

MUNICIPAL SOLID WASTE IN THE UNITED STATES



2005 FACTS AND FIGURES



**MUNICIPAL SOLID WASTE IN
THE UNITED STATES:
2005 FACTS AND FIGURES**

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**MUNICIPAL SOLID WASTE
IN THE UNITED STATES: 2005 FACTS AND FIGURES**

EXECUTIVE SUMMARY

OVERVIEW

This report describes the national municipal solid waste (MSW) stream based on data collected for 1960 through 2005. The historical perspective is useful for establishing trends in types of MSW generated and in the ways it is managed. In this Executive Summary, we briefly describe the methodology used to characterize MSW in the United States and provide the latest facts and figures on MSW generation, recycling, and disposal.

In the United States, we generated approximately 245.7 million tons of MSW in 2005—a decrease of 1.6 million tons from 2004. Excluding composting, the amount of MSW recycled increased to 58.4 million tons, an increase of 1.2 million tons from 2004. This is a 2 percent increase in the tons recycled. The tons recovered for composting rose slightly to 20.6 million tons in 2005, up from 20.5 million tons in 2004. The recovery rate for recycling (including composting) was 32.1 percent in 2005, up from 31.4 percent in 2004.¹ (See Tables ES-1 and ES-2 and Figures ES-1 and ES-2.)

MSW generation in 2005 declined to 4.54 pounds per person per day. This is a decrease of 1.5 percent from 2004 to 2005. The recycling rate in 2005 was 1.46 pounds per person per day. Discards sent to a landfill after recycling declined to 2.46 pounds per person per day in 2005 (Table ES-3).

¹ Data shown for 2000 through 2004 have been adjusted to reflect the latest revisions and, therefore, may differ from the same measure reported previously.

Table ES-1
GENERATION, MATERIALS RECOVERY, COMPOSTING,
COMBUSTION WITH ENERGY RECOVERY, AND DISCARDS OF MUNICIPAL SOLID WASTE,
1960 - 2005
(in millions of tons)

Activity	1960	1970	1980	1990	2000	2003	2004	2005
Generation	88.1	121.1	151.6	205.2	237.6	240.4	247.3	245.7
Recovery for recycling	5.6	8.0	14.5	29.0	52.7	55.8	57.2	58.4
Recovery for composting*	Neg.	Neg.	Neg.	4.2	16.5	19.1	20.5	20.6
Total materials recovery	5.6	8.0	14.5	33.2	69.1	74.9	77.7	79.0
Combustion with energy recovery†	0.0	0.4	2.7	29.7	33.7	33.7	34.1	33.4
Discards to landfill, other disposal‡	82.5	112.7	134.4	142.3	134.8	131.9	135.5	133.3

* Composting of yard trimmings, food scraps and other MSW organic material.

Does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets and tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery. Details may not add to totals due to rounding.

Table ES-2
GENERATION, MATERIALS RECOVERY, COMPOSTING,
COMBUSTION WITH ENERGY RECOVERY, AND DISCARDS OF MUNICIPAL SOLID WASTE,
1960 - 2005
(in percent of total generation)

Activity	1960	1970	1980	1990	2000	2003	2004	2005
Generation	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Recovery for recycling	6.4%	6.6%	9.6%	14.2%	22.2%	23.2%	23.1%	23.8%
Recovery for composting*	Neg.	Neg.	Neg.	2.0%	6.9%	7.9%	8.3%	8.4%
Total materials recovery	6.4%	6.6%	9.6%	16.2%	29.1%	31.1%	31.4%	32.1%
Combustion with energy recovery†	0.0%	0.3%	1.8%	14.5%	14.2%	14.0%	13.8%	13.6%
Discards to landfill, other disposal‡	93.6%	93.1%	88.6%	69.3%	56.7%	54.9%	54.8%	54.3%

* Composting of yard trimmings, food scraps and other MSW organic material.

Does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets and tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery. Details may not add to totals due to rounding.

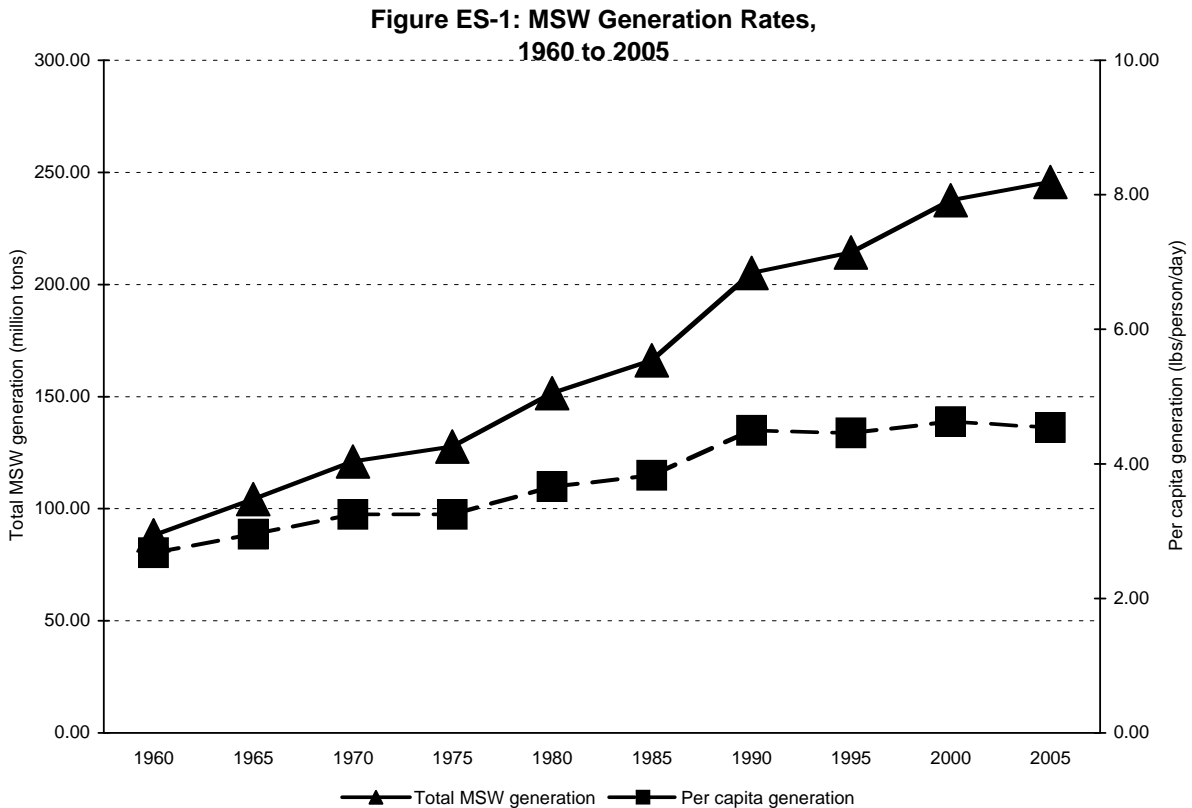
**Table ES-3
GENERATION, MATERIALS RECOVERY, COMPOSTING
COMBUSTION WITH ENERGY RECOVERY, AND DISCARDS OF MUNICIPAL SOLID WASTE,
1960 - 2005
(in pounds per person per day)**

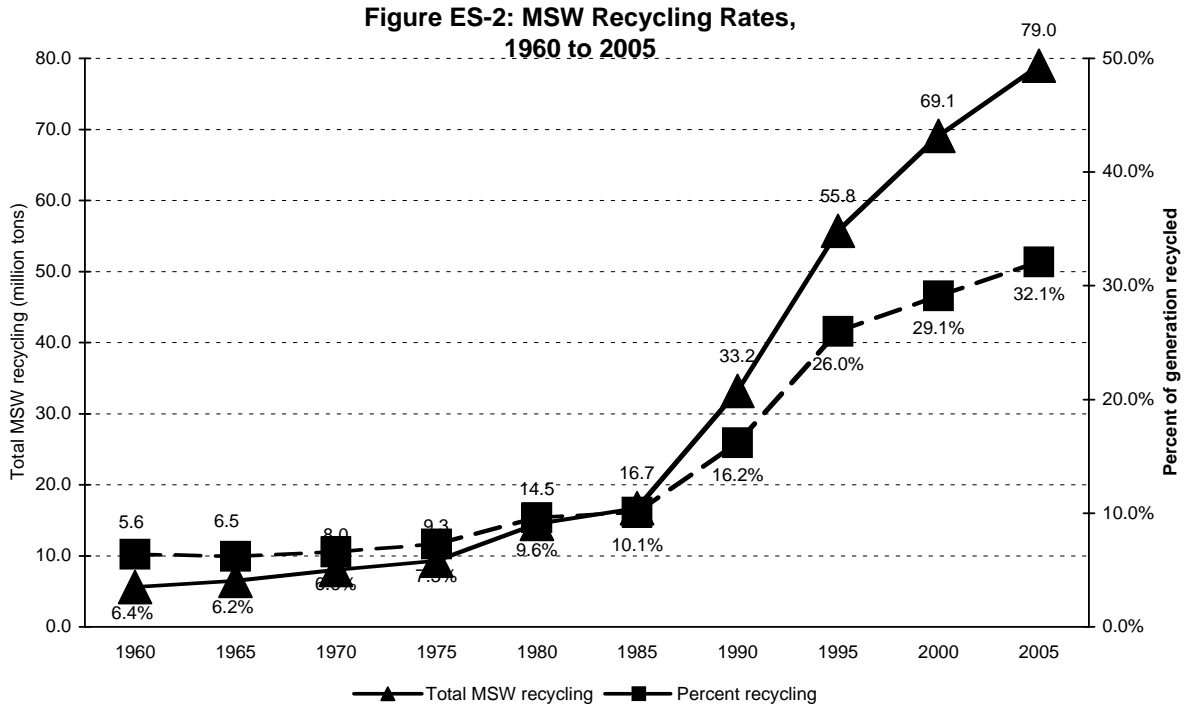
Activity	1960	1970	1980	1990	2000	2003	2004	2005
Generation	2.68	3.25	3.66	4.50	4.63	4.53	4.61	4.54
Recovery for recycling	0.17	0.22	0.35	0.64	1.03	1.05	1.07	1.08
Recovery for composting*	Neg.	Neg.	Neg.	0.09	0.32	0.36	0.38	0.38
Total materials recovery	0.17	0.22	0.35	0.73	1.35	1.41	1.45	1.46
Combustion with energy recovery†	0.00	0.01	0.07	0.65	0.66	0.63	0.64	0.62
Discards to landfill, other disposal‡	2.51	3.02	3.24	3.12	2.62	2.49	2.52	2.46
Population (millions)	179.979	203.984	227.255	249.907	281.422	290.850	293.660	296.410

* Composting of yard trimmings, food scraps and other MSW organic material.
Does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets and tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery.
Details may not add to totals due to rounding.





The state of the economy has a strong impact on consumption and waste generation. Waste generation continued to increase through the 1990s as economic growth continued to be strong. Between 2000 and 2005, total growth in waste generation slowed. On a per capita basis, 2005 waste generation at 4.54 pounds per person per day is only slightly higher than the 1990 rate of 4.50 pounds per person per day.

WHAT IS INCLUDED IN MUNICIPAL SOLID WASTE?

MSW—otherwise known as trash or garbage—consists of everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, and batteries. Not included are materials that also may be disposed in landfills but are not generally considered MSW, such as construction and demolition debris, municipal wastewater treatment sludges, and non-hazardous industrial wastes.

MUNICIPAL SOLID WASTE IN PERSPECTIVE

Trends Over Time

Over the last few decades, the generation, recycling, and disposal of MSW have changed substantially (see Tables ES-1, ES-2, and ES-3 and Figures ES-1 and ES-2). MSW generation has continued to increase from 1960, when it was 88 million tons. The generation rate in 1960 was just 2.7 pounds per person per day; it grew to 3.7 pounds per person per day in 1980; reached 4.5 pounds per person per day in 1990; increased to 4.6 pounds per person per day in 2000; and returned to about 4.5 pounds per person per day in 2005.

Over time, recycling rates have increased from 10 percent of MSW generated in 1980 to 16 percent in 1990, to 29 percent in 2000, and to 32 percent in 2005. Disposal of waste to a landfill has decreased from 89 percent of the amount generated in 1980 to 54 percent of MSW in 2005.

MUNICIPAL SOLID WASTE IN 2005

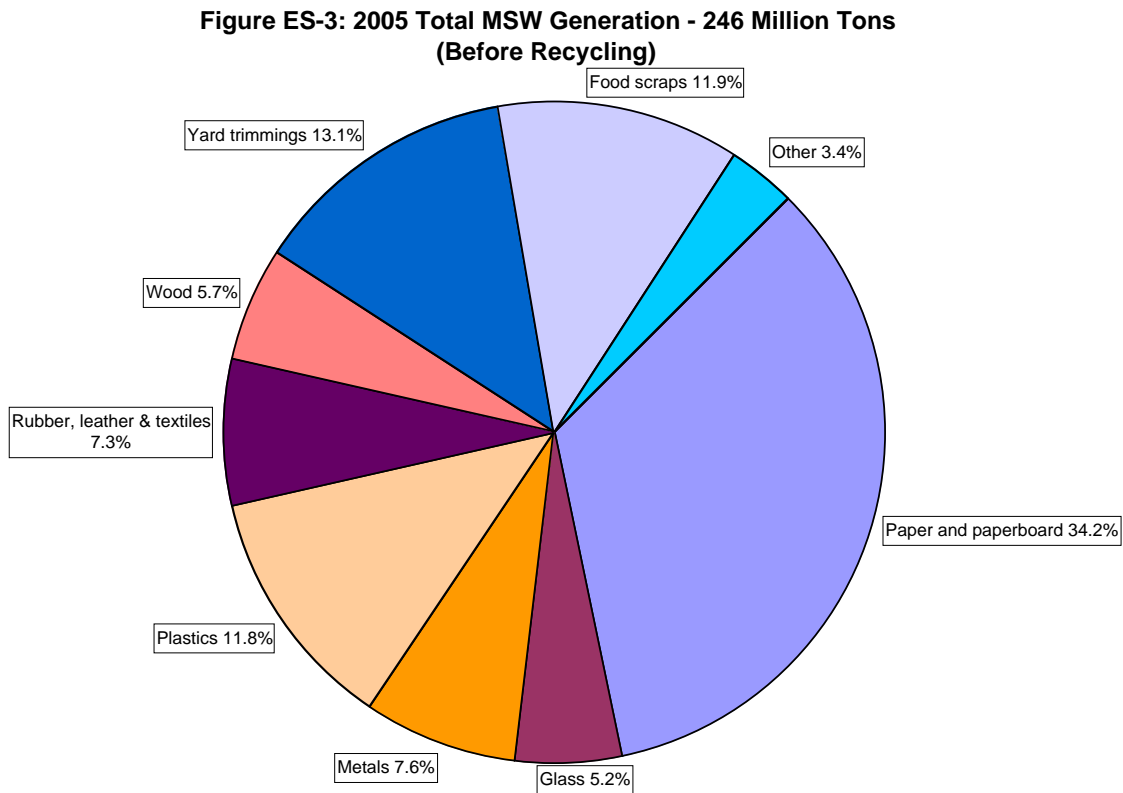
The U.S. Environmental Protection Agency (EPA) uses two methods to analyze the 245.7 million tons of MSW generated in 2005. The first is by **material** (paper and paperboard, yard trimmings, food scraps, plastics, metals, glass, wood, rubber, leather and textiles, and other); the second is by several major **product** categories. The product-based categories are containers and packaging; nondurable goods (e.g., newspapers); durable goods (e.g., appliances); food scraps; and other materials.

Materials in MSW

A breakdown, by weight, of the MSW **materials** generated in 2005 is provided in Figure ES-3. Paper and paperboard made up the largest component of MSW generated (34 percent), and yard trimmings were the second-largest component (13 percent). Glass, metals, plastics, wood, and food scraps each constituted between 5 and 12 percent of the total MSW generated. Rubber,

leather, and textiles combined made up about 7 percent of MSW, while other miscellaneous wastes made up approximately 3 percent of the MSW generated in 2005.

A portion of each material category in MSW was recycled or composted in 2005. The highest rates of recovery were achieved with yard trimmings, paper and paperboard products, and metal products. About 62 percent (19.9 million tons) of yard trimmings was recovered for composting in 2005. This represents nearly a five-fold increase since 1990. Fifty percent (42.0 million tons) of paper and paperboard was recovered for recycling in 2005. Recycling these organic materials alone diverted more than 25 percent of municipal solid waste from landfills and combustion facilities. In addition, about 6.9 million tons, or about 37 percent, of metals were recovered for recycling. Recycling rates for all materials categories in 2005 are listed in Table ES-4.



**Table ES-4
GENERATION AND RECOVERY OF MATERIALS IN MSW, 2005
(in millions of tons and percent of generation of each material)**

Material	Weight Generated	Weight Recovered	Recovery As a Percent of Generation
Paper and paperboard	84.0	42.0	50.0%
Glass	12.8	2.76	21.6%
Metals			
Steel	13.8	4.93	35.8%
Aluminum	3.21	0.69	21.5%
Other nonferrous metals*	1.74	1.26	72.4%
<i>Total metals</i>	18.7	6.88	36.8%
Plastics	28.9	1.65	5.7%
Rubber and leather	6.70	0.96	14.3%
Textiles	11.1	1.70	15.3%
Wood	13.9	1.31	9.4%
Other materials	4.57	1.17	25.6%
<i>Total Materials in Products</i>	180.7	58.4	32.3%
Other wastes			
Food, other**	29.2	0.69	2.4%
Yard trimmings	32.1	19.9	61.9%
Miscellaneous inorganic wastes	3.69	Neg.	Neg.
<i>Total Other Wastes</i>	65.0	20.6	31.6%
<i>TOTAL MUNICIPAL SOLID WASTE</i>	245.7	79.0	32.1%

Includes waste from residential, commercial, and institutional sources.

