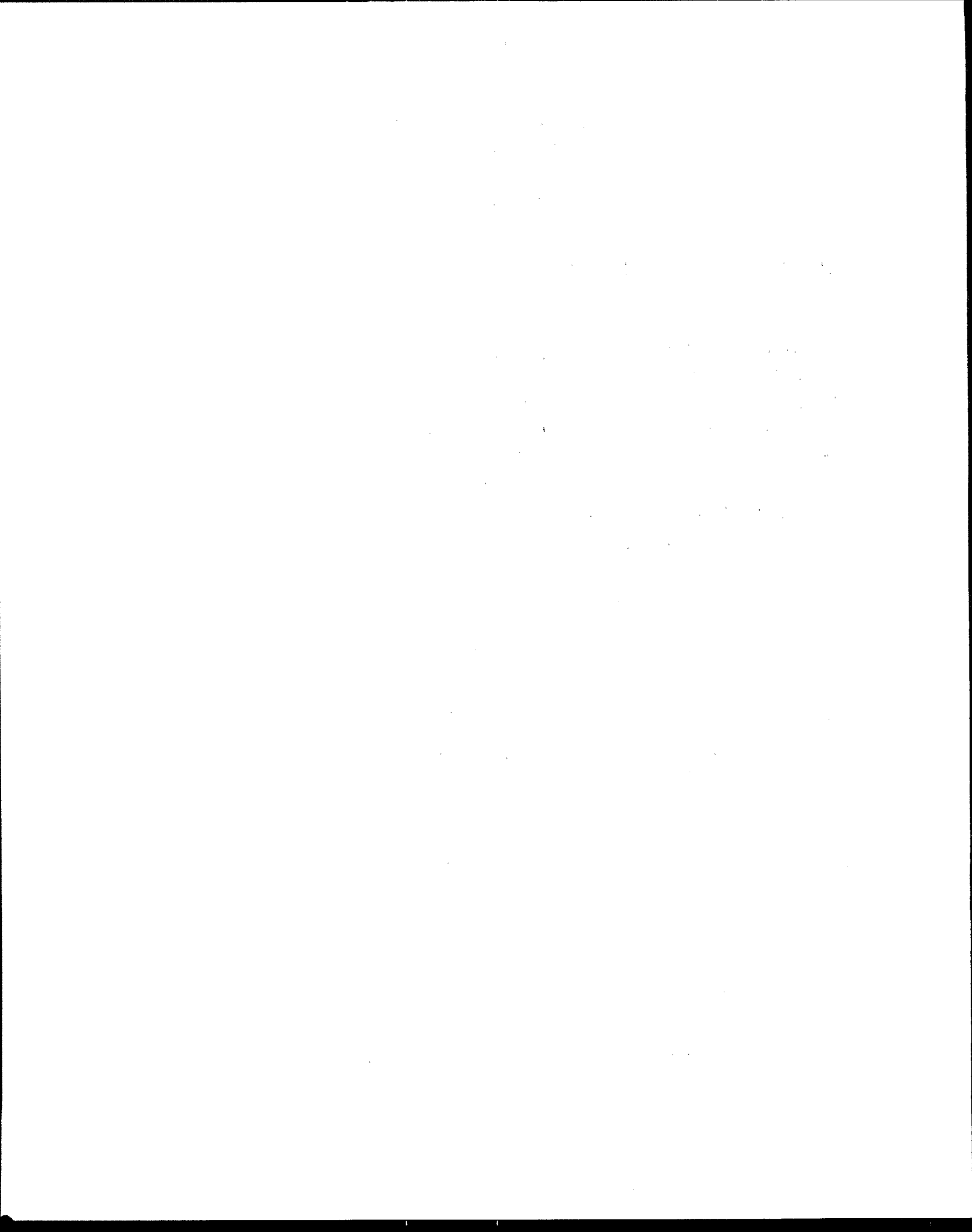
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CHARACTERIZATION OF MUNICIPAL SOLID WASTE IN THE UNITED STATES: 1996 UPDATE

Executive Summary

FEATURES OF THIS REPORT

This report is the latest in a series of reports published by the U.S. Environmental Protection Agency (EPA) describing the national municipal solid waste (MSW) stream. The report characterizes the national solid waste stream for the previous calendar year based on data collected from 1960 through 1995. It also discusses trends and highlights changes that have occurred over the years, both in the types of wastes generated and in the ways they are managed. Although the report does not specifically address local and regional variations in the waste stream, the data in the report can be used to develop approximate estimates of MSW generation and composition in defined areas.

This report includes information on:

- Total MSW generation, recovery, and discards from 1960 to 1995.
- Per capita generation and discard rates.
- Materials (e.g., paper, glass, metals, plastic) that comprise MSW, as well as products (e.g., durable and nondurable goods, containers, packaging) found in the waste stream.
- Aggregate data on the infrastructure for MSW management, including estimates of the number of curbside recycling programs, drop-off centers, and materials recovery facilities in the United States.
- Trends in MSW management from 1960 to 1995, including examples of source reduction of specific products, selected materials reuse programs, recovery for recycling (including composting), and disposal via combustion and landfilling.
- Projections for MSW generation and management through 2010, including three scenarios of conditions that could achieve targeted recovery rates.

REPORT HIGHLIGHTS

1995 MSW Generation and Management:

- A total of 208 million tons of MSW was generated in 1995. This reflects a decrease of more than 1 million tons from 1994, when MSW generation was over 209 million tons.
- The per capita generation rate in 1995 was 4.3 pounds per person per day, compared to 4.4 pounds per person per day in 1994.
- The per capita discard rate (after recovery for recycling, including composting) was 3.2 pounds per person per day in 1995, down from 3.3 pounds per person per day in 1994.
- Recycling (including composting) recovered 27 percent (56 million tons) of MSW in 1995, up from 25 percent (52 million tons) in 1994.
- There were over 7,000 curbside recycling programs in the United States in 1995, as well as nearly 9,000 drop-off centers for recyclables. More than 300 materials recovery facilities helped process the recyclables collected.
- Recovery of paper and paperboard reached 40 percent (33 million tons) in 1995, accounting for more than half of the total MSW recovered. In addition, more than 9 million tons of yard trimmings were recovered for composting in 1995, accounting for the second largest fraction of total recovery. The percentage of yard trimmings composted (30 percent) has doubled since 1992.
- Landfills managed 57 percent of MSW generated (118 million tons), down from 60 percent in 1994. Combustion facilities managed 16 percent (33.5 million tons) of the total MSW generated, slightly more than the 15 percent managed in 1994.

Trends in MSW Generation and Management:

- Per capita MSW generation is expected to remain relatively stable through the year 2000. This rate will remain steady because even though the per capita generation of certain MSW components will continue to rise, source reduction efforts are beginning to have an effect.
- Generation of yard trimmings is projected to decline from 29.8 million tons in 1995 to 27.1 million tons in 2000. This decline is due to the effect of source reduction efforts, such as grasscycling and backyard composting, spurred, in part, by legislation passed by many states banning yard trimmings from landfills or charging residents separately for pickup.
- Generation rates for paper and paperboard, plastics, and wood are all projected to increase faster than population until 2010, while generation rates for glass, metals, and food wastes are projected to increase at about the same rate as population growth.
- Annual generation of MSW is projected to increase to 222 million tons by the year 2000 and 253 million tons in 2010. Containers and packaging are expected to remain the largest category of products in MSW, at 36 percent of total generation by 2000 and 38 percent by 2010. Nondurables will remain the second largest category at 28 percent of total MSW generation by 2000 and 29 percent by 2010.
- For the year 2000, possible recovery scenarios are presented for 30 and 35 percent recovery levels. Possible recovery scenarios between 30 and 40 percent are made for the year 2010.
- Combustion is expected to remain relatively unchanged, managing about 16 percent of the total MSW generated by the year 2000 (36 million tons) and 15 percent by 2010 (39 million tons).
- While the percentage of total MSW being disposed of in landfills is decreasing, the actual tonnage is expected to increase to 119 million tons by 2000, and 125 million tons by 2010. Landfilling is expected to continue to be the single most predominant MSW management method in future years.