* Includes lead from lead-acid batteries.

** Includes recovery of other MSW organics for composting.

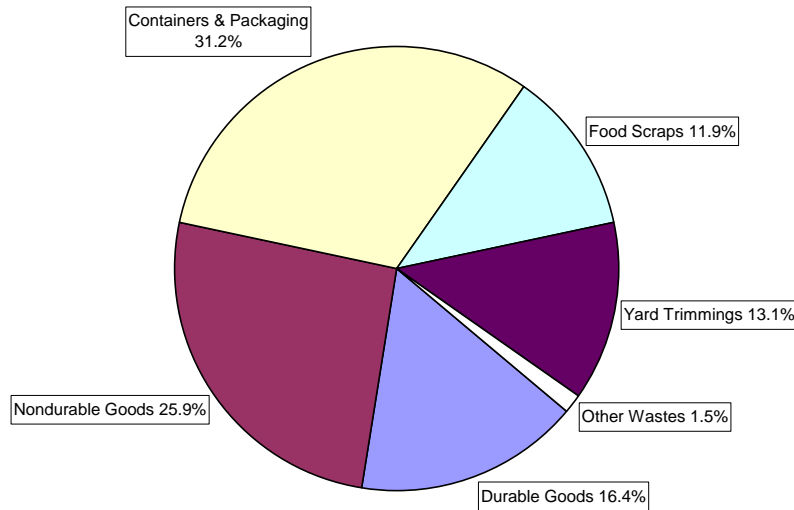
Details may not add to totals due to rounding.

Neg. = Less than 5,000 tons or 0.05 percent.

Products in MSW

The breakdown, by weight, of **product categories** generated in 2005 is shown in Figure ES-4. Containers and packaging comprised the largest portion of products generated, at 31 percent (76.7 million tons) of total MSW generation. Nondurable goods were the second-largest fraction, at 26 percent (63.7 million tons). The third-largest category of products is durable goods, which made up 16 percent (40.3 million tons) of total MSW generation.

Figure ES-4: Products Generated in MSW, 2005
(Total Weight = 246 million tons)



The generation and recovery of the product categories in MSW in 2005 are shown in Table ES-5. This table shows that recovery of containers and packaging was the highest of the three product categories—39.8 percent of containers and packaging generated in 2005 were recovered for recycling. About 45 percent of all aluminum cans was recovered (36.3 percent of all aluminum packaging, including foil), while 63.3 percent of steel packaging (mostly cans) was recovered. Paper and paperboard containers and packaging were recovered at a rate of 58.8 percent; corrugated containers accounted for most of that amount.

Approximately 25 percent of glass containers was recovered, while about 15 percent of wood packaging (mostly wood pallets removed from service) was recovered for recycling. More than 9 percent of plastic containers and packaging were recovered—mostly soft drink, milk, and water bottles.

Table ES-5
GENERATION AND RECOVERY OF PRODUCTS IN MSW
BY MATERIAL, 2005
(in millions of tons and percent of generation of each product)

Products	Weight Generated	Weight Recovered	Recovery as a Percent of Generation
Durable Goods			
Steel	11.4	3.43	30.1%
Aluminum	1.08	Neg.	Neg.
Other non-ferrous metals*	1.74	1.26	72.4%
<i>Total metals</i>	14.2	4.69	33.0%
Glass	1.83	Neg.	Neg.
Plastics	8.71	0.37	4.2%
Rubber and leather	5.68	0.96	16.9%
Wood	5.37	Neg.	Neg.
Textiles	3.02	0.28	9.3%
Other materials	1.45	1.17	80.7%
<i>Total durable goods</i>	40.3	7.47	18.5%
Nondurable Goods			
Paper and paperboard	44.9	19.0	42.4%
Plastics	6.55	Neg.	Neg.
Rubber and leather	0.99	Neg.	Neg.
Textiles	7.91	1.42	18.0%
Other materials	3.36	Neg.	Neg.
<i>Total nondurable goods</i>	63.7	20.5	32.1%
Containers and Packaging			
Steel	2.37	1.50	63.3%
Aluminum	1.90	0.69	36.3%
<i>Total metals</i>	4.27	2.19	51.3%
Glass	10.9	2.76	25.3%
Paper and paperboard	39.0	22.9	58.8%
Plastics	13.7	1.28	9.4%
Wood	8.56	1.31	15.3%
Other materials	0.24	Neg.	Neg.
<i>Total containers and packaging</i>	76.7	30.5	39.8%
Other Wastes			
Food, other**	29.2	0.69	2.4%
Yard trimmings	32.1	19.9	61.9%
Miscellaneous inorganic wastes	3.69	Neg.	Neg.
<i>Total other wastes</i>	65.0	20.6	31.6%
TOTAL MUNICIPAL SOLID WASTE	245.7	79.0	32.1%

Includes waste from residential, commercial, and institutional sources.

* Includes lead from lead-acid batteries.

** Includes recovery of other MSW organics for composting.

Details may not add to totals due to rounding.

Neg. = Less than 5,000 tons or 0.05 percent.

Overall recovery of *nondurable goods* was at 32.1 percent in 2005. Most of this recovery comes from paper products such as newspapers and high-grade office papers (e.g., white papers). Newspapers constituted the largest portion of this recovery, with 88.9 percent of newspapers generated being recovered for recycling. An estimated 62.6 percent of high-grade office papers and 38.5 percent of magazines was recovered in 2005. Newspaper, high-grade office paper, and magazine recovery increased in percentage between 2004 and 2005.

Recovery percentage of “Other Commercial Printing” stayed about the same at 10.4 percent. The other paper products in the nondurable goods category increased slightly between 2004 and 2005, with Standard mail* recovered at an estimated 35.8 percent, and directories at an estimated 18.2 percent.

The nondurable goods category also includes clothing and other textile products—18 percent of these products were recovered for recycling or export in 2005.

Overall, *durable goods* were recovered at a rate of 18.5 percent in 2005. Nonferrous metals other than aluminum had one of the highest recovery rates, at 72.4 percent, due to the high rate of lead recovery from lead-acid batteries. Recovery of steel in all durable goods was 30.1 percent, with high rates of recovery from appliances and other miscellaneous durable goods.

One of the products with a very high recovery rate was lead-acid batteries, recovered at a rate of 98.8 percent in 2005. Other products with particularly high recovery rates were newspapers (88.9 percent), corrugated boxes (71.5 percent), major appliances (67.0 percent), steel packaging (63.3 percent), and aluminum cans (44.8 percent). About 35 percent of rubber tires were recovered for recycling. (Other tires were retreaded, and shredded rubber tires were made into tire-derived fuel.)

* Standard mail was formerly called Third Class mail by the U.S. Postal Service.

RESIDENTIAL AND COMERCIAL SOURCES OF MSW

Sources of MSW, as characterized in this report, include both residential and commercial locations. We estimated residential waste (including waste from multi-family dwellings) 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 of MSW. Local and regional factors, such as climate and level of commercial activity, contribute to these variations.

MANAGEMENT OF MSW

Overview

EPA's integrated waste management hierarchy includes the following four components, listed in order of preference:

- Source reduction (or waste prevention), including reuse of products and on-site (or backyard) composting of yard trimmings
- Recycling, including off-site (or community) composting
- Combustion with energy recovery
- Disposal through landfilling or combustion without energy recovery.

Although we encourage the use of strategies that emphasize the top of the hierarchy whenever possible, all four components remain important within an integrated waste management system.

Source Reduction

When we first established our waste management hierarchy, we emphasized the importance of *reducing* the amount of waste created, reusing whenever possible, and then recycling whatever is left. When municipal solid waste is reduced and reused, this is called “source reduction”—meaning the material never enters the waste stream.

Source reduction, also called waste prevention, 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. Examples of source reduction activities are:

- Designing products or packaging to reduce the quantity or the toxicity of the materials used or make them easy to reuse.
- Reusing existing products or packaging, such as refillable bottles, reusable pallets, and reconditioned barrels and drums.
- Lengthening the lives of products such as tires so fewer need to be produced and therefore fewer need to be disposed of.
- Using packaging that reduces the amount of damage or spoilage to the product.
- Managing nonproduct organic wastes (e.g., food scraps, yard trimmings) through onsite composting or other alternatives to disposal (e.g., leaving grass clippings on the lawn).

As the nation has begun to realize the value of its resources, both financial and material, efforts to reduce waste generation have increased.

Recycling

- Recycling (including community composting) recovered 32.1 percent (79 million tons) of MSW in 2005.
- There were about 8,550 curbside recycling programs in the United States in 2005.
- About 3,470 yard trimmings composting programs were reported in 2005.

Combustion with Energy Recovery

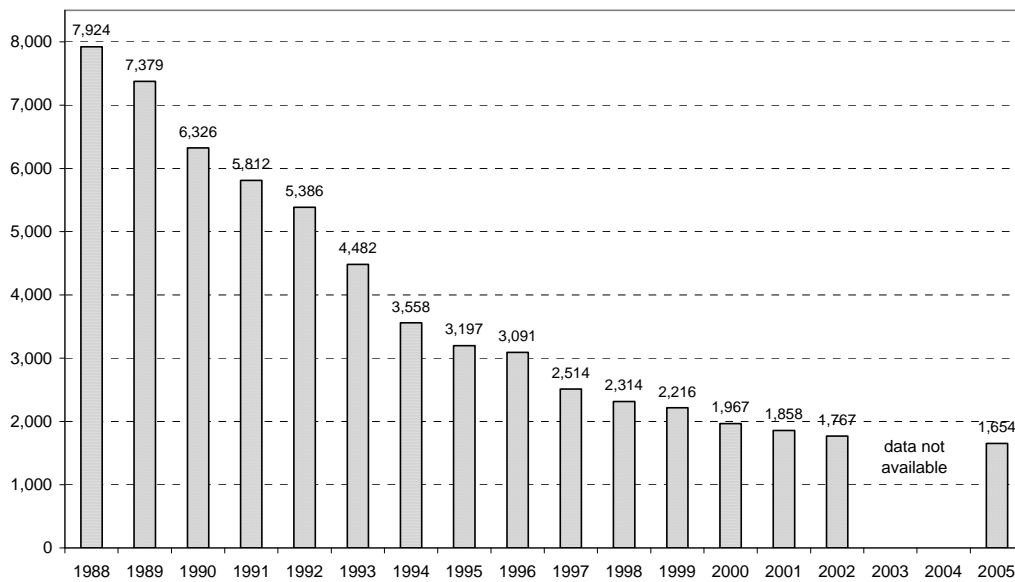
An estimated 33.4 million tons (13.6 percent) of MSW was combusted with energy recovery in 2005 (see Tables ES-1 and ES-2), slightly less than the 34.1 million tons estimated in 2004. Combustion with energy recovery increased from 2.7 million tons in 1980 to 29.7 million tons in 1990. Since 1990, the quantity of MSW combusted with energy recovery has increased slightly.

Disposal

During 2005, about 54.3 percent of MSW was landfilled, down somewhat from 54.8 percent in 2004. As shown in Figure ES-5, the number of MSW landfills decreased substantially over the past 18 years, from nearly 8,000 in 1988 to 1,654 in 2005—while average landfill size increased. At the national level, capacity does not appear to be a problem, although regional dislocations sometimes occur.

- The percentage of MSW landfilled decreased slightly from 2004 to 2005. Over the long term, the tonnage of MSW landfilled in 1990 was 142.3 million tons (see Table ES-1), but decreased to 134.8 million tons in 2000. The tonnage increased to 135.5 million tons in 2004, then declined to 133.3 in 2005. The tonnage landfilled results from an interaction among generation, recycling, and combustion with energy recovery, which do not necessarily rise and fall at the same time.
- The net per capita discard rate (after materials recovery and combustion with energy recovery) was 2.46 pounds per person per day, down from 3.12 pounds per person per day in 1990, down from the 2.62 pounds per person per day in 2000 (Table ES-3).

Figure ES-5: Number of Landfills in the United States, 1988-2005

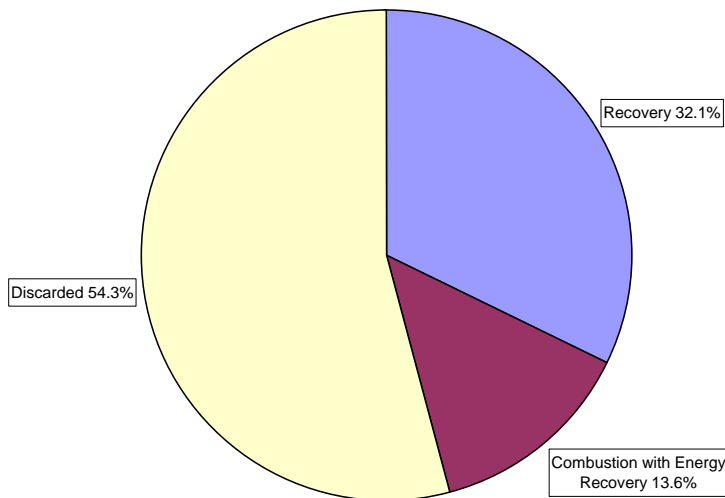


MSW recovered for recycling (including composting), combusted with energy recovery, and discarded in 2005 is shown in Figure ES-6. In 2005, 79.0 millions tons (32.1 percent) of MSW were recycled, 33.4 million tons (13.6 percent) were combusted with energy recovery, and 133.3 million tons (54.3 percent) were landfilled or otherwise disposed. (Relatively small amounts of this total undoubtedly were incinerated without energy recovery, littered, or illegally dumped rather than landfilled.)

FOR FURTHER INFORMATION

This report and related additional data are available on the Internet at www.epa.gov/osw.

Figure ES-6: Management of MSW in the United States, 2005



CHAPTER 1

INTRODUCTION AND METHODOLOGY

INTRODUCTION

This report is the most recent in a series of reports sponsored by the U.S. Environmental Protection Agency to characterize municipal solid waste (MSW) in the United States. Together with the previous reports, this report provides a historical database for a 45-year characterization (by weight) of the materials and products in MSW.

Management of the nation's municipal solid waste (MSW) continues to be a high priority for communities in the 21st century. The concept of integrated solid waste management—source reduction of wastes before they enter the waste stream, recovery of generated wastes for recycling (including composting), and environmentally sound disposal through combustion facilities and landfills that meet current standards—is being used by communities as they plan for the future.

This chapter provides background on integrated waste management and this year's characterization report, followed by a brief overview of the methodology. Next is a section on the variety of uses for the information in this report. Then, more detail on the methodology is provided, followed by a description of the contents of the remainder of the report.

BACKGROUND

The Solid Waste Management Hierarchy

EPA's 1989 Agenda for Action endorsed the concept of integrated waste management, by which municipal solid waste is reduced or managed through several different practices, which can be tailored to fit a particular community's needs. The components of the hierarchy are:

- Source reduction (or waste prevention), including reuse of products and on-site (or backyard) composting of yard trimmings.
- Recycling, including off-site (or community) composting.
- Combustion with energy recovery.
- Disposal through landfilling or combustion without energy recovery.

As done in previous versions of this report, combustion with energy recovery is shown as discards in the Chapter 2 tables and figures.

Overview of the Methodology

Readers should note that this report characterizes the municipal solid waste stream of *the nation as a whole*. Data in this report can be used at the national level. It can also be used to address state, regional, and local situations, where more detailed data are not available or would be too expensive to gather. More detail on uses for this information in this report for both national and local uses is provided later in this chapter.

At the state or local level, recycling rates often are developed by counting and weighing all the recyclables collected, and then aggregating these data to yield a state or local recycling rate. At the national level, we use instead a *materials flow methodology*, which relies heavily on a mass balance approach. Using data gathered from industry associations, key businesses, and similar industry sources, and supported by government data from sources such as the Department of Commerce and the U.S. Census Bureau, we estimate tons of materials and products generated, recycled, or discarded. Other sources of data, such as waste characterizations and surveys performed by governments, industry, or the press, supplement these data.

To estimate MSW generation, production data are adjusted by imports and exports from the United States, where necessary. Allowances are made for the average lifespans of different

products. Information on amounts of disposed MSW managed by combustion comes from industry sources as well. MSW not managed by recycling (including composting) or combustion is assumed to be landfilled.

In any estimation of MSW generation, it is important to define what is and is not included in municipal solid waste. EPA includes those materials that historically have been handled in the municipal solid waste stream—those materials from municipal sources, sent to municipal landfills. In this report, MSW includes wastes such as product packaging, newspapers, office and classroom papers, bottles and cans, boxes, wood pallets, food scraps, grass clippings, clothing, furniture, appliances, automobile tires, consumer electronics, and batteries.

A common error in using this report is to assume that *all* nonhazardous wastes are included. As shown later in this chapter, municipal solid waste as defined here does *not* include construction and demolition debris, biosolids (sewage sludges), industrial process wastes, or a number of other wastes that, in some cases, may go to a municipal waste landfill. These materials, over time, have tended to be handled separately and are not included in the totals in this report. EPA has addressed several of these materials separately, for instance, in *Biosolids Generation, Use, and Disposal in the United States*, EPA530-R-99-009, September 1999, and *Characterization of Building-Related Construction and Demolition Debris in the United States*, EPA530-R-98-010, May 1998. Recycling (including composting) is encouraged for these materials as well.