DEFINITIONS AND METHODOLOGY

Municipal solid waste (MSW) includes wastes such as durable goods, nondurable goods, containers and packaging, food scraps, yard trimmings, and miscellaneous inorganic wastes from residential, commercial, institutional, and industrial sources. Examples of waste from these categories include appliances, automobile tires, newspapers, clothing, boxes, disposable tableware, office and classroom paper, wood pallets, and cafeteria wastes. MSW does not include wastes from other sources, such as construction and demolition debris, automobile bodies, municipal sludges, combustion ash, and industrial process wastes that might also be disposed in municipal waste landfills or incinerators.

Source reduction activities reduce the amount or toxicity of wastes before they enter the municipal solid waste management system (see **Generation**). Reuse is a source reduction activity involving the recovery or reapplication of a package, used product, or material in a manner that retains its original form or identity. Reuse of products such as refillable glass bottles, reusable plastic food storage containers, or refurbished wood pallets are examples of source reduction.

Generation refers to the amount (weight or volume) of materials and products that enter the waste stream before recycling (including composting), landfilling, or combustion takes place.

Recovery of materials means removing MSW from the waste stream for the purpose of recycling (including composting). Recovery for recycling as defined for this report includes purchases of postconsumer recovered materials plus net exports of the materials. Recovery of yard trimmings includes diverting yard trimmings from disposal to a composting facility. For some materials, recovery for uses such as highway construction or insulation is considered recovery along with materials used in remanufacturing processes.

Combustion includes combustion of mixed MSW, fuel prepared from MSW, or a separated component of MSW (such as rubber tires), with or without energy recovery.

Discards include the municipal solid waste remaining after recycling (including composting). These discards are usually combusted or disposed of in landfills, although some MSW is littered, stored, or disposed on site, particularly in rural areas.



Methodology. There are two primary methods for conducting a waste characterization study. The first is a source-specific approach in which the individual components of the waste stream are sampled, sorted, and weighed. Although this method is useful for defining a local waste stream, extrapolating from a limited number of studies can produce a skewed or misleading picture if used for a nationwide characterization of waste. Atypical circumstances encountered during sampling or errors in the sample would be greatly magnified when expanded to represent the nation's entire waste stream. The second method, which is used in this report, is called the "material flows methodology." EPA's Office of Solid Waste and its predecessors in the Public Health Service sponsored work in the 1960s and early 1970s to develop the material flows methodology. This methodology is based on production data (by weight) for the materials and products in the waste stream, with adjustments for imports, exports, and product lifetimes.

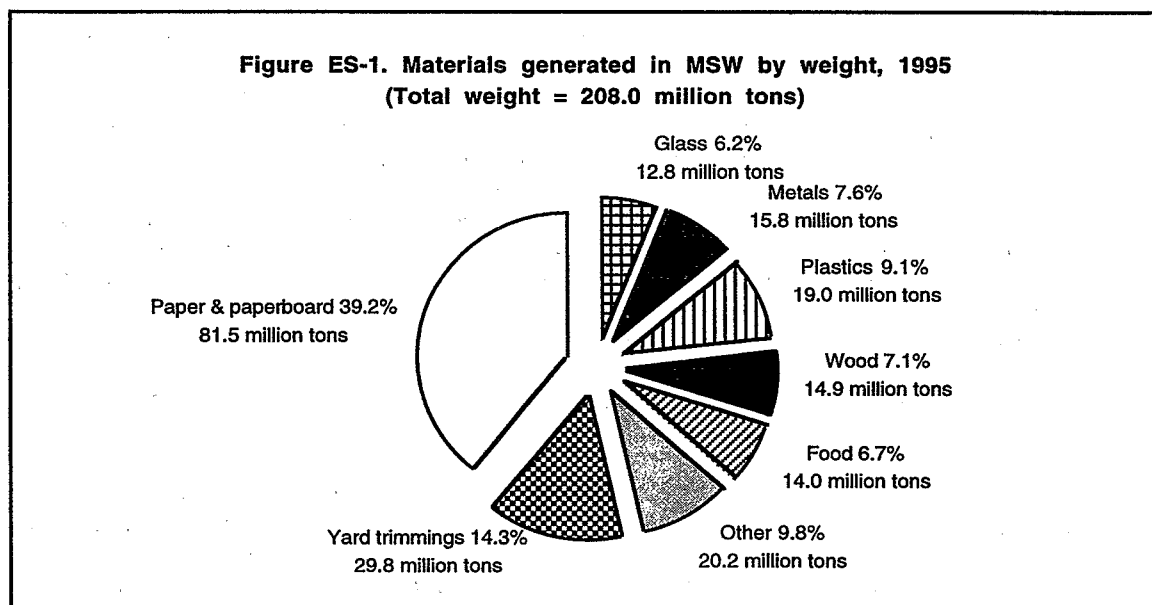
Note that when the report is updated, there are numerical discrepancies in waste generation, recovery, and discards from previous editions. These differences are due to revised estimates from source data (e.g., industry associations and federal agencies) made to the MSW characterization database.