In addition, the source of municipal solid waste is important. EPA's figures include municipal solid waste from homes, institutions such as schools and prisons, commercial sources such as restaurants and small businesses, and occasional industrial sources. MSW does not include wastes of other types or from other sources, including automobile bodies, municipal sludges, combustion ash, and industrial process wastes that might also be disposed in municipal waste landfills or combustion units.

HOW THIS REPORT CAN BE USED

Nationwide. The data in this report provide a nationwide picture of municipal solid waste generation and management. The historical perspective is particularly useful in establishing trends and highlighting the changes that have occurred over the years, both in types of wastes generated and in the ways they are managed. This perspective on MSW and its management is useful in assessing national solid waste management needs and policy. The consistency in methodology and scope aids in the use of the document for reporting over time. The report is, however, of equal or greater value as a solid waste management planning tool for state and local governments and private firms.

Local or state level. At the local or state level, the data in this report can be used to develop approximate (but quick) estimates of MSW generation in a defined area. That is, the data on generation of MSW per person nationally may be used to estimate generation in a city or other local area based on the population in that area. This can be of value when a “ballpark” estimate of MSW generation in an area is needed. For example, communities may use such an estimate to determine the potential viability of regional versus single community solid waste management facilities. This information can help define solid waste management planning areas and the planning needed in those areas. However, for communities making decisions where knowledge of the amount and composition of MSW is crucial, (e.g., where a solid waste management facility is being sited), local estimates of the waste stream should be made.

Another useful feature of this report for local planning is the information provided on MSW trends. Changes over time in total MSW generation and the mix of MSW materials can affect the need for and use of various waste management alternatives. Observing trends in MSW generation can help in planning an integrated waste management system that includes facilities sized and designed for years of service.

While the national average data are useful as a checkpoint against local MSW characterization data, any differences between local and national data should be examined carefully. There are many regional variations that require each community to examine its own

waste management needs. Such factors as local and regional availability of suitable landfill space, proximity of markets for recovered materials, population density, commercial and industrial activity, and climatic and groundwater variations all may motivate each community to make its own plans.

Specific reasons for regional differences may include:

- Variations in climate and local waste management practices, which greatly influence generation of yard trimmings. For instance, yard trimmings exhibit strong seasonal variations in most regions of the country. Also, the level of backyard composting in a region will affect generation of yard trimmings.
- Differences in the scope of waste streams. That is, a local landfill may be receiving construction and demolition wastes in addition to MSW, but this report addresses MSW only.
- Variance in the per capita generation of some products, such as newspapers and telephone directories, depending upon the average size of the publications. Typically, rural areas will generate less of these products on a per person basis than urban areas.
- Level of commercial activity in a community. This will influence the generation rate of some products, such as office paper, corrugated boxes, wood pallets, and food scraps from restaurants.
- Variations in economic activity, which affect waste generation in both the residential and the commercial sectors.
- Local and state regulations and practices. Deposit laws, bans on landfilling of specific products, and variable rate pricing for waste collection are examples of practices that can influence a local waste stream.

While caution should be used in applying the data in this report, for some areas, the national breakdown of MSW by material may be the only such data available for use in comparing and planning waste management alternatives. Planning a curbside recycling program, for example, requires an estimate of household recyclables that may be recovered. If resources are not available to adequately estimate these materials by other means, local planners may turn to the national data. This is useful in areas that may have typical MSW generation or in areas where appropriate adjustments in the data can be made to account for local conditions.

In summary, the data in this report can be used in local planning to:

- Develop approximate estimates of total MSW generation in an area.
- Check locally developed MSW data for accuracy and consistency.
- Account for trends in total MSW generation and the generation of individual components.
- Help set goals and measure progress in source reduction and recycling (including composting).

CHARACTERIZATION OF MUNICIPAL SOLID WASTE: IN PERSPECTIVE

The Two Methodologies for Characterizing MSW: Site-Specific Versus Materials Flow

There are two basic approaches to estimating quantities of municipal solid waste at the local, state, or national levels—site-specific and materials flow. This report is based on the materials flow approach.

Site-specific studies. In the first methodology, which is site-specific, sampling, sorting, and weighing the individual components of the waste stream could be used. This methodology is useful in defining a local waste stream, especially if large numbers of samples are taken over several seasons. Results of sampling also increase the body of knowledge about variations due to climatic and seasonal changes, population density, regional differences, and the like. In addition, quantities of MSW components such as food scraps and yard trimmings can only be estimated through sampling and weighing studies.

A disadvantage of sampling studies based on a limited number of samples is that they may be skewed and misleading if, for example, atypical circumstances were experienced during the sampling. These circumstances could include an unusually wet or dry season, delivery of some unusual wastes during the sampling period, or errors in the sampling methodology. Any errors of this kind will be greatly magnified when a limited number of samples are taken to represent a community's entire waste stream for a year. Magnification of errors could be even more serious if a limited number of samples was relied upon for making the national estimates of MSW. Also, extensive sampling would be prohibitively expensive for making the national estimates. An additional disadvantage of sampling studies is that they do not provide information about trends unless performed in a consistent manner over a long period of time.

Of course, at the state or local level, sampling may not be necessary—many states and localities count all materials recovered for recycling, and many weigh all wastes being disposed to generate state or local recycling rates from the “ground up.” To use these figures at the

national level would require all states to perform these studies, and perform them in a consistent manner conducive to developing a national summary, which so far has not been practical.

Materials flow. The second approach to quantifying and characterizing the municipal solid waste stream—the methodology used for this report—utilizes a materials flow approach to estimate the waste stream on a nationwide basis. In the late 1960s and early 1970s, EPA’s Office of Solid Waste and its predecessors at the Public Health Service sponsored work that began to develop this methodology. This report represents the latest version of this database that has been evolving for over 30 years.

The materials flow methodology is based on production data (by weight) for the materials and products in the waste stream. To estimate generation data, specific adjustments are made to the production data for each material and product category. Adjustments are made for imports and exports and for diversions from MSW (e.g., for building materials made of plastic and paperboard that become construction and demolition debris.) Adjustments are also made for the lifetimes of products. Finally, food scraps, yard trimmings, and a small amount of miscellaneous inorganic wastes are accounted for by compiling data from a variety of waste sampling studies.

One problem with the materials flow methodology is that product residues associated with other items in MSW (usually containers) are not accounted for. These residues would include, for example, food left in a jar, detergent left in a box or bottle, and dried paint in a can. Some household hazardous wastes, (e.g., pesticide left in a can) are also included among these product residues.

Municipal Solid Waste Defined in Greater Detail

As stated earlier, EPA includes those materials that historically have been handled in the municipal solid waste stream—those materials from municipal sources, sent to municipal landfills. In this report, MSW includes wastes such as product packaging, newspapers, office and classroom paper, bottles and cans, boxes, wood pallets, food scraps, grass clippings, clothing, furniture, appliances, automobile tires, consumer electronics, and batteries. For purposes of

analysis, these products and materials are often grouped in this report into the following categories: durable goods, nondurable goods, containers and packaging, food scraps and yard trimmings, and miscellaneous inorganic wastes.

Municipal solid wastes characterized in this report come from residential, commercial, institutional, or industrial sources. Some examples of the types of MSW that come from each of the broad categories of sources are:

<u>Sources and Examples</u>	<u>Example Products</u>
<i>Residential</i> (single-and multi-family homes)	Newspapers, clothing, disposable tableware, food packaging, cans and bottles, food scraps, yard trimmings
<i>Commercial</i> (office buildings, retail and wholesale establishments, restaurants)	Corrugated boxes, food scraps, office papers, disposable tableware, paper napkins, yard trimmings
<i>Institutional</i> (schools, libraries, hospitals, prisons)	Cafeteria and restroom trash can wastes, office papers, classroom wastes, yard trimmings
<i>Industrial</i> (packaging and administrative; <i>not</i> process wastes)	Corrugated boxes, plastic film, wood pallets, lunchroom wastes, office papers.

The materials flow methodology used in this report does not readily lend itself to the quantification of wastes according to their sources. For example, corrugated boxes may be unpacked and discarded from residences, commercial establishments such as grocery stores and offices, institutions such as schools, or factories. Similarly, office papers are mostly generated in offices, but they also are generated in residences and institutions. The methodology estimates only the total quantity of products generated, not their places of disposal or recovery for recycling.

Other Subtitle D Wastes

Some people assume that “municipal solid waste” must include everything that is landfilled in Subtitle D landfills. (Subtitle D of the Resource Conservation and Recovery Act deals with wastes other than the hazardous wastes covered under Subtitle C.) As shown in Figure 1, however, RCRA Subtitle D includes many kinds of wastes. It has been common practice to landfill wastes such as municipal sludges, nonhazardous industrial wastes, residue from automobile salvage operations, and construction and demolition debris along with MSW, but these other kinds of wastes are not included in the estimates presented in this report.

Figure 1: Municipal Solid Waste in the Universe of Subtitle D Wastes

Subtitle D Wastes	
The Subtitle D Waste included in this report is Municipal Solid Waste, which includes:	
Containers and packaging such as soft drink bottles and corrugated boxes	
Durable goods such as furniture and appliances	
Nondurable goods such as newspapers, trash bags, and clothing	
Other wastes such as food scraps and yard trimmings.	
Subtitle D Wastes not included in this report are:	
Municipal sludges	Agricultural wastes
Industrial nonhazardous wastes	Oil and gas wastes
Construction and demolition debris	Mining wastes

Figure 1-A: Definition of Terms

The materials flow methodology produces an estimate of total municipal solid waste generation in the United States, by material categories and by product categories.

The term **generation** as used in this report refers to the weight of materials and products as they enter the waste management system from residential, commercial, institutional, and industrial sources and before materials recovery or combustion takes place. Preconsumer (industrial) scrap is not included in the generation estimates. Source reduction activities (e.g., backyard composting of yard trimmings) take place *ahead of* generation.

Source reduction activities reduce the amount or toxicity of wastes before they enter the municipal solid waste management system. 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 is considered to be source reduction, not recycling.

Recovery of materials as estimated in this report includes products and yard trimmings removed from the waste stream for the purpose of recycling (including composting). For recovered products, recovery equals reported purchases of postconsumer recovered material (e.g., glass cullet, old newspapers) plus net exports (if any) of the material. Thus, recovery of old corrugated containers (OCC) is the sum of OCC purchases by paper mills plus net exports of OCC. If recovery as reported by a data source includes converting or fabrication (preconsumer) scrap, the preconsumer scrap is *not* counted towards the recovery estimates in this report. Imported secondary materials are also not counted in recovery estimates in this report. For some materials, additional uses, such as glass used for highway construction or newspapers used to make insulation, are added into the recovery totals.

Combustion of MSW with energy recovery, often called “waste-to-energy,” is estimated in Chapter 3 of this report. Combustion of separated materials—wood and rubber from tires—is included in the estimates of combustion with energy recovery in this report.

Discards include MSW remaining after recovery for recycling (including composting). These discards presumably would be combusted without energy recovery or landfilled, although some MSW is littered, stored or disposed onsite, or burned onsite, particularly in rural areas. No good estimates for these other disposal practices are available, but the total amounts of MSW involved are presumed to be small.

Materials and Products Not Included in These Estimates

As noted earlier, other Subtitle D wastes (illustrated in Figure 1) are not included in these estimates, even though some may be managed along with MSW (e.g., by combustion or landfilling). Household hazardous wastes, while generated as MSW with other residential wastes, are not identified separately in this report. Transportation parts and equipment (including automobiles and trucks) are not included in the wastes characterized in this report.

Certain other materials associated with products in MSW are often not accounted for because the appropriate data series have not yet been developed. These include, for example, inks and other pigments and some additives associated with packaging materials. Considerable additional research would be required to estimate these materials, which constitute a relatively small percentage of the waste stream.

Some adjustments are made in this report to account for packaging of imported goods, but there is little available documentation of these amounts.

OVERVIEW OF THIS REPORT

Following this introductory chapter, Chapter 2 presents the results of the municipal solid waste characterization (by weight). Estimates of MSW generation, recovery, and discards are presented in a series of tables, with discussion. Detailed tables and figures summarizing 2005 MSW generation, recovery, and discards of products in each material category are included.

In Chapter 3 of the report, estimates of 2005 MSW management by the various alternatives are summarized. These include recovery for recycling (including composting), combustion, and landfilling. Summaries of the infrastructure currently available for each waste management alternative are also included in Chapter 3.

A brief discussion of the materials flow methodology for estimating generation, recycling, and disposal is presented in Appendix A.

CHAPTER 1**REFERENCES**

Darnay, A., and W.E. Franklin, *The Role of Packaging in Solid Waste Management, 1966 to 1976*. Public Health Service Publication No. 1855. U.S. Government Printing Office. 1969.

Franklin, W.E., and A. Darnay. *The Role of Nonpackaging Paper in Solid Waste Management, 1966 to 1976*. Public Health Service Publication No. 2040. U.S. Government Printing Office. 1971.

Darnay, A., and W.E. Franklin. *Salvage Markets for Materials in Solid Wastes*. Environmental Protection Publication SW-29c. U.S. Government Printing Office. 1972.

Franklin, W.E., et al. *Base Line Forecasts of Resource Recovery 1972 to 1990*. Midwest Research Institute for the U.S. Environmental Protection Agency. March 1975.

U.S. Environmental Protection Agency, Office of Solid Waste Management Programs. *Second Report to Congress: Resource Recovery and Source Reduction (SW-122)*. 1974.

Smith, F.L., Jr. *A Solid Waste Estimation Procedure: Material Flows Approach*. U.S. Environmental Protection Agency (SW-147). May 1975.

U.S. Environmental Protection Agency, Office of Solid Waste Management Programs. *Third Report to Congress: Resource Recovery and Source Reduction (SW-161)*. 1975.

U.S. Environmental Protection Agency, Office of Solid Waste Management Programs. *Fourth Report to Congress: Resource Recovery and Waste Reduction (SW-600)*. 1977.

Franklin Associates, Ltd. *Post-consumer Solid Waste and Resource Recovery Baseline*. Prepared for the Resource Conservation Committee. May 16, 1979.

Franklin Associates, Ltd. *Post-consumer Solid Waste and Resource Recovery Baseline: Working Papers*. Prepared for the Resource Conservation Committee. May 16, 1979.

Resource Conservation Committee. *Choices for Conservation: Final Report to the President and Congress (SW-779)*. July 1979.

Franklin Associates, Ltd. *Characterization of Municipal Solid Waste in the United States, 1960 to 2000*. U.S. Environmental Protection Agency. July 11, 1986.

Franklin Associates, Ltd. *Characterization of Municipal Solid Waste in the United States, 1960 to 2000 (Update 1988)*. U.S. Environmental Protection Agency. March 30, 1988.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1990 Update*. (EPA/SW-90-042). June 1990.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1992 Update*. (EPA/530-R-92-019). July 1992.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1994 Update*. EPA/530-R-94-042. November 1994.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1995 Update*. EPA/530-R-945-001. March 1996.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1996 Update*. EPA/530-R-97-015. June 1997.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1997 Update*. EPA/530-R-98-007. May 1998.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1998 Update*. EPA/530-R-99-021. September 1999.

U.S. Environmental Protection Agency. *Municipal Solid Waste Generation, Recycling and Disposal in the United States: Facts and Figures for 1998*. EPA/530-F-00-024. April 2000.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 1999 Facts and Figures*. EPA/530-R-01-014. July 2001.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2000 Facts and Figures*. EPA/530-R-02-001. June 2002.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2001 Facts and Figures*. EPA/530-R-03-011. October 2003.

U.S. Environmental Protection Agency, Municipal Solid Waste Task Force, Office of Solid Waste. *The Solid Waste Dilemma: An Agenda for Action*. February 1989.

U.S. Environmental Protection Agency, Office of Solid Waste. *Subtitle D Study Phase I Report* (EPA/530-SW-054). October 1986.

CHAPTER 2

CHARACTERIZATION OF MUNICIPAL SOLID WASTE BY WEIGHT

INTRODUCTION

The tables and figures in this chapter present the results of the update of EPA's municipal solid waste characterization report through 2005. The data presented also incorporate some revisions to previously reported data for 2003 and, in some instances, to data for earlier years. The revisions are generally due to revisions and improvements in the data available from data sources used in developing this report.

This chapter discusses how much municipal solid waste (MSW) is generated, recovered, and disposed. First, an overview presents this information for the most recent years, and for selected years back to 1960. This information is summarized in Tables 1 to 3 and Figures 10 to 13. Then, throughout the remainder of the chapter, MSW is characterized in more detail. Findings are presented in two basic ways: the first portion of the chapter presents data by *material type*. Some material types of most use to planners (paper and paperboard, glass, metals, plastics, and rubber and leather) are presented in detail in Tables 4 to 8 and Figures 2 to 9, while data on other materials also is summarized in Figures 12 and 13.

The second portion of the chapter presents data by *product type*. This information is presented in Tables 9 to 23 and Figures 14 to 16. Products are classified into durable goods (e.g., appliances, furniture, tires); nondurable goods (e.g., newspapers, office-type papers, trash bags, clothing); and containers and packaging (e.g., bottles, cans, corrugated boxes). A fourth major category includes other wastes—yard trimmings, food scraps, and miscellaneous inorganic wastes. These wastes are not manufactured products, but to provide complete information in each table, they are included in both the product and the material tables.