MUNICIPAL SOLID WASTE IN 1995

MSW consists of both materials and products. Materials in MSW include paper and paperboard, yard trimmings, glass, metal, plastic, wood, and food wastes. Each material category (except for food wastes and yard trimmings) is made up of many different products. Products in MSW are grouped into three main categories: (1) durable goods (e.g., appliances), (2) nondurable goods (e.g., newspapers), and (3) containers and packaging. These product categories generally contain each type of MSW material, with some exceptions. The durable goods category contains no paper and paperboard. The nondurable goods category includes only small amounts of metals and essentially no glass or wood. The containers and packaging category includes only very small amounts of rubber, leather, and textiles.

Materials in MSW

In 1995, MSW generation totaled 208 million tons. Figure ES-1 provides a breakdown, by weight, of the MSW materials generated in 1995. Paper and paperboard products made up the largest component of MSW generated (39 percent), and yard trimmings comprised the second largest material component (14 percent). Glass, metals, plastics, wood, and food wastes each constituted



between 6 and 10 percent of the total MSW generated. Other materials in MSW, such as rubber, leather, textiles, and miscellaneous wastes, made up approximately 10 percent of the MSW generated in 1995.

A portion of each material category in MSW was recycled (including being composted) in 1995, as illustrated in Table ES-1. It should be noted, however, that recovery rates for some products within a material category are higher than the overall recovery rate for the material category, because some products are not

Table ES-1
GENERATION AND RECOVERY OF MATERIALS IN MSW, 1995
(In millions of tons and percent of generation of each material)

	Weight Generated	Weight Recovered	Recovery as a Percent of Generation
Paper and paperboard	81.5	32.6	40.0%
Glass	12.8	3.1	24.5%
Metals			
Ferrous metals	11.6	4.2	36.5%
Aluminum	3.0	1.0	34.5%
Other nonferrous metals	1.3	0.9	69.4%
<i>Total metals</i>	15.8	6.2	38.9%
Plastics	19.0	1.0	5.2%
Rubber and Leather	6.0	0.5	8.9%
Textiles	7.4	0.9	12.2%
Wood	14.9	1.4	9.6%
Other materials	3.6	0.8	23.1%
<i>Total Materials in Products</i>	161.1	46.6	28.9%
Other Wastes			
Food Wastes	14.0	0.6	4.1%
Yard Trimmings	29.8	9.0	30.3%
Miscellaneous Inorganic Wastes	3.2	Neg.	Neg.
<i>Total Other Wastes</i>	46.9	9.6	20.4%
TOTAL MUNICIPAL SOLID WASTE	208.0	56.2	27.0%

Includes wastes from residential, commercial, and institutional sources.
Neg. = Less than 50,000 tons or 0.05 percent.

recovered at all. For example, aluminum cans are recovered at rates above 60 percent, but the overall recovery rate for aluminum is only 35 percent. Likewise, even though corrugated containers are recovered at rates above 64 percent, the overall recovery rate for paper and paperboard is 40 percent.