This chapter provides data on generation, recovery, and discards of MSW. (See Chapter 1 for definitions of these terms.) Recovery, in this report, means that the materials have been removed from the municipal solid waste stream. Recovery of materials in products means that the materials are reported to have been purchased by an end user or have been exported from the United States. For yard trimmings, recovery includes estimates of the trimmings delivered to a composting facility (not backyard composting). Under these definitions, residues from a materials recovery facility (MRF) or other waste processing facility are counted as generation (and, of course, discards), since they are not purchased by an end user. Residues from an end user facility (e.g., sludges from a paper deinking mill) are considered to be industrial process wastes that are no longer part of the municipal solid waste stream.

MUNICIPAL SOLID WASTE: CHARACTERIZED BY MATERIAL TYPE

Generation, recovery, and discards of materials in MSW, by weight and by percentage of generation and discards, are summarized in Tables 1 through 3. Figures 10 and 11 (later in this chapter) illustrate this data over time. A snapshot, by material, for 2005 is provided in Figures 12 and 13. In the following sections, each material is discussed in detail.

Table 1
MATERIALS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(In thousands of tons and percent of total generation)

Materials	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Paper and Paperboard	29,990	44,310	55,160	72,730	87,740	83,030	86,360	83,950
Glass	6,720	12,740	15,130	13,100	12,620	12,340	12,680	12,750
Metals								
Ferrous	10,300	12,360	12,620	12,640	13,530	13,980	13,990	13,770
Aluminum	340	800	1,730	2,810	3,150	3,200	3,210	3,210
Other Nonferrous	180	670	1,160	1,100	1,560	1,590	1,660	1,740
<i>Total Metals</i>	<i>10,820</i>	<i>13,830</i>	<i>15,510</i>	<i>16,550</i>	<i>18,240</i>	<i>18,770</i>	<i>18,860</i>	<i>18,720</i>
Plastics	390	2,900	6,830	17,130	25,340	27,620	29,160	28,910
Rubber and Leather	1,840	2,970	4,200	5,790	6,530	6,820	6,700	6,700
Textiles	1,760	2,040	2,530	5,810	9,440	10,590	10,820	11,140
Wood	3,030	3,720	7,010	12,210	13,020	13,610	13,780	13,930
Other **	70	770	2,520	3,190	4,190	4,320	4,450	4,570
Total Materials in Products	54,620	83,280	108,890	146,510	177,120	177,100	182,810	180,670
Other Wastes								
Food Scraps	12,200	12,800	13,000	20,800	26,480	28,180	29,070	29,230
Yard Trimmings	20,000	23,200	27,500	35,000	30,530	31,470	31,770	32,070
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,620	3,650	3,690
Total Other Wastes	33,500	37,780	42,750	58,700	60,510	63,270	64,490	64,990
Total MSW Generated - Weight	88,120	121,060	151,640	205,210	237,630	240,370	247,300	245,660
Materials	Percent of Total Generation							
	1960	1970	1980	1990	2000	2003	2004	2005
Paper and Paperboard	34.0%	36.6%	36.4%	35.4%	36.9%	34.5%	34.9%	34.2%
Glass	7.6%	10.5%	10.0%	6.4%	5.3%	5.1%	5.1%	5.2%
Metals								
Ferrous	11.7%	10.2%	8.3%	6.2%	5.7%	5.8%	5.7%	5.6%
Aluminum	0.4%	0.7%	1.1%	1.4%	1.3%	1.3%	1.3%	1.3%
Other Nonferrous	0.2%	0.6%	0.8%	0.5%	0.7%	0.7%	0.7%	0.7%
<i>Total Metals</i>	<i>12.3%</i>	<i>11.4%</i>	<i>10.2%</i>	<i>8.1%</i>	<i>7.7%</i>	<i>7.8%</i>	<i>7.6%</i>	<i>7.6%</i>
Plastics	0.4%	2.4%	4.5%	8.3%	10.7%	11.5%	11.8%	11.8%
Rubber and Leather	2.1%	2.5%	2.8%	2.8%	2.7%	2.8%	2.7%	2.7%
Textiles	2.0%	1.7%	1.7%	2.8%	4.0%	4.4%	4.4%	4.5%
Wood	3.4%	3.1%	4.6%	6.0%	5.5%	5.7%	5.6%	5.7%
Other **	0.1%	0.6%	1.7%	1.6%	1.8%	1.8%	1.8%	1.9%
Total Materials in Products	62.0%	68.8%	71.8%	71.4%	74.5%	73.7%	73.9%	73.5%
Other Wastes								
Food Scraps	13.8%	10.6%	8.6%	10.1%	11.1%	11.7%	11.8%	11.9%
Yard Trimmings	22.7%	19.2%	18.1%	17.1%	12.8%	13.1%	12.8%	13.1%
Miscellaneous Inorganic Wastes	1.5%	1.5%	1.5%	1.4%	1.5%	1.5%	1.5%	1.5%
Total Other Wastes	38.0%	31.2%	28.2%	28.6%	25.5%	26.3%	26.1%	26.5%
Total MSW Generated - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Generation before materials recovery or combustion. Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Includes electrolytes in batteries and fluff pulp, feces, and urine in disposable diapers. Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Table 2
RECOVERY* OF MUNICIPAL SOLID WASTE, 1960 TO 2005
(In thousands of tons and percent of generation of each material)

Materials	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Paper and Paperboard	5,080	6,770	11,740	20,230	37,560	39,980	40,710	41,970
Glass	100	160	750	2,630	2,880	2,650	2,730	2,760
Metals								
Ferrous	50	150	370	2,230	4,610	5,090	5,100	4,930
Aluminum	Neg.	10	310	1,010	860	690	710	690
Other Nonferrous	Neg.	320	540	730	1,060	1,060	1,200	1,260
<i>Total Metals</i>	50	480	1,220	3,970	6,530	6,840	7,010	6,880
Plastics	Neg.	Neg.	20	370	1,350	1,400	1,600	1,650
Rubber and Leather	330	250	130	370	820	1,100	1,030	960
Textiles	50	60	160	660	1,290	1,520	1,710	1,700
Wood	Neg.	Neg.	Neg.	130	1,240	1,280	1,290	1,310
Other **	Neg.	300	500	680	980	980	1,110	1,170
Total Materials in Products	5,610	8,020	14,520	29,040	52,650	55,750	57,190	58,400
Other Wastes								
Food Scraps	Neg.	Neg.	Neg.	Neg.	680	750	660	690
Yard Trimmings	Neg.	Neg.	Neg.	4,200	15,770	18,330	19,810	19,860
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	19,080	20,470	20,550
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,100	74,830	77,660	78,950
Materials	Percent of Generation of Each Material							
	1960	1970	1980	1990	2000	2003	2004	2005
Paper and Paperboard	16.9%	15.3%	21.3%	27.8%	42.8%	48.2%	47.1%	50.0%
Glass	1.5%	1.3%	5.0%	20.1%	22.8%	21.5%	21.5%	21.6%
Metals								
Ferrous	0.5%	1.2%	2.9%	17.6%	34.1%	36.4%	36.5%	35.8%
Aluminum	Neg.	1.3%	17.9%	35.9%	27.3%	21.6%	22.1%	21.5%
Other Nonferrous	Neg.	47.8%	46.6%	66.4%	67.9%	66.7%	72.3%	72.4%
<i>Total Metals</i>	0.5%	3.5%	7.9%	24.0%	35.8%	36.4%	37.2%	36.8%
Plastics	Neg.	Neg.	0.3%	2.2%	5.3%	5.1%	5.5%	5.7%
Rubber and Leather	17.9%	8.4%	3.1%	6.4%	12.6%	16.1%	15.4%	14.3%
Textiles	2.8%	2.9%	6.3%	11.4%	13.7%	14.4%	15.8%	15.3%
Wood	Neg.	Neg.	Neg.	1.1%	9.5%	9.4%	9.4%	9.4%
Other **	Neg.	39.0%	19.8%	21.3%	23.4%	22.7%	24.9%	25.6%
Total Materials in Products	10.3%	9.6%	13.3%	19.8%	29.7%	31.5%	31.3%	32.3%
Other Wastes								
Food, Other^	Neg.	Neg.	Neg.	Neg.	2.6%	2.7%	2.3%	2.4%
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	51.7%	58.2%	62.4%	61.9%
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	7.2%	27.2%	30.2%	31.7%	31.6%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.2%	29.1%	31.1%	31.4%	32.1%

* Recovery of postconsumer wastes; does not include converting/fabrication scrap.

** Recovery of electrolytes in batteries; probably not recycled.

Neg. = Less than 5,000 tons or 0.05 percent.

^ Includes recovery of paper for composting.

Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Table 3
MATERIALS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(In thousands of tons and percent of total discards)

Materials	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Paper and Paperboard	24,910	37,540	43,420	52,500	50,180	43,050	45,650	41,980
Glass	6,620	12,580	14,380	10,470	9,740	9,690	9,950	9,990
Metals								
Ferrous	10,250	12,210	12,250	10,410	8,920	8,890	8,890	8,840
Aluminum	340	790	1,420	1,800	2,290	2,510	2,500	2,520
Other Nonferrous	180	350	620	370	500	530	460	480
<i>Total Metals</i>	<i>10,770</i>	<i>13,350</i>	<i>14,290</i>	<i>12,580</i>	<i>11,710</i>	<i>11,930</i>	<i>11,850</i>	<i>11,840</i>
Plastics	390	2,900	6,810	16,760	23,990	26,220	27,560	27,260
Rubber and Leather	1,510	2,720	4,070	5,420	5,710	5,720	5,670	5,740
Textiles	1,710	1,980	2,370	5,150	8,150	9,070	9,110	9,440
Wood	3,030	3,720	7,010	12,080	11,780	12,330	12,490	12,620
Other **	70	470	2,020	2,510	3,210	3,340	3,340	3,400
Total Materials in Products	49,010	75,260	94,370	117,470	124,470	121,350	125,620	122,270
Other Wastes								
Food Scraps	12,200	12,800	13,000	20,800	25,800	27,430	28,410	28,540
Yard Trimmings	20,000	23,200	27,500	30,800	14,760	13,140	11,960	12,210
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,620	3,650	3,690
Total Other Wastes	33,500	37,780	42,750	54,500	44,060	44,190	44,020	44,440
Total MSW Discarded - Weight	82,510	113,040	137,120	171,970	168,530	165,540	169,640	166,710
Materials	Percent of Total Discards							
	1960	1970	1980	1990	2000	2003	2004	2005
Paper and Paperboard	30.2%	33.2%	31.7%	30.5%	29.8%	26.0%	26.9%	25.2%
Glass	8.0%	11.1%	10.5%	6.1%	5.8%	5.9%	5.9%	6.0%
Metals								
Ferrous	12.4%	10.8%	8.9%	6.1%	5.3%	5.4%	5.2%	5.3%
Aluminum	0.4%	0.7%	1.0%	1.0%	1.4%	1.5%	1.5%	1.5%
Other Nonferrous	0.2%	0.3%	0.5%	0.2%	0.3%	0.3%	0.3%	0.3%
<i>Total Metals</i>	<i>13.1%</i>	<i>11.8%</i>	<i>10.4%</i>	<i>7.3%</i>	<i>6.9%</i>	<i>7.2%</i>	<i>7.0%</i>	<i>7.1%</i>
Plastics	0.5%	2.6%	5.0%	9.7%	14.2%	15.8%	16.2%	16.4%
Rubber and Leather	1.8%	2.4%	3.0%	3.2%	3.4%	3.5%	3.3%	3.4%
Textiles	2.1%	1.8%	1.7%	3.0%	4.8%	5.5%	5.4%	5.7%
Wood	3.7%	3.3%	5.1%	7.0%	7.0%	7.4%	7.4%	7.6%
Other **	0.1%	0.4%	1.5%	1.5%	1.9%	2.0%	2.0%	2.0%
Total Materials in Products	59.4%	66.6%	68.8%	68.3%	73.9%	73.3%	74.1%	73.3%
Other Wastes								
Food Scraps	14.8%	11.3%	9.5%	12.1%	15.3%	16.6%	16.7%	17.1%
Yard Trimmings	24.2%	20.5%	20.1%	17.9%	8.8%	7.9%	7.1%	7.3%
Miscellaneous Inorganic Wastes	1.6%	1.6%	1.6%	1.7%	2.1%	2.2%	2.2%	2.2%
Total Other Wastes	40.6%	33.4%	31.2%	31.7%	26.1%	26.7%	25.9%	26.7%
Total MSW Discarded - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Discards after materials and compost recovery. In this table, discards include combustion with energy recovery. Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Includes electrolytes in batteries and fluff pulp, feces, and urine in disposable diapers.

Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Paper and Paperboard

Collectively, the many products made of paper and paperboard² materials comprise the largest component of MSW. The paper and paperboard materials category includes products such as office papers, newspapers, corrugated boxes, milk cartons, tissue paper, and paper plates and cups (Figure 2 and Table 4).

Total generation of paper and paperboard in MSW has grown from 30 million tons in 1960 to 84 million tons in 2005 (Table 1). As a percentage of total MSW generation, paper represented 34 percent in 1960 (Table 1). The percentage has varied over time, but is estimated to be 34.2 percent of total MSW generation in 2005. As Figure 3 illustrates, paper generation declined in 1996, peaked at about 88 million tons in 1999, and declined to 84 million tons in 2005.

Figure 2. Paper and paperboard products generated in MSW, 2005

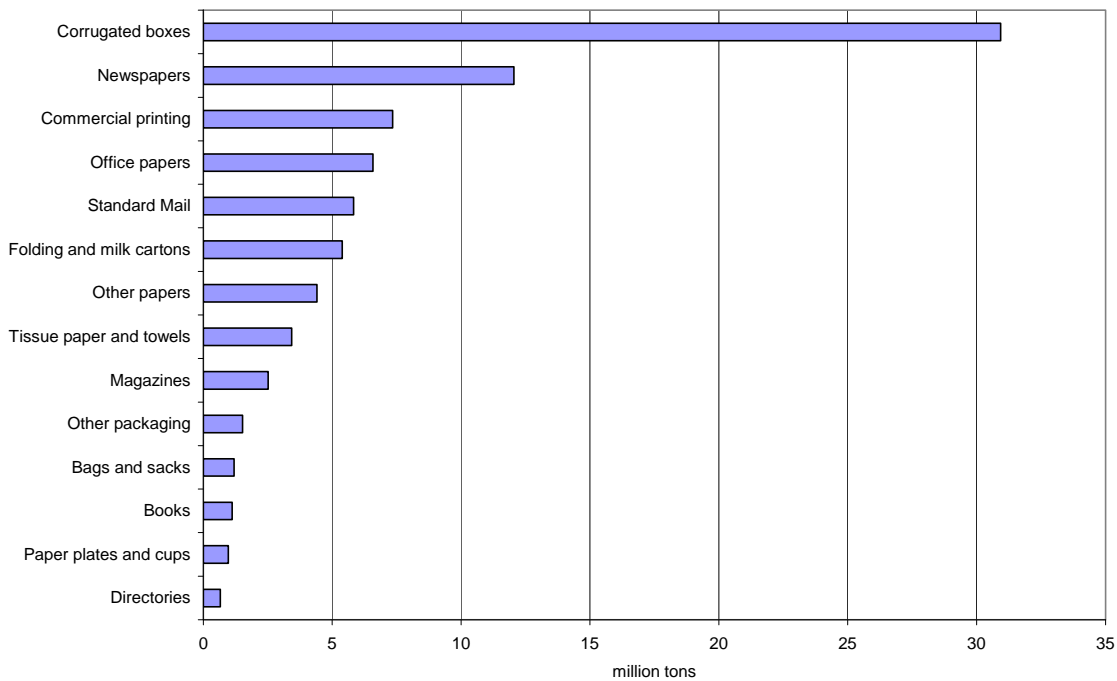


Table 4
PAPER AND PAPERBOARD PRODUCTS IN MSW, 2005
(In thousands of tons and percent of generation)

Product Category	Generation (Thousand tons)	Recovery		Discards (Thousand tons)
		(Thousand tons)	(Percent of generation)	
Nondurable Goods				
Newspapers				
Newsprint	9,790	8,730	89.2%	1,060
Groundwood inserts	2,260	1,980	87.6%	280
Total Newspapers	<u>12,050</u>	<u>10,710</u>	88.9%	<u>1,340</u>
Books	1,120	260	23.2%	860
Magazines	2,520	970	38.5%	1,550
Office Papers*	6,580	4,120	62.6%	2,460
Telephone Directories	660	120	18.2%	540
Standard Mail**	5,830	2,090	35.8%	3,740
Other Commercial Printing	7,340	760	10.4%	6,580
Tissue Paper and Towels	3,430	Neg.	Neg.	3,430
Paper Plates and Cups	970	Neg.	Neg.	970
Other Nonpackaging Paper***	4,410	Neg.	Neg.	4,410
Total Paper and Paperboard Nondurable Goods	<u>44,910</u>	<u>19,030</u>	42.4%	<u>25,880</u>
Containers and Packaging				
Corrugated Boxes	30,930	22,100	71.5%	8,830
Milk Cartons	420	Neg.	Neg.	420
Folding Cartons	4,970	590	11.9%	4,380
Other Paperboard Packaging	150	Neg.	Neg.	150
Bags and Sacks	1,190	250	21.0%	940
Other Paper Packaging	1,370	Neg.	Neg.	1,370
Total Paper and Paperboard Containers and Packaging	<u>39,030</u>	<u>22,940</u>	58.8%	<u>16,090</u>
Total Paper and Paperboard	<u>83,940</u>	<u>41,970</u>	50.0%	<u>41,970</u>

* High-grade papers such as copy paper and printer paper.

** Formerly called Third Class Mail by the U.S. Postal Service.

*** Includes tissue in disposable diapers, paper in games and novelties, cards, etc.
Table 4 does not include 10,000 tons of paper used in durable goods (Table 1).

Neg. = Less than 5,000 tons or 0.05 percent.

Details may not add to totals due to rounding.

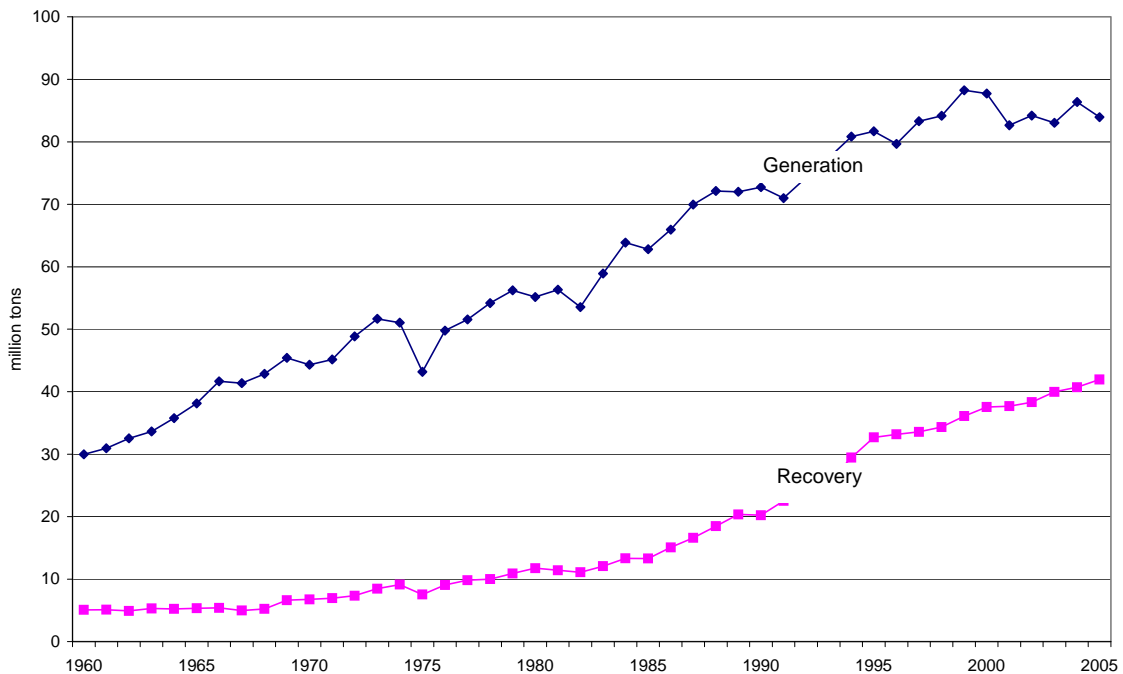
Source: Franklin Associates, A Division of ERG

² The term “cardboard” is often used for products made of paperboard (boxboard and containerboard), but this inexact term is not used in the paper industry.

The sensitivity of paper products to economic conditions can be observed in Figure 3. The tonnage of paper generated in 1975—a severe recession year—was actually less than the tonnage in 1970. Similar but less pronounced declines in paper generation can be seen in other recession years.

The wide variety of products that comprise the paper and paperboard materials total is illustrated in Table 4 and Figure 2. In this report, these products are classified as nondurable goods or as containers and packaging, with nondurable goods being the larger category.

Figure 3. Paper and paperboard generation and recovery, 1960 to 2005



Generation. Estimates of paper and paperboard generation are based on statistics published by the American Forest & Paper Association (AF&PA). These statistics include data on new supply (production plus net imports) of the various paper and paperboard grades that go into the products found in MSW. The AF&PA new supply statistics are adjusted to deduct converting scrap, which is generated when sheets or rolls of paper or paperboard are cut to make products such as envelopes or boxes. Converting scrap rates vary from product to product; the rates used in this report were developed as part of a 1992 report for the Recycling Advisory Council, with a few more revisions as new data became available. Various deductions also are made to account for products diverted out of municipal solid waste, such as gypsum wallboard facings (classified as construction and demolition debris) or toilet tissue (which goes to wastewater treatment plants).

Recovery. Estimates of recovery of paper and paperboard products for recycling are based on annual reports of recovery published by AF&PA. The AF&PA reports include recovery of paper and paperboard purchased by U.S. paper mills, plus exports of recovered paper, plus a relatively small amount estimated to have been used in other products such as insulation and animal bedding. Recovery as reported by AF&PA includes both preconsumer and postconsumer paper.

To estimate recovery of postconsumer paper products for this EPA report, estimates of recovery of converting scrap are deducted from the total recovery amounts reported by AF&PA. In earlier versions of this EPA report, a simplifying assumption that all converting scrap is recovered was made. For more recent updates, various converting scrap recovery rates ranging from 70 percent to 98 percent were applied to the estimates for 1990 through 2005. The converting scrap recovery rates were developed for a 1992 report for the Recycling Advisory Council. Because recovered converting scrap is deducted, the paper recovery rates presented in this report are always lower than the total recovery rates published by AF&PA.

When recovered paper is repulped, and often deinked, at a recycling paper mill, considerable amounts of sludge are generated in amounts varying from 5 percent to 35 percent of the paper feedstock. Since these sludges are generated at an industrial site, they are considered to be industrial process waste, not municipal solid waste; therefore they have been removed from the municipal waste stream.

Recovery of paper and paperboard for recycling is at the highest rate overall compared to most other materials in MSW. As Table 4 shows, 71.5 percent of all corrugated boxes were recovered for recycling in 2005; this is up from 67.3 percent in 2000. Newspapers were recovered at a rate of 88.9 percent, and high grade office papers at 62.6 percent, with lesser percentages of other papers being recovered also. Approximately 42 million tons of postconsumer paper were recovered in 2005—50 percent of total paper and paperboard generation. This is up from 42.8 percent in 2000.

Discards After Recovery. After recovery of paper and paperboard for recycling, discards were 42 million tons in 2005, or 25.2 percent of total MSW discards.

Glass

Glass is found in MSW primarily in the form of containers (Table 5 and Figures 4 and 5), but also in durable goods like furniture, appliances, and consumer electronics. In the container category, glass is found in beer and soft drink bottles, wine and liquor bottles, and bottles and jars for food, cosmetics, and other products. More detail on these products is included in the later section on products in MSW.

Table 5
GLASS PRODUCTS IN MSW, 2005
(In thousands of tons and percent of generation)

Product Category	Generation (Thousand tons)	Recovery		Discards (Thousand tons)
		(Thousand tons)	(Percent of generation)	
Durable Goods*	1,830	Neg.	Neg.	1,830
Containers and Packaging				
Beer and Soft Drink Bottles	7,150	2,190	30.6%	4,960
Wine and Liquor Bottles	1,640	250	15.2%	1,390
Food and Other Bottles and Jars	<u>2,130</u>	<u>320</u>	15.0%	<u>1,810</u>
Total Glass Containers	10,920	2,760	25.3%	8,160
Total Glass	<u>12,750</u>	<u>2,760</u>	21.6%	<u>9,990</u>

* Glass as a component of appliances, furniture, consumer electronics, etc.
 Neg. = Less than 5,000 tons or 0.05 percent.
 Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Figure 4. Glass products generated in MSW, 2005

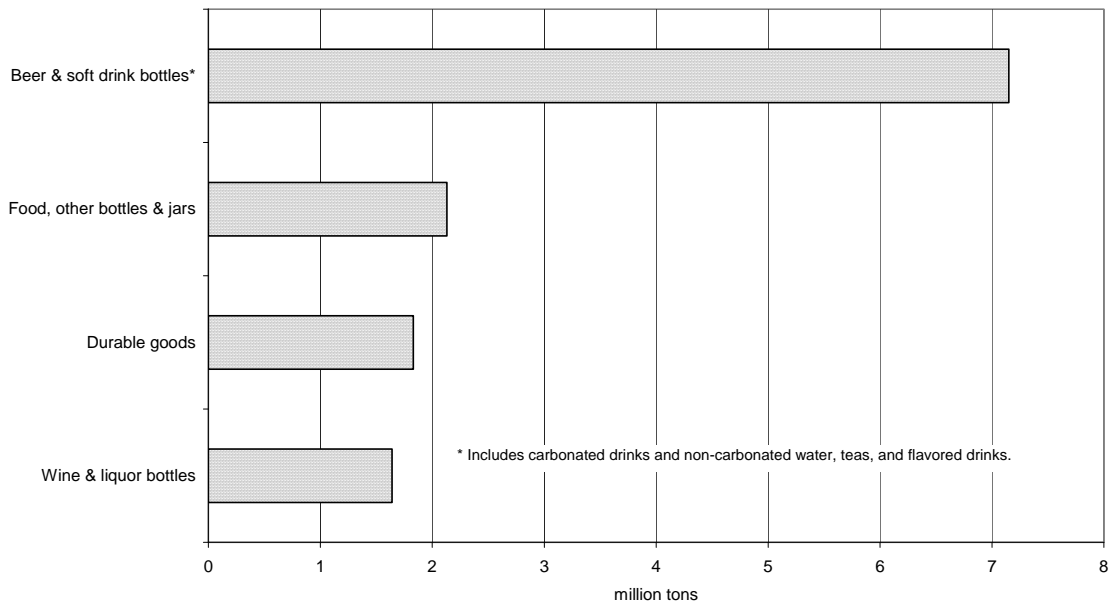
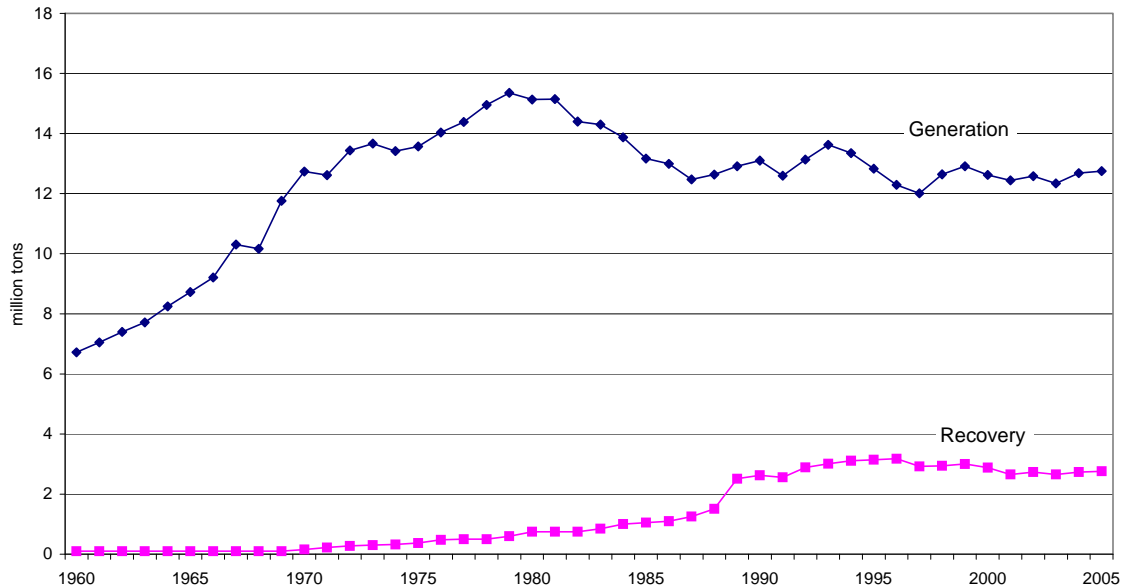


Figure 5. Glass generation and recovery, 1960 to 2005



Generation. Glass accounted for 6.7 million tons of MSW in 1960, or 7.6 percent of total generation. Generation of glass continued to grow over the next two decades, but then glass containers were widely displaced by other materials, principally aluminum and plastics. Thus the tonnage of glass in MSW declined in the 1980s, from approximately 15.1 million tons in 1980 to 13.1 million tons in 1990. Beginning about 1987, however, the decline in generation of glass containers slowed (Figure 5), and glass generation in 2005 was 12.8 million tons. During the 1990s glass generation varied from 12.0 to 13.6 million tons per year. Glass was 10 percent of MSW generation in 1980, declining to 5.2 percent in 2005.

Recovery. Most recovered glass containers (bottles) are used to make new glass containers, but a portion goes to other uses such as fiberglass insulation, aggregate, and glassphalt for highway construction. Until 1998, the Glass Packaging Institute published estimates of glass bottle recovery annually. Since this data source is no longer available, industry sources were contacted for recovery data. Recovery of glass bottles was estimated at 2.8 million tons in 2005, down slightly from an estimated 2.9 million tons in 2000.

Discards After Recovery. Recovery for recycling lowered discards of glass to 10 million tons in 2005 (6.0 percent of total MSW discards).

Ferrous Metals

By weight, ferrous metals (iron and steel) are the largest category of metals in MSW (Table 6 and Figure 6). The largest quantities of ferrous metals in MSW are found in durable goods such as appliances, furniture, and tires. Containers and packaging are the other source of ferrous metals in MSW. Large quantities of ferrous metals are found in construction materials and in transportation parts and products such as automobiles, locomotives, and ships, but these are not counted as MSW in this report.

Total generation and recovery of all metals in MSW from 1960 to 2005 are shown in Figure 7.

Generation. Approximately 10.3 million tons of ferrous metals were generated in 1960. Like glass, the tonnages grew during the 1960s, but began to drop as lighter materials like aluminum and plastics replaced steel in many applications. Since 1970, generation of ferrous metals has varied between about 12.4 million tons in 1970 to 13.8 million tons in 2005. The percentage of ferrous metals generation in MSW has declined from 11.7 percent in 1960 to 5.6 percent in 2005.

Table 6
METAL PRODUCTS IN MSW, 2005
(In thousands of tons and percent of generation)

Product Category	Generation (Thousand tons)	Recovery		Discards (Thousand tons)
		(Thousand tons)	(Percent of generation)	
Durable Goods				
Ferrous metals*	11,400	3,430	30.1%	7,970
Aluminum**	1,080	Neg.	Neg.	1,080
Lead†	1,280	1,260	98.4%	20
Other nonferrous metals‡	460	Neg.	Neg.	460
Total Metals in Durable Goods	14,220	4,690	33.0%	9,530
Nondurable Goods				
Aluminum	230	Neg.	Neg.	230
Containers and Packaging				
Steel				
Food and other cans	2,130	1,340	62.9%	790
Other steel packaging	240	160	66.7%	80
Total Steel Packaging	2,370	1,500	63.3%	870
Aluminum				
Beer and soft drink cans	1,450	650	44.8%	800
Food and other cans	50	Neg.	Neg.	50
Foil and closures	400	40	10.0%	360
Total Aluminum Packaging	1,900	690	36.3%	1,210
Total Metals in Containers and Packaging	4,270	2,190	51.3%	2,080
Total Metals	18,720	6,880	36.8%	11,840
Ferrous	13,770	4,930	35.8%	8,840
Aluminum	3,210	690	21.5%	2,520
Other nonferrous	1,740	1,260	72.4%	480

* Ferrous metals (iron and steel) in appliances, furniture, tires, and miscellaneous durables.

** Aluminum in appliances, furniture, and miscellaneous durables.

† Lead in lead-acid batteries.

‡ Other nonferrous metals in appliances and miscellaneous durables.

Neg. = Less than 5,000 tons or 0.05 percent.

Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Figure 6. Metal products generated in MSW, 2005

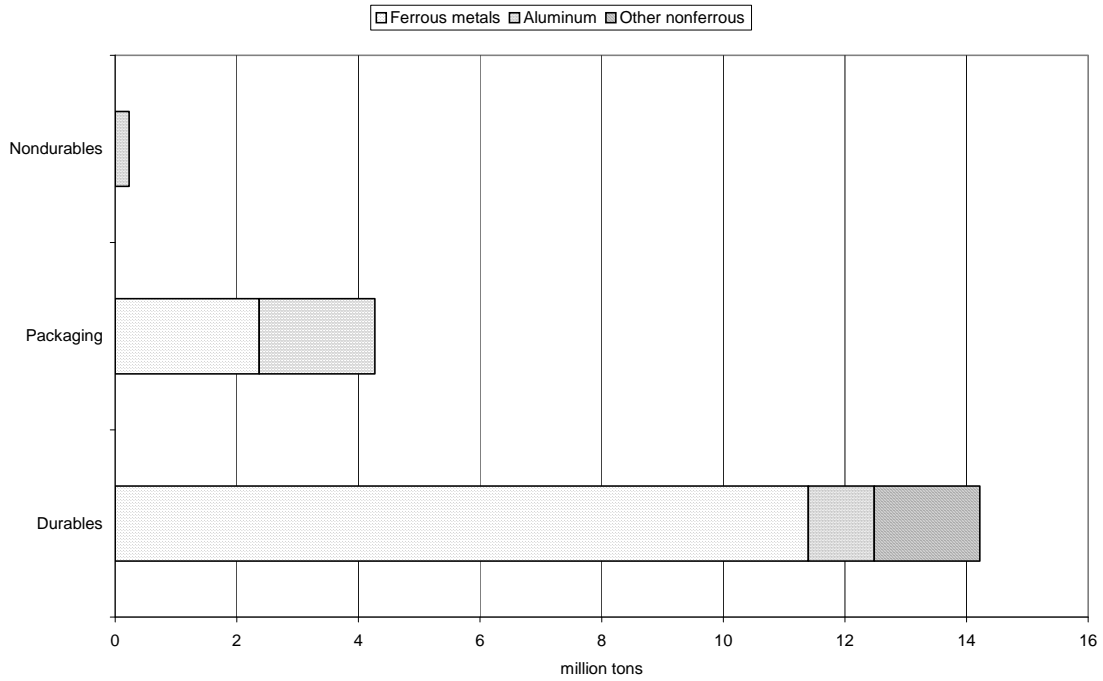
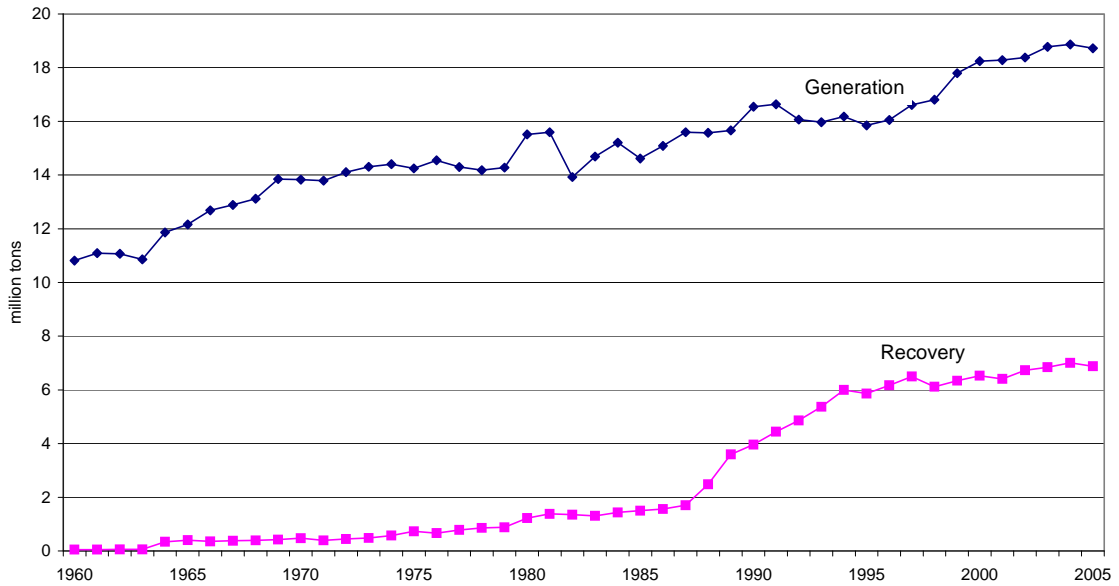


Figure 7. Metals generation and recovery, 1960 to 2005



Recovery. The renewed emphasis on recovery and recycling in recent years has included ferrous metals. Based on data from the Steel Recycling Institute, recovery of ferrous metals from appliances (“white goods”) was estimated at a rate of 90 percent in 2005. Overall recovery of ferrous metals from durable goods (large and small appliances, furniture, and tires) was estimated to be 30 percent (3.4 million tons) in 2005 (Table 6).

Steel food cans and other cans were estimated to be recovered at a rate of 62.9 percent (1.3 million tons) in 2005. Approximately 160,000 tons of other steel packaging, mostly steel barrels and drums, were estimated to have been recovered for recycling in 2005.

Discards After Recovery. In 2005, discards of ferrous metals after recovery were 8.8 million tons, or 5.3 percent of total discards.

Aluminum

The largest source of aluminum in MSW is aluminum cans and other packaging (Table 6 and Figure 6). Other sources of aluminum are found in durable and nondurable goods.

Generation. In 2005, 1.9 million tons of aluminum were generated as containers and packaging, while approximately 1.3 million tons were found in durable and nondurable goods. The total—3.2 million tons—was 1.3 percent of total MSW generation in 2005. Aluminum generation was only 340,000 tons (0.4 percent of MSW generation) in 1960.

Recovery. Aluminum beverage containers were recovered at a rate of 44.8 percent of generation (0.7 million tons) in 2005, and 36.3 percent of all aluminum in containers and packaging was recovered for recycling in 2005.

Discards After Recovery. In 2005, about 2.5 million tons of aluminum were discarded in MSW after recovery, which was 1.5 percent of total MSW discards.

Other Nonferrous Metals

Other nonferrous metals (e.g., lead, copper, zinc) are found in durable products such as appliances, consumer electronics, etc. Lead in lead-acid batteries is the most prevalent nonferrous metal (other than aluminum) in MSW. Note that only lead-acid batteries from passenger cars, trucks, and motorcycles are included. Lead-acid batteries used in large equipment or industrial applications are not included.

Generation. Generation of other nonferrous metals in MSW totaled 1.7 million tons in 2005. Lead in batteries accounted for 1.3 million tons of this amount. Generation of these metals has increased slowly, up from 180,000 tons in 1960. As a percentage of total generation, nonferrous metals have never exceeded one percent.

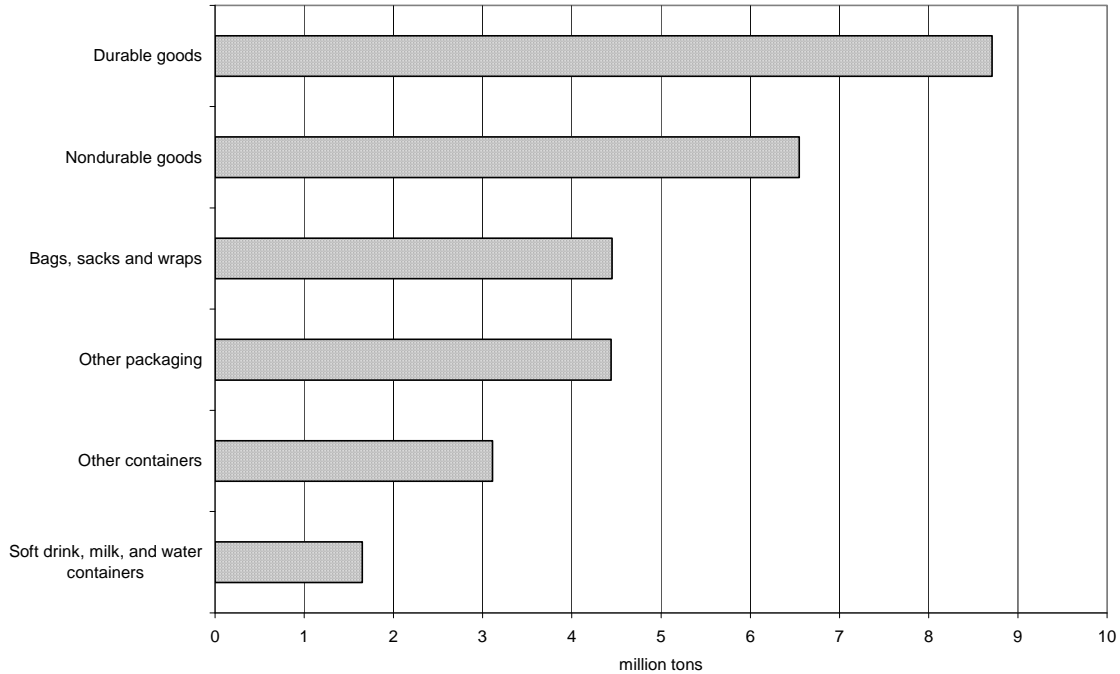
Recovery. Recovery of the other nonferrous metals was 1.3 million tons in 2005, with most of this being lead recovered from batteries. It was estimated that 99 percent of battery lead was recovered in 2005.

Discards After Recovery. In 2005, 480,000 tons of nonferrous metals were discarded in MSW. Percentages of total discards remained less than one percent over the entire period.

Plastics

Plastics are a rapidly growing segment of MSW. While plastics are found in all major MSW categories, the containers and packaging category has the most plastic tonnage (Figure 8 and Table 7).

Figure 8. Plastics products generated in MSW, 2005



In durable goods, plastics are found in appliances, furniture, casings of lead-acid batteries, and other products. (Note that plastics in transportation products generally are not included in this report.) As shown in Table 7, a wide range of resin types is found in durable goods. While some detail is provided in Table 7 for resins in durable goods, there are hundreds of different resin formulations used in appliances, carpets, and other durable goods; a complete listing is beyond the scope of this report.

Table 7

PLASTICS IN PRODUCTS IN MSW, 2005
(In thousands of tons, and percent of generation by resin)

Product Category	Generation	Recovery		Discards
	(Thousand tons)	(Thousand tons)	(Percent of Gen.)	(Thousand tons)
Durable Goods				
PET	480			
HDPE	650			
PVC	510			
LDPE/LLDPE	770			
PP	1,370			
PS	730			
Other resins	4,200			
Total Plastics in Durable Goods	8,710	370	4.2%	8,340
Nondurable Goods				
Plastic Plates and Cups				
LDPE/LLDPE	20			20
PS	910	Neg.		910
Subtotal Plastic Plates and Cups	930			930
Trash Bags				
HDPE	280			280
LDPE/LLDPE	780			780
Subtotal Trash Bags	1,060			1,060
All other nondurables*				
PET	240			240
HDPE	430			430
PVC	660			660
LDPE/LLDPE	1,630			1,630
PP	900			900
PS	600			600
Other resins	100			100
Subtotal All Other Nondurables	4,560			4,560
Total Plastics in Nondurable Goods, by resin				
PET	240			240
HDPE	710			710
PVC	660			660
LDPE/LLDPE	2,430			2,430
PP	900			900
PS	1,510			1,510
Other resins	100			100
Total Plastics in Nondurable Goods	6,550	Neg.	Neg.	6,550
Plastic Containers & Packaging				
Soft drink bottles				
PET	850	290	34.1%	560
Milk and water bottles				
HDPE	800	230	28.8%	570

HDPE = High density polyethylene

PET = Polyethylene terephthalate

PS = Polystyrene

LDPE = Low density polyethylene

PP = Polypropylene

PVC = Polyvinyl chloride

LLDPE = Linear low density polyethylene

* All other nondurables include plastics in disposable diapers, clothing, footwear, etc.

** Other plastic packaging includes coatings, closures, caps, trays, shapes, etc.

Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Table 7 (continued)
PLASTICS IN PRODUCTS IN MSW, 2005
(In thousands of tons, and percent of generation by resin)

Product Category	Generation	Recovery		Discards
	(Thousand tons)	(Thousand tons)	(Percent of Gen.)	(Thousand tons)
Plastic Containers & Packaging, cont.				
Other plastic containers				
PET	1,040	210		830
HDPE	1,410	230		1,180
PVC	90			90
LDPE/LLDPE	40			40
PP	80			80
PS	0			0
Other resins	450			450
Subtotal Other Containers	3,110	440	14.1%	2,670
Bags, sacks, & wraps				
HDPE	790	40		750
PVC	70			70
LDPE/LLDPE	2,680	190		2,490
PP	710			710
PS	0			0
Other resins	200			200
Subtotal Bags, Sacks, & Wraps	4,450	230	5.2%	4,220
Other Plastics Packaging**				
PET	250	40		210
HDPE	1,530	20		1,510
PVC	310			310
LDPE/LLDPE	530			530
PP	940	10		930
PS	350			350
Other resins	530	20		510
Subtotal Other Packaging	4,440	90	2.0%	4,350
Total Plastics in Containers & Packaging, by resin				
PET	2,140	540		1,600
HDPE	4,530	520		4,010
PVC	470			470
LDPE/LLDPE	3,250	190		3,060
PP	1,730	10		1,720
PS	350			350
Other resins	1,180	20		1,160
Total Plastics in Cont. & Packaging	13,650	1,280	9.4%	12,370
Total Plastics in MSW, by resin				
PET	2,860	540		2,320
HDPE	5,890	520		5,370
PVC	1,640			1,640
LDPE/LLDPE	6,450	190		6,260
PP	4,000	10		3,990
PS	2,590			2,590
Other resins	5,480	390		5,090
Total Plastics in MSW	28,910	1,650	5.7%	27,260

HDPE = High density polyethylene

LDPE = Low density polyethylene

LLDPE = Linear low density polyethylene

PET = Polyethylene terephthalate

PP = Polypropylene

PS = Polystyrene

PVC = Polyvinyl chloride

* All other nondurables include plastics in disposable diapers, clothing, footwear, etc.

** Other plastic packaging includes coatings, closures, caps, trays, shapes, etc.

Some detail of recovery by resin omitted due to lack of data.

This table understates the recovery of plastics due to the dispersed nature of plastics recycling activities.

Source: Franklin Associates, A Division of ERG

Plastics are found in such nondurable products as disposable diapers, trash bags, cups, eating utensils, sporting and recreational equipment, medical devices, and household items such as shower curtains. The plastic food service items are generally made of clear or foamed polystyrene, while trash bags are made of high-density polyethylene (HDPE) or low-density polyethylene (LDPE). A wide variety of other resins are used in other nondurable goods.

Plastic resins are also used in a variety of container and packaging products such as polyethylene terephthalate (PET) soft drink bottles, high-density polyethylene (HDPE) bottles for milk and water, and a wide variety of other resin types used in other plastic containers, bags, sacks, wraps, and lids.

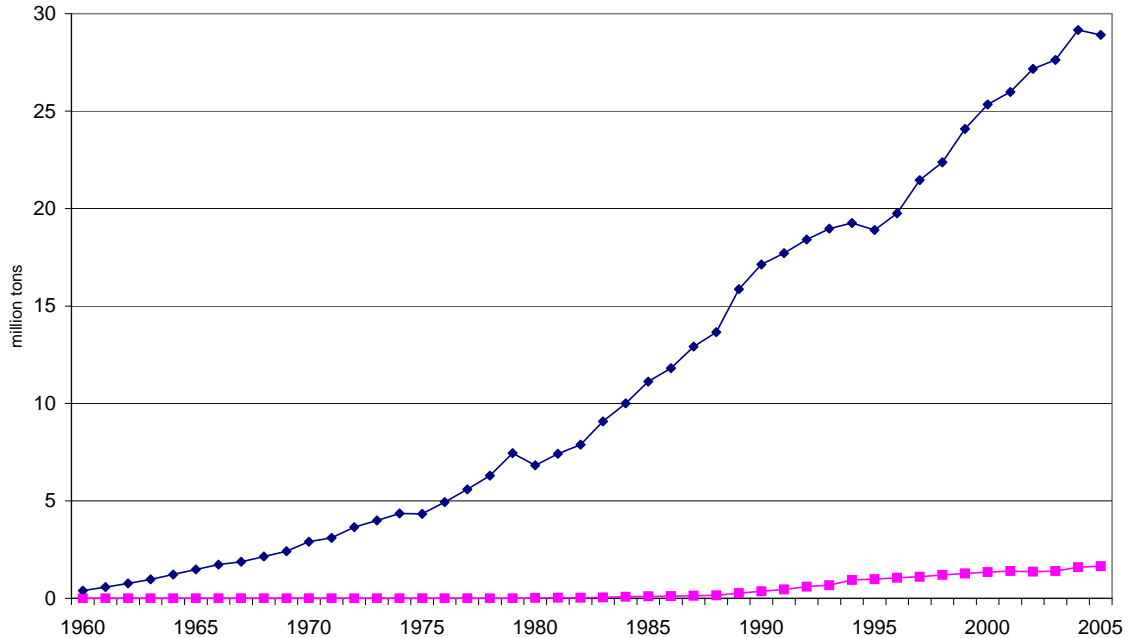
Generation. Production data on plastics resin use in products are taken from the American Plastics Council's annual resin reports. The basic data are adjusted for product service life, fabrication losses, and net imports of plastic products to derive generation of plastics in the various products in MSW.

Plastics made up an estimated 390,000 tons of MSW generation in 1960. The quantity has increased relatively steadily to 28.9 million tons in 2005 (Figure 9). As a percentage of MSW generation, plastics were less than one percent in 1960, increasing to 11.8 percent in 2005.

Recovery for Recycling. While overall recovery of plastics for recycling is relatively small—1.7 million tons, or 5.7 percent of plastics generation in 2005 (Table 7)—recovery of some plastic containers is more significant. PET soft drink bottles were recovered at a rate of 34.1 percent in 2005. Recovery of high-density polyethylene milk and water bottles was estimated at about 28.8 percent in 2005. Significant recovery of plastics from lead-acid battery casings and from some other containers was also reported. The primary source of data on plastics recovery is an annual survey conducted for the American Plastics Council.

Discards After Recovery. Discards of plastics in MSW after recovery were 27.3 million tons, or 16.4 percent of total MSW discards in 2005.

Figure 9. Plastics generation and recovery, 1960 to 2005



Other Materials

Rubber and Leather. The predominant source of rubber in MSW is rubber tires from automobiles and trucks (Table 8). Other sources of rubber and leather include clothing and footwear and other miscellaneous durable and nondurable products. These other sources are quite diverse, including such items as gaskets on appliances, furniture, and hot water bottles, for example.

Generation. Generation of rubber and leather in MSW has shown slow growth over the years, increasing from 1.8 million tons in 1960 to 6.7 million tons in 2005. One reason for the relatively slow rate of growth is that tires have been made smaller and longer-wearing than in earlier years.