Products in MSW

Figure ES-2 shows the breakdown, by weight, of MSW products generated in 1995. Containers and packaging comprised the largest portion of products generated, at 35 percent (73 million tons) of total MSW generation. Nondurable goods were the second largest fraction, comprising about 27 percent (57 million tons). The third main category of products is durable goods, which comprised 15 percent (31 million tons) of total MSW generation.

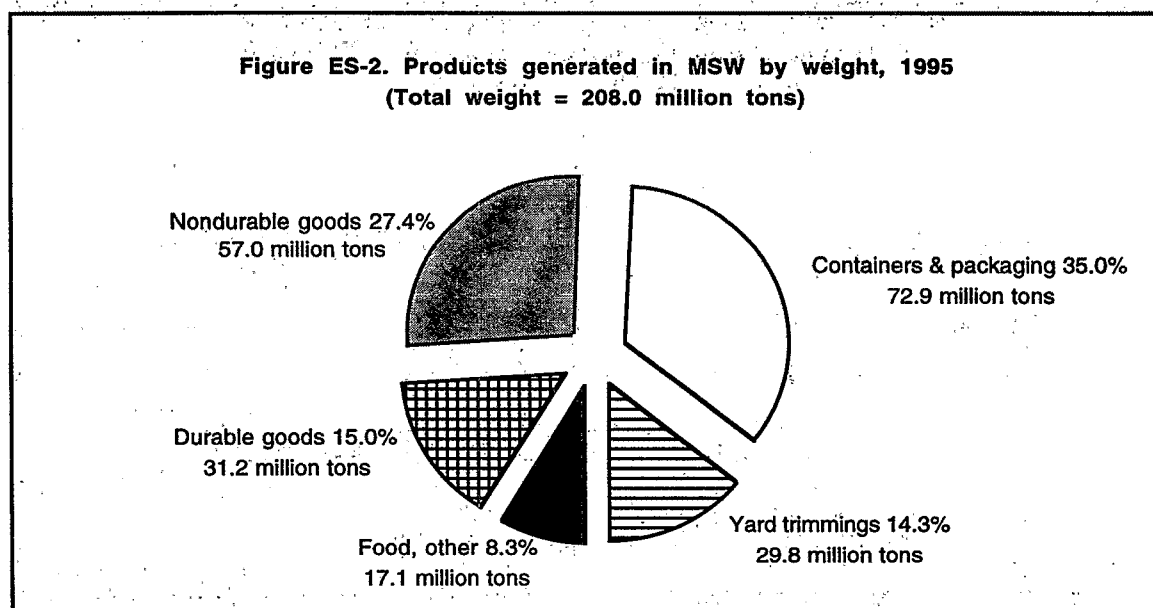


Table ES-2 shows the generation and recovery of the product categories in MSW. Recovery of **containers and packaging** was the highest of the three product categories—38 percent of containers and packaging generated in 1995 were recovered for recycling. About 52 percent of aluminum packaging was recovered (mostly aluminum beverage cans), while more than 54 percent of steel

Table ES-2

**GENERATION AND RECOVERY OF PRODUCTS IN MSW
BY MATERIAL, 1995**
(In millions of tons and percent of generation of each product)

	Weight Generated	Weight Recovered	Recovery as a Percent of Generation
Durable goods			
Ferrous metals	8.7	2.7	30.7%
Aluminum	0.8	Neg.	Neg.
Other non-ferrous metals	1.3	0.9	69.4%
<i>Total metals</i>	10.8	3.6	33.1%
Glass	1.3	Neg.	Neg.
Plastics	6.2	0.2	3.8%
Rubber and leather	5.2	0.5	10.3%
Wood	4.2	Neg.	Neg.
Textiles	2.3	0.1	5.0%
Other materials	1.1	0.8	77.8%
<i>Total durable goods</i>	31.2	5.3	17.0%
Nondurable goods			
Paper and paperboard	43.5	12.7	29.3%
Plastics	5.1	Neg.	<1%
Rubber and leather	0.8	Neg.	Neg.
Textiles	5.0	0.8	15.8%
Other materials	2.7	Neg.	Neg.
<i>Total nondurable goods</i>	57.0	13.5	23.7%
Containers and packaging			
Steel	2.8	1.6	54.6%
Aluminum	2.0	1.0	51.6%
<i>Total metals</i>	4.8	2.6	53.4%
Glass	11.5	3.1	27.3%
Paper and paperboard	38.1	19.9	52.3%
Plastics	7.7	0.7	9.7%
Wood	10.6	1.4	13.5%
Other materials	0.1	Neg.	Neg.
<i>Total containers and packaging</i>	72.9	27.8	38.1%
Other wastes			
Food wastes	14.0	0.6	4.1%
Yard trimmings	29.8	9.0	30.3%
Miscellaneous inorganic wastes	3.2	Neg.	Neg.
<i>Total other wastes</i>	46.9	9.6	20.4%
TOTAL MUNICIPAL SOLID WASTE	208.0	56.2	27.0%

Includes wastes from residential, commercial, and institutional sources.

Neg. = less than 50,000 tons or 0.05 percent.

packaging (mostly cans) was recovered. Paper and paperboard packaging recovery was estimated at 52 percent; corrugated containers accounted for most of that figure. Approximately 27 percent of glass containers were recovered overall, while about 14 percent of wood packaging (mostly pallets) was recovered. About 10 percent of plastic containers and packaging was recovered in 1995, most of which was made up of soft drink, milk, and water bottles.

Overall recovery of **nondurable goods** was almost 24 percent in 1995. Newspapers constituted the largest portion of this recovery, with 53 percent of newspapers generated being recovered for recycling. Office papers and magazines were also recovered in significant quantities in 1995, at 44 percent and 28 percent, respectively. Over 16 percent of clothing and other textile nondurable products also were recovered for recycling.

Overall, **durable goods** were recovered at a rate of 17 percent in 1995, up from 15 percent in 1994. Nonferrous metals had one of the highest recovery rates, at 70 percent, due to the high rate of lead recovery from lead-acid batteries. Nearly 31 percent of ferrous metals were recovered from appliances and miscellaneous durable goods. Excluding retreads and tire derived fuel use, over 17 percent of tires also were recovered for recycling.

Residential and Commercial Sources of MSW

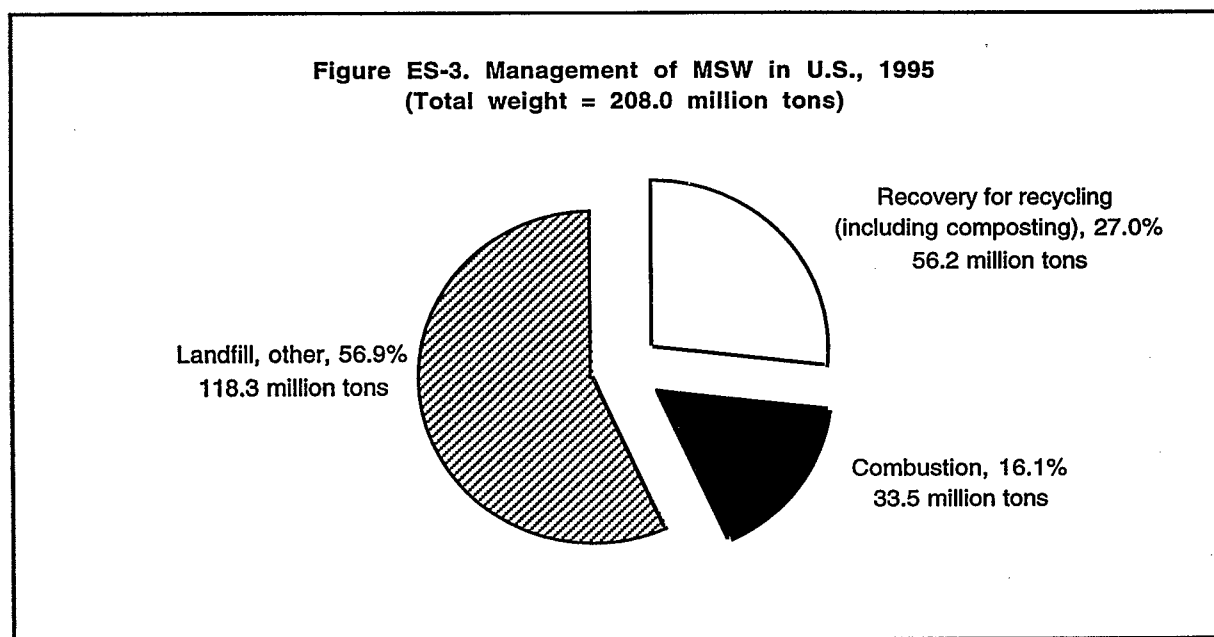
Sources of MSW, as characterized in this report, include both residential and commercial locations. Residential waste (including waste from multi-family dwellings) is estimated to be 55 to 65 percent of total MSW generation. Commercial waste (including waste from schools, some industrial sites where packaging is generated, and businesses) constitutes between 35 and 45 percent. Local and regional factors, such as climate and level of commercial activity, contribute to these variations.