As a percentage of total MSW generation, rubber and leather has been about 3 percent for many years.

Recovery for Recycling. The only recovery for recycling identified in this category is rubber from tires, and that was estimated to be 960,000 tons in 2005. This is 34.8 percent of rubber in tires in 2005. (Table 8). (This recovery estimate does not include tires retreaded or energy recovery from tires.) Overall, 14.3 percent of rubber and leather in MSW was recovered in 2005.

Table 8
RUBBER AND LEATHER PRODUCTS IN MSW, 2005
(In thousands of tons and percent of generation)

Product Category	Generation (Thousand tons)	Recovery		Discards (Thousand tons)
		(Thousand tons)	(Percent of generation)	
Durable Goods				
Rubber in Tires*	2,760	960	34.8%	1,800
Other Durables**	<u>2,920</u>	<u>Neg.</u>	Neg.	<u>2,920</u>
Total Rubber & Leather				
<i>Durable Goods</i>	5,680	960	16.9%	4,720
Nondurable Goods				
Clothing and Footwear	700	Neg.	Neg.	700
Other Nondurables	<u>290</u>	<u>Neg.</u>	Neg.	<u>290</u>
Total Rubber & Leather				
<i>Nondurable Goods</i>	990	Neg.	Neg.	990
Containers and Packaging	30	Neg.	Neg.	30
Total Rubber & Leather	<u>6,700</u>	<u>960</u>	14.3%	<u>5,740</u>

* Automobile and truck tires. Does not include other materials in tires.

** Includes carpets and rugs and other miscellaneous durables.

Neg. = Less than 5,000 tons or 0.05 percent.

Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Discards After Recovery. Discards of rubber and leather after recovery were 5.7 million tons in 2005 (3.4 percent of total discards).

Textiles. Textiles in MSW are found mainly in discarded clothing, although other sources were identified to be furniture, carpets, tires, footwear, and other nondurable goods such as sheets and towels.

Generation. An estimated 11.1 million tons of textiles were generated in 2005 (4.5 percent of total MSW generation).

Recovery for Recycling and Discards. Significant amounts of textiles are recovered for reuse. However, the reused garments and wiper rags re-enter the waste stream eventually, so this is considered a diversion rather than recovery for recycling and, therefore, not included in the recovery for recycling estimates. Since data on elapsed time from recovery of textiles for reuse to final discard is limited, it was assumed that reused textiles re-enter the waste stream the same year that they are first discarded. It was estimated that 15.3 percent of textiles in clothing and items such as sheets and pillowcases was recovered for export or reprocessing in 2005 (1.7 million tons) leaving discards of 9.4 million tons of textiles in 2005.

Wood

The sources of wood in MSW include furniture, other durable goods (e.g., cabinets for electronic equipment), wood packaging (crates, pallets), and some other miscellaneous products. Generation and recovery data for wood pallets comes from the Center for Forest Products Marketing and Management (Virginia Polytechnic Institute).

Generation. Generation of wood in MSW was 13.9 million tons in 2005 (5.7 percent of total MSW generation).

Recovery for Recycling and Discards. Wood pallet recovery for recycling (usually by chipping for uses such as mulch or bedding material, but excluding wood combusted as fuel) was estimated at 1.3 million tons in 2005.

Accounting for pallet reuse and recovery for recycling, wood discards were 12.6 million tons in 2005, or 7.6 percent of total MSW discards.

Other products. Generation of “other products” waste is mainly associated with disposable diapers, which are discussed under Products in Municipal Solid Waste. The only other significant sources of materials in this category are the electrolytes and other materials associated with lead-acid batteries that are not classified as plastics or nonferrous metal.

Food Scraps

Food scraps included here consist of uneaten food and food preparation wastes from residences, commercial establishments such as grocery stores and sit-down and fast food restaurants, institutional sources such as school cafeterias, and industrial sources such as factory lunchrooms. Food waste generated during the preparation and packaging of food products is considered industrial waste and therefore not included in MSW food scrap estimates.

Generation. No production data are available for food scraps. Food scraps from residential and commercial sources were estimated using data from sampling studies in various parts of the country in combination with demographic data on population, grocery store sales, restaurant sales, numbers of employees, and numbers of prisoners and students in institutions. Generation of food scraps was estimated to be 29.2 million tons in 2005 (11.9 percent of total generation).

Recovery for Composting and Discards. Beginning in 1994 for this series of reports, a significant amount of food scraps composting from commercial sources was identified. As the data source (a survey published by *BioCycle* magazine) has improved, it has become apparent that some other composted materials (e.g., industrial food processing wastes) have been included with food scraps classified as MSW in the past. For the 2005 estimate, food scrap composting data were obtained from primary sources including state solid waste officials, large-scale municipal and commercial composting facilities, and large generators (e.g., supermarkets and restaurants).

Additional data on MSW food scrap composting operations resulted in an estimate of 370,000 tons food scraps composted in 2005.

Another *BioCycle* survey yielded an estimate of approximately 320,000 tons of MSW composted. The total—690,000 tons of food scraps and other organic materials composted in 2005—is shown in the recovery tables.

Yard Trimmings

Yard trimmings³ include grass, leaves, and tree and brush trimmings from residential, institutional, and commercial sources.

Generation. In earlier versions of this report, generation of yard trimmings was estimated using sampling studies and population data. While in past years generation of yard trimmings had been increasing steadily as population and residential housing grew (i.e., constant generation on a per capita basis), in the 1990s local and state governments started enacting legislation that discouraged yard trimmings disposal in landfills.

Legislation affecting yard trimmings disposal in landfills was tabulated, using published sources. In 1992, 11 states and the District of Columbia—accounting for more than 28 percent of the nation’s population—had legislation in effect that bans or discourages yard trimmings disposal in landfills. The tabulation of current legislation shows 21 states and the District of Columbia, representing about 50 percent of the nation’s population, has legislation affecting disposal of yard trimmings. This has led to an increase in backyard composting and the use of mulching mowers to allow grass trimmings to remain in place.

³ Although limited data are available on the composition of yard trimmings, it is estimated that the average composition by weight is about 50 percent grass, 25 percent brush, and 25 percent leaves. These are “ballpark” numbers that will vary widely according to climate and region of the country.

Using these facts, it was estimated that yard trimmings generation has declined since 1990. In the absence of significant new legislation, yard trimmings generation has been increasing slightly in recent years (i.e., increasing as natural population and residential dwelling units increase). An estimated 32.1 million tons of yard trimmings were generated in MSW in 2005.

Recovery for Composting and Discards. Recovery for composting of yard trimmings was estimated using information from state composting programs, which estimated tonnages composted or mulched in 2005. This information resulted in an estimate of 19.9 million tons of yard trimmings removed for composting or mulching in 2005—a significant increase over the 2000 estimate.

It should be noted that the estimated 19.9 million tons recovered for composting in 2005 does not include yard trimmings recovered for direct landspreading disposal. It also should be noted that these recovery estimates do not account for backyard composting by individuals and practices such as less bagging of grass clippings. These are source reduction activities taking place onsite, while the yard trimmings recovery estimates are based on material sent off-site.

Miscellaneous Inorganic Wastes

This relatively small category of MSW is derived from sampling studies. It is not well defined and often shows up in sampling reports as “fines” or “other.” It includes soil, bits of concrete, stones, and the like.

Generation, Recovery, and Discards. This category contributed an estimated 3.7 million tons of MSW in 2005. No recovery of these products was identified; discards are the same as generation.

Summary of Materials in Municipal Solid Waste

Generation. Changing quantities and composition of municipal solid waste generation are illustrated in Figure 10. Generation of MSW has grown relatively steadily, from 88.1 million tons in 1960 to 247.3 million tons in 2004. It decreased slightly to 245.7 million tons in 2005.

Over the years paper and paperboard has been the dominant material category generated in MSW, accounting for 34.2 percent of generation in 2005. Yard trimmings, the second largest material component of MSW (13.1 percent of MSW generation) has declined as a percentage of MSW due to state and local legislated landfill bans and increased emphasis on backyard composting and other source reduction measures such as the use of mulching mowers.

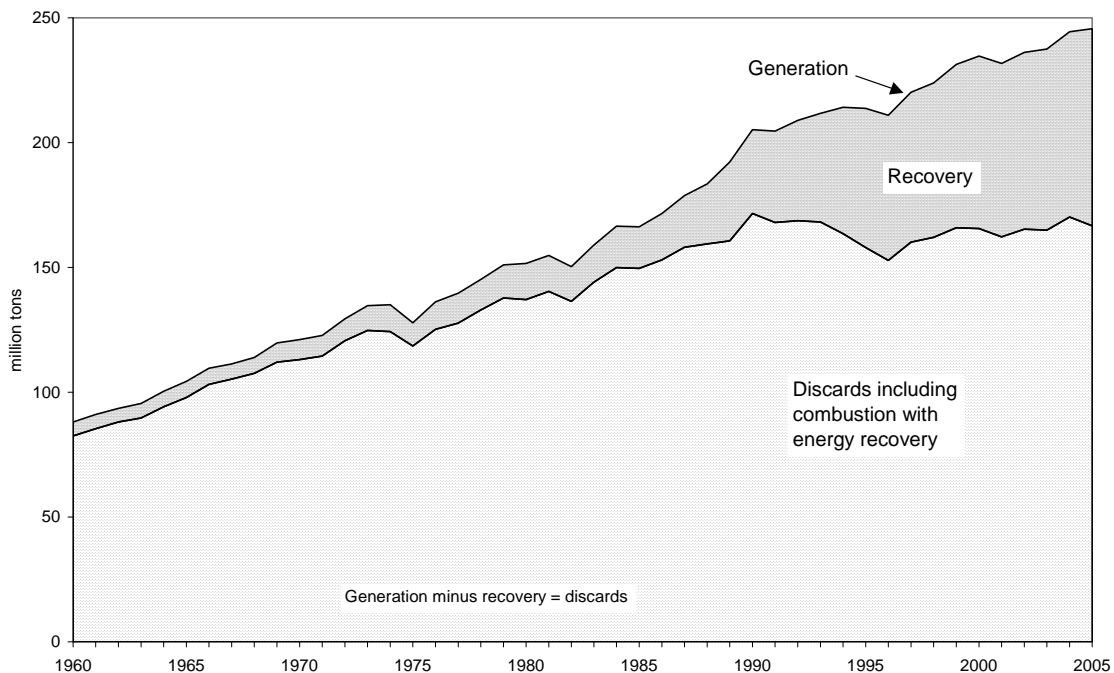
Figure 10. Generation of materials in MSW, 1960 to 2005



Metals account for 7.6 percent of MSW generation and have remained fairly constant as a source of MSW since 1990. Glass increased until the 1980s, decreasing somewhat in the 1990s. Glass generation was 12.8 million tons in 2005, 5.2 percent of generation. Food scraps have increased in terms of MSW tonnage (11.9 percent of generation in 2005). Plastics have increasingly been used in a variety of products and thus have been a rapidly growing component of MSW. In terms of tonnage contributed they ranked fourth in 2005 (behind paper, yard trimmings, and food scraps), and account for 11.8 percent of MSW generation.

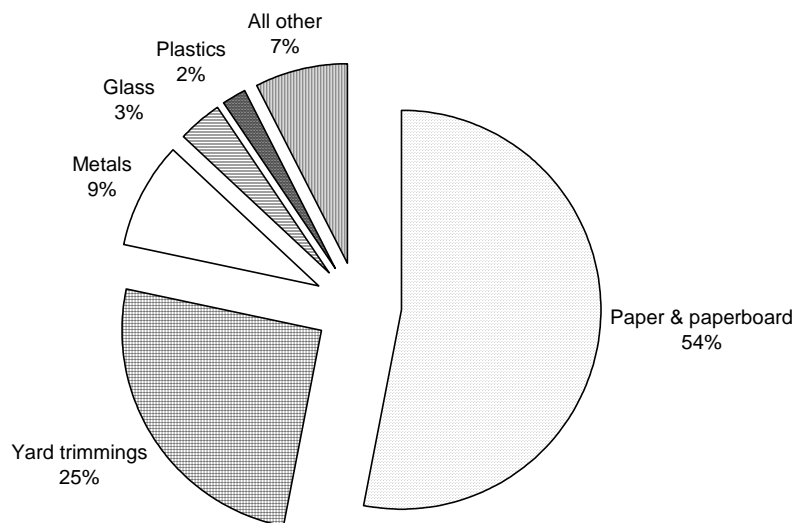
Recovery and Discards. The effect of recovery on MSW discards is illustrated in Figure 11. Recovery of materials for recycling and composting grew at a rather slow pace from 1960 to the 1980s, increasing only from 6.4 percent of generation in 1960 to 9.6 percent in 1980. Renewed interest in recycling (including composting) as waste management alternatives came about in the late 1980s, and the recovery rate in 1990 was estimated to be 16.2 percent of generation, increasing to 32.1 percent in 2005.

Figure 11. Recovery and discards of materials in MSW, 1960 to 2005



Estimated recovery of materials (including composting) is shown in Figure 12. In 2005, recovery of paper and paperboard dominated materials recovery at 54 percent of total tonnage recovered, while yard trimmings contributed 25 percent of total recovery. Recovery of other materials, while generally increasing, contributes much less tonnage, reflecting in part the relatively smaller amounts of materials generated in those categories.

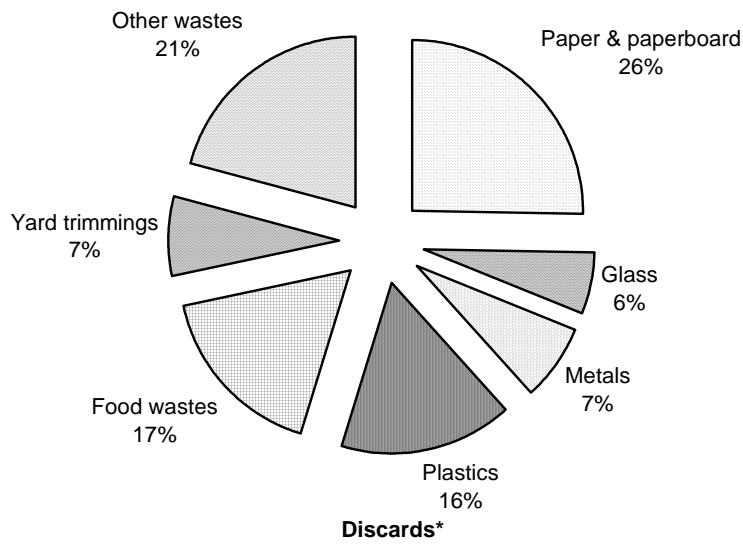
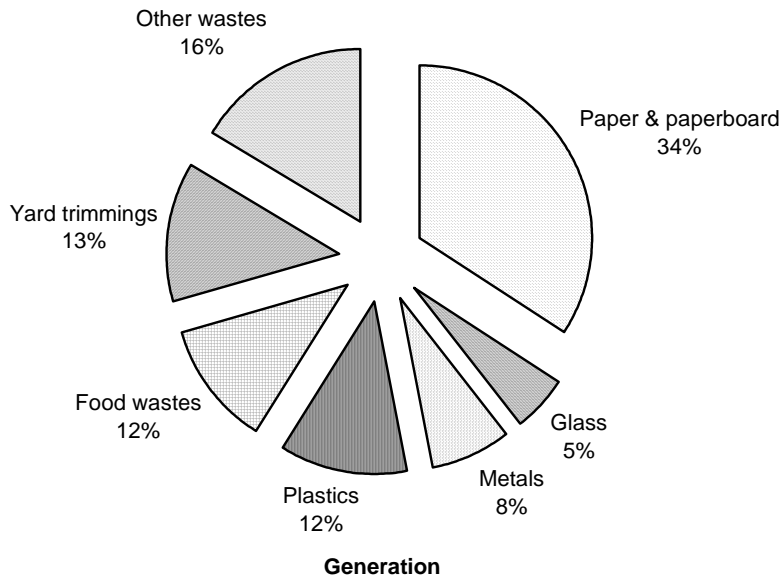
Figure 12. Materials recovery,* 2005



* In percent by weight of total recovery

Figure 13 illustrates the effect of recovery of materials for recycling, including composting, on the composition of MSW discards. For example, paper and paperboard products were 34 percent of MSW generated in 2005, but after recovery, paper and paperboard products were 26 percent of discards. Materials that have little or no recovery exhibit a larger percentage of MSW discards compared to generation.

**Figure 13. Materials generated and discarded*
in municipal solid waste, 2005**
(In percent of total generation and discards)



*Discards in this figure include combustion with energy recovery.

The Chapter 2 section above gave a breakdown of municipal solid waste by material. It described how the 245.7 million tons of MSW were generated, recycled (including composted) and disposed of. The following section breaks out the same 245.7 million tons of MSW by product.

PRODUCTS IN MUNICIPAL SOLID WASTE

The purpose of this section is to show how the products that make up municipal solid waste are generated, recycled (including composted) and discarded. For the analysis, products are divided into three basic categories: durable goods, nondurable goods, and containers and packaging. These three categories generally follow the definitions of the U.S. Department of Commerce, one of EPA's data sources. By these definitions, durable goods, (e.g., appliances) are those that last 3 years or more, while nondurable goods (e.g., newspapers and trash bags) last less than 3 years. For this report, containers and packaging are assumed to be discarded the same year the products they contain are purchased.