MANAGEMENT OF MSW

EPA's integrated waste management hierarchy includes the following components:

- Source reduction (including reuse of products and backyard composting of yard trimmings).
- Recycling (including composting).
- Waste combustion (preferably with energy recovery) and landfilling.

Figure ES-3 shows how much MSW was recovered for recycling (including composting) and how much was disposed of by combustion and landfilling in 1995. Approximately 27 percent (56 million tons) of MSW was recycled and composted; an estimated 16 percent (33 million tons) was combusted (nearly all with energy recovery); and the remainder, 57 percent (118 million tons), was landfilled (small amounts may have been littered or self-disposed).



Source Reduction

Source reduction includes the design, manufacture, purchase, or use of materials, such as products and packaging, to reduce their amount or toxicity before they enter the MSW management system. Some examples of source reduction activities are:

- Designing products or packaging to reduce the quantity or the toxicity of the materials used, or to make them easy to reuse.
- Reusing existing products or packaging.
- Lengthening the lives of products to postpone disposal.
- Using packaging that reduces the amount of damage or spoilage to the product.
- Managing nonproduct organic wastes (e.g., food scraps and yard trimmings) through onsite composting or other alternatives to disposal (e.g., leaving grass clippings on the lawn).

Although product source reduction activities are not quantified at the national level in this report, the report includes several case studies that illustrate the impact of source reduction on different product categories. For example, newspaper publishers have reduced the weight of their newsprint from 93 pages per pound in 1985 to 118 pages per pound in 1995. Efforts to reuse electronics, durable goods, textiles, and pallets have also been successful. Numerous businesses exist nationwide, for example, that upgrade and repair computers, and use their valuable components to rebuild other electronic items.

Recovery

Recovery for recycling (including composting) continues to be one of the most effective waste management techniques. In 1995, approximately 46 percent of the U.S. population (121 million people) had access to the nation's 7,000 curbside recycling programs. Most of these programs (40 percent) were in the

Midwest, although the Northeast had the largest population served. In addition, nearly 9,000 drop-off centers for recyclables were reported in 35 states in 1995.

More than 300 materials recovery facilities helped process the recyclables collected in 1995. An estimated 3,300 yard trimmings composting programs (not backyard composting) existed in 1995, the majority of which were in the Northeast and Midwest.

Combustion

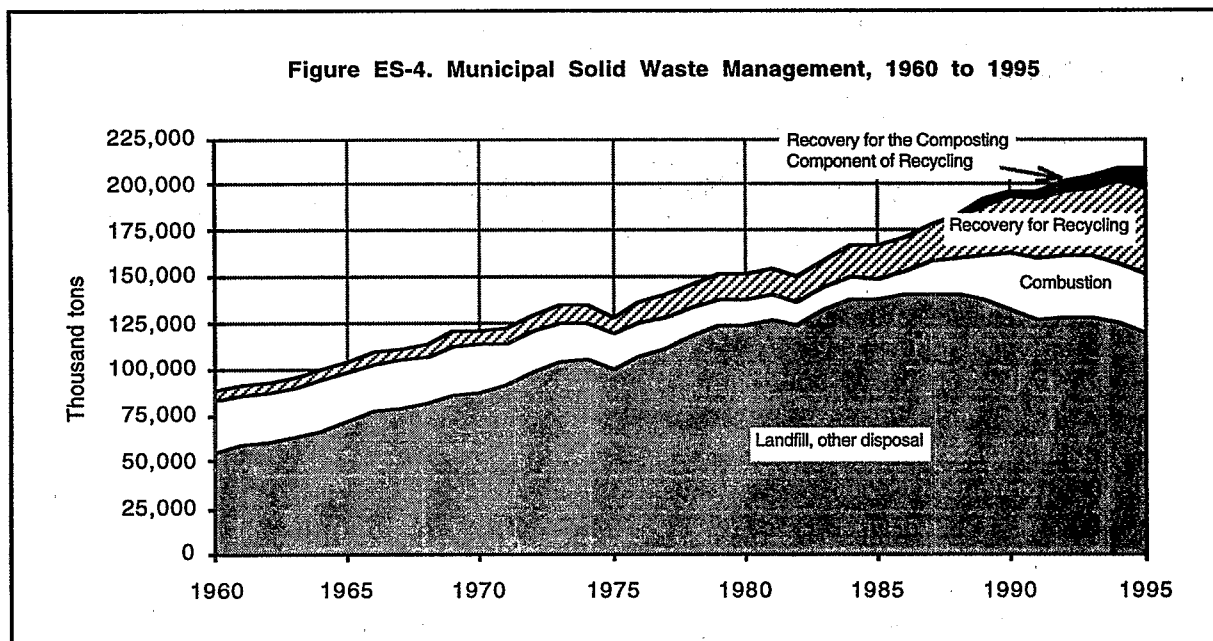
Most MSW combustion in the United States involves the recovery of an energy product (generally steam or electricity). Total MSW combustion with energy recovery, referred to as waste-to-energy combustion, currently has a design capacity of 99,000 tons per day. There were 112 waste-to-energy combustion facilities in the United States in 1995: One-third of these were located in the Northeast, accounting for 60 percent of the total design capacity.

Landfilling

Although the number of landfills in the United States is decreasing, landfill capacity has remained relatively constant. In 1995, more than 2,500 landfills existed in the United States, with the Southeast and West having the greatest number of landfills. Excluding Alaska and Hawaii, thirty-seven states have landfills reporting more than 10 years of capacity remaining. Only two states report having less than 5 years of capacity left.

Trends in MSW Management

MSW generation has grown steadily from 88 million tons in 1960 to 208 million tons in 1995 (Figure ES-4). In the 1960s and early 1970s, a large percentage of MSW was burned. Through the mid-1980s, incineration declined considerably and landfills became more difficult to site. MSW generation continued to rise, however, while materials recovery rates increased slowly. As a result, the burden on the nation's landfills grew dramatically. As recovery rates increased in the late 1980s and early 1990s—and combustion stayed constant—discards to landfills have steadily decreased.



The report presents projections for MSW generation and management through 2010, including possible scenarios for recovery. The MSW generation projections are based on historical trends in combination with expected population and subsequent economic growth. For the year 2000, possible recovery scenarios are presented for 30 and 35 percent recovery levels. Possible recovery scenarios between 30 and 40 percent are made for the year 2010.

To achieve these increased levels of recovery, EPA assumed that local, state, and federal agencies would continue to emphasize recycling (including composting) as a priority; that industries would continue to make the necessary investments in recovery and utilization of materials; that sufficient end-user capacity would be available for most recovered materials; that state and local governments would continue to expand programs designed to keep yard trimmings out of landfills; and that most U.S. citizens would continue to have access to some sort of recovery program and that they would be willing to participate.