The following 15 tables (Tables 9 through 23) show generation, recycling (including composting) and discards of municipal solid waste in the three categories—durable goods, nondurable goods, and containers and packaging. Within these three categories, products are listed by type—for instance, carpets and rugs, office paper, or aluminum cans. The material the product is made of may be stated as well (for instance, glass beverage containers or steel cans), or may be obvious (for instance, magazines are made of paper.) Some products, such as tires and appliances, are made of several different material types.

At the bottom of each of these 15 tables (Tables 9 through 23) there is a section titled “Other Wastes.” This contains information on food scraps, yard trimmings, and miscellaneous inorganic wastes. These wastes are not products that can be estimated through the materials flow methodology, but they are estimated by other means, as described earlier.

Within Tables 9 through 23, the first three tables—Tables 9 through 11—serve as an index to the other tables. Table 9 shows what tables to consult for detailed information on generation; Table 10 shows what tables to consult for detailed information on recovery; and Table 11 does the same for detailed information on discards. The tables on generation all have the same “bottom line”—245.7 million tons in 2005—with detail provided in different categories—durable goods, nondurable goods, or containers and packaging. For Table 10 and related tables, the “bottom line” is MSW is recovered—79 million tons; and for Table 11 and related tables, the “bottom line” is MSW discarded—166.7 million tons.

Durable Goods

Durable goods generally are defined as products having a lifetime of three years or more, although there are some exceptions. In this report, durable goods include large and small appliances, furniture and furnishings, carpets and rugs, rubber tires, lead-acid automotive batteries, consumer electronics, and other miscellaneous durable goods (e.g., luggage, sporting goods, miscellaneous household goods) (see Tables 12 through 14). These products are often called “oversize and bulky” in municipal solid waste management practice, and they are generally handled in a somewhat different manner than other components of MSW. That is, they are often picked up separately, and may not be mixed with other MSW at the landfill, combustor, or other waste management facility. Durable goods are made up of a wide variety of materials. In order of tonnage in MSW in 2005, these include: ferrous metals, plastics, rubber and leather, wood, textiles, glass, other nonferrous metals (e.g., lead, copper), and aluminum.

Generation of durable goods in MSW totaled 40.3 million tons in 2005 (16.4 percent of total MSW generation). After recovery for recycling, 32.8 million tons of durable goods remained as discards in 2005.

Table 9
CATEGORIES OF PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(In thousands of tons and percent of total generation)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 12)</i>	9,920	14,660	21,800	29,810	36,980	39,440	39,850	40,280
Nondurable Goods <i>(Detail in Table 15)</i>	17,330	25,060	34,420	52,170	64,120	62,300	64,410	63,720
Containers and Packaging <i>(Detail in Table 18)</i>	27,370	43,560	52,670	64,530	76,020	75,360	78,550	76,670
Total Product** Wastes	54,620	83,280	108,890	146,510	177,120	177,100	182,810	180,670
Other Wastes								
Food Scraps	12,200	12,800	13,000	20,800	26,480	28,180	29,070	29,230
Yard Trimmings	20,000	23,200	27,500	35,000	30,530	31,470	31,770	32,070
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,620	3,650	3,690
Total Other Wastes	33,500	37,780	42,750	58,700	60,510	63,270	64,490	64,990
Total MSW Generated - Weight	88,120	121,060	151,640	205,210	237,630	240,370	247,300	245,660
Products	Percent of Total Generation							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 12)</i>	11.3%	12.1%	14.4%	14.5%	15.6%	16.4%	16.1%	16.4%
Nondurable Goods <i>(Detail in Table 15)</i>	19.7%	20.7%	22.7%	25.4%	27.0%	25.9%	26.0%	25.9%
Containers and Packaging <i>(Detail in Table 19)</i>	31.1%	36.0%	34.7%	31.4%	32.0%	31.4%	31.8%	31.2%
Total Product** Wastes	62.0%	68.8%	71.8%	71.4%	74.5%	73.7%	73.9%	73.5%
Other Wastes								
Food Scraps	13.8%	10.6%	8.6%	10.1%	11.1%	11.7%	11.8%	11.9%
Yard Trimmings	22.7%	19.2%	18.1%	17.1%	12.8%	13.1%	12.8%	13.1%
Miscellaneous Inorganic Wastes	1.5%	1.5%	1.5%	1.4%	1.5%	1.5%	1.5%	1.5%
Total Other Wastes	38.0%	31.2%	28.2%	28.6%	25.5%	26.3%	26.1%	26.5%
Total MSW Generated - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Generation before materials recovery or combustion. Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Other than food products.

Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Table 10
RECOVERY* OF MUNICIPAL SOLID WASTE, 1960 TO 2005
(In thousands of tons and percent of generation of each category)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 13)</i>	350	940	1,360	3,460	6,350	7,160	7,440	7,470
Nondurable Goods <i>(Detail in Table 16)</i>	2,390	3,730	4,670	8,800	17,560	19,290	19,960	20,450
Containers and Packaging <i>(Detail in Table 20)</i>	2,870	3,350	8,490	16,780	28,740	29,300	29,790	30,480
Total Product** Wastes	5,610	8,020	14,520	29,040	52,650	55,750	57,190	58,400
Other Wastes								
Food, Other^	Neg.	Neg.	Neg.	Neg.	680	750	660	690
Yard Trimmings	Neg.	Neg.	Neg.	4,200	15,770	18,330	19,810	19,860
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	19,080	20,470	20,550
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,100	74,830	77,660	78,950
Products	Percent of Generation of Each Category							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 13)</i>	3.5%	6.4%	6.2%	11.6%	17.2%	18.2%	18.7%	18.5%
Nondurable Goods <i>(Detail in Table 16)</i>	13.8%	14.9%	13.6%	16.9%	27.4%	31.0%	31.0%	32.1%
Containers and Packaging <i>(Detail in Table 21)</i>	10.5%	7.7%	16.1%	26.0%	37.8%	38.9%	37.9%	39.8%
Total Product** Wastes	10.3%	9.6%	13.3%	19.8%	29.7%	31.5%	31.3%	32.3%
Other Wastes								
Food, Other^	Neg.	Neg.	Neg.	Neg.	2.6%	2.7%	2.3%	2.4%
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	51.7%	58.2%	62.4%	61.9%
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	7.2%	27.2%	30.2%	31.7%	31.6%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.2%	29.1%	31.1%	31.4%	32.1%

* Recovery of postconsumer wastes; does not include converting/fabrication scrap.

** Other than food products.

^ Includes recovery of paper for composting.

Neg. = Less than 5,000 tons or 0.05 percent.

Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Table 11
CATEGORIES OF PRODUCTS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(In thousands of tons and percent of total discards)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 14)</i>	9,570	13,720	20,440	26,350	30,630	32,280	32,410	32,810
Nondurable Goods <i>(Detail in Table 17)</i>	14,940	21,330	29,750	43,370	46,560	43,010	44,450	43,270
Containers and Packaging <i>(Detail in Table 22)</i>	24,500	40,210	44,180	47,750	47,280	46,060	48,760	46,190
Total Product** Wastes	49,010	75,260	94,370	117,470	124,470	121,350	125,620	122,270
Other Wastes								
Food Wastes	12,200	12,800	13,000	20,800	25,800	27,430	28,410	28,540
Yard Trimmings	20,000	23,200	27,500	30,800	14,760	13,140	11,960	12,210
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,620	3,650	3,690
Total Other Wastes	33,500	37,780	42,750	54,500	44,060	44,190	44,020	44,440
Total MSW Discarded - Weight	82,510	113,040	137,120	171,970	168,530	165,540	169,640	166,710
Products	Percent of Total Discards							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 14)</i>	11.6%	12.1%	14.9%	15.3%	18.2%	19.5%	19.1%	19.7%
Nondurable Goods <i>(Detail in Table 17)</i>	18.1%	18.9%	21.7%	25.2%	27.6%	26.0%	26.2%	26.0%
Containers and Packaging <i>(Detail in Table 23)</i>	29.7%	35.6%	32.2%	27.8%	28.1%	27.8%	28.7%	27.7%
Total Product** Wastes	59.4%	66.6%	68.8%	68.3%	73.9%	73.3%	74.1%	73.3%
Other Wastes								
Food Scraps	14.8%	11.3%	9.5%	12.1%	15.3%	16.6%	16.7%	17.1%
Yard Trimmings	24.2%	20.5%	20.1%	17.9%	8.8%	7.9%	7.1%	7.3%
Miscellaneous Inorganic Wastes	1.6%	1.6%	1.6%	1.7%	2.1%	2.2%	2.2%	2.2%
Total Other Wastes	40.6%	33.4%	31.2%	31.7%	26.1%	26.7%	25.9%	26.7%
Total MSW Discarded - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Discards after materials and compost recovery. In this table, discards include combustion with energy recovery. Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Other than food products.

Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Major Appliances. Major appliances in MSW include refrigerators, washing machines, water heaters, etc. They are often called “white goods” in the trade. Data on unit production of appliances are taken from *Appliance Manufacturer Market Profile*. The unit data are converted to weight using various conversion factors developed over the years, plus data on the materials

composition of the appliances. Adjustments are also made for the estimated lifetimes of the appliances, which range up to 20 years.

Generation of major appliances has increased very slowly over the years, and in fact was about constant for the past 5 years. In 2005, generation was 3.6 million tons, or 1.5 percent of total MSW generation. In general, appliances have increased in quantity but not in average weight over the years. Ferrous metals (steel and iron) are the predominant materials in major appliances, but other metals, plastics, glass, and other materials are also present.

Data on recovery of ferrous metals from major appliances are taken from a survey conducted by the Steel Recycling Institute. Recovery of ferrous metals from shredded appliances was estimated to be 2.4 million tons in 2005, leaving 1.2 million tons of appliances to be discarded.

Small Appliances. This category includes items such as toasters, hair dryers, electric coffee pots, and the like. Information on shipments of small appliances was obtained from Department of Commerce data. Information on weights and materials composition of discarded small appliances was obtained through interviews. It was estimated that 0.9 million tons of small appliances were generated in 2005. A small amount of ferrous metals in small appliances is recovered through magnetic separation.

Furniture and Furnishings. Data on sales of furniture and furnishings are provided by the Department of Commerce in dollars. These data are converted to tons using factors developed for this study over the years. Adjustments are made for imports and exports, and adjustments are made for the lifetimes of the furniture.

Generation of furniture and furnishings in MSW has increased from 2.2 million tons in 1960 to 8.8 million tons in 2005 (3.6 percent of total MSW). No significant recovery of materials from furniture was identified. Wood is the largest material category in furniture, with ferrous metals second. Plastics, glass, and other materials are also found in furniture.

Table 13
RECOVERY* OF PRODUCTS IN MUNICIPAL SOLID WASTE, 1960 TO 2005
(WITH DETAIL ON DURABLE GOODS)
(In thousands of tons and percent of generation of each product)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods								
Major Appliances	10	50	130	1,070	2,000	2,320	2,390	2,420
Small Appliances**				10	20	20	10	10
Furniture and Furnishings	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Carpets and Rugs**				Neg.	30	40	60	60
Rubber Tires	330	250	150	440	1,290	1,700	1,600	1,490
Batteries, lead acid	Neg.	620	1,040	1,470	2,130	2,130	2,410	2,540
Miscellaneous Durables								
Selected Consumer Electronics***					190	290	310	330
Other Miscellaneous Durables					690	660	660	620
<i>Total Miscellaneous Durables</i>	10	20	40	470	880	950	970	950
Total Durable Goods	350	940	1,360	3,460	6,350	7,160	7,440	7,470
Nondurable Goods <i>(Detail in Table 16)</i>	2,390	3,730	4,670	8,800	17,560	19,290	19,960	20,450
Containers and Packaging <i>(Detail in Table 20)</i>	2,870	3,350	8,490	16,780	28,740	29,300	29,790	30,480
Total Product Wastes†	5,610	8,020	14,520	29,040	52,650	55,750	57,190	58,400
Other Wastes								
Food Scraps	Neg.	Neg.	Neg.	Neg.	680	750	660	690
Yard Trimmings	Neg.	Neg.	Neg.	4,200	15,770	18,330	19,810	19,860
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	19,080	20,470	20,550
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,100	74,830	77,660	78,950
Products	Percent of Generation of Each Product							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods								
Major Appliances	0.6%	2.3%	4.4%	32.3%	54.9%	66.7%	66.9%	67.0%
Small Appliances**				2.2%	2.2%	2.2%	1.1%	1.1%
Furniture and Furnishings	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Carpets and Rugs**				Neg.	1.2%	1.4%	2.0%	2.0%
Rubber Tires	29.5%	13.2%	5.5%	12.2%	26.2%	35.6%	35.8%	34.7%
Batteries, Lead-Acid	Neg.	75.6%	69.8%	97.4%	93.4%	93.0%	99.2%	98.8%
Miscellaneous Durables								
Selected Consumer Electronics***					8.8%	12.8%	12.7%	12.5%
Other Miscellaneous Durables					5.5%	4.6%	4.6%	4.3%
<i>Total Miscellaneous Durables</i>	0.2%	0.3%	0.4%	3.8%	6.0%	5.7%	5.7%	5.5%
Total Durable Goods	3.5%	6.4%	6.2%	11.6%	17.2%	18.2%	18.7%	18.5%
Nondurable Goods <i>(Detail in Table 16)</i>	13.8%	14.9%	13.6%	16.9%	27.4%	31.0%	31.0%	32.1%
Containers and Packaging <i>(Detail in Table 21)</i>	10.5%	7.7%	16.1%	26.0%	37.8%	38.9%	37.9%	39.8%
Total Product Wastes†	10.3%	9.6%	13.3%	19.8%	29.7%	31.5%	31.3%	32.3%
Other Wastes								
Food Scraps	Neg.	Neg.	Neg.	Neg.	2.6%	2.7%	2.3%	2.4%
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	51.7%	58.2%	62.4%	61.9%
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	7.2%	27.2%	30.2%	31.7%	31.6%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.2%	29.1%	31.1%	31.4%	32.1%

* Recovery of postconsumer wastes; does not include converting/fabrication scrap.

** Not estimated separately prior to 1990.

*** Not estimated separately prior to 1999.

† Other than food products.

Neg. = Less than 5,000 tons or 0.05 percent. Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Table 14
PRODUCTS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(WITH DETAIL ON DURABLE GOODS)
(In thousands of tons and percent of total discards)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods								
Major Appliances	1,620	2,120	2,820	2,240	1,640	1,160	1,180	1,190
Small Appliances**				450	880	900	890	910
Furniture and Furnishings	2,150	2,830	4,760	6,790	7,990	8,500	8,640	8,770
Carpets and Rugs**				1,660	2,540	2,820	2,870	2,920
Rubber Tires	790	1,640	2,570	3,170	3,640	3,070	2,870	2,810
Batteries, lead acid	Neg.	200	450	40	150	160	20	30
Miscellaneous Durables								
Selected Consumer Electronics***					1,970	1,980	2,130	2,300
Other Miscellaneous Durables					11,820	13,690	13,810	13,880
<i>Total Miscellaneous Durables</i>	5,010	6,930	9,840	12,000	13,790	15,670	15,940	16,180
Total Durable Goods	9,570	13,720	20,440	26,350	30,630	32,280	32,410	32,810
Nondurable Goods <i>(Detail in Table 17)</i>	14,940	21,330	29,750	43,370	46,560	43,010	44,450	43,270
Containers and Packaging <i>(Detail in Table 22)</i>	24,500	40,210	44,180	47,750	47,280	46,060	48,760	46,190
Total Product Wastes†	49,010	75,260	94,370	117,470	124,470	121,350	125,620	122,270
Other Wastes								
Food Scraps	12,200	12,800	13,000	20,800	25,800	27,430	28,410	28,540
Yard Trimmings	20,000	23,200	27,500	30,800	14,760	13,140	11,960	12,210
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,620	3,650	3,690
Total Other Wastes	33,500	37,780	42,750	54,500	44,060	44,190	44,020	44,440
Total MSW Discarded - Weight	82,510	113,040	137,120	171,970	168,530	165,540	169,640	166,710
Products	Percent of Total Discards							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods								
Major Appliances	2.0%	1.9%	2.1%	1.3%	1.0%	0.7%	0.7%	0.7%
Small Appliances**				0.3%	0.5%	0.5%	0.5%	0.5%
Furniture and Furnishings	2.6%	2.5%	3.5%	3.9%	4.7%	5.1%	5.1%	5.3%
Carpets and Rugs**				1.0%	1.5%	1.7%	1.7%	1.8%
Rubber Tires	1.0%	1.5%	1.9%	1.8%	2.2%	1.9%	1.7%	1.7%
Batteries, Lead-Acid	Neg.	0.2%	0.3%	0.0%	0.1%	0.1%	0.0%	0.0%
Miscellaneous Durables								
Selected Consumer Electronics***					1.2%	1.2%	1.3%	1.4%
Other Miscellaneous Durables					6.9%	8.2%	8.0%	8.2%
<i>Total Miscellaneous Durables</i>	6.1%	6.1%	7.2%	7.0%	8.2%	9.5%	9.4%	9.7%
Total Durable Goods	11.6%	12.1%	14.9%	15.3%	18.2%	19.5%	19.1%	19.7%
Nondurable Goods <i>(Detail in Table 17)</i>	18.1%	18.9%	21.7%	25.2%	27.6%	26.0%	26.2%	26.0%
Containers and Packaging <i>(Detail in Table 23)</i>	29.7%	35.6%	32.2%	27.8%	28.1%	27.8%	28.7%	27.7%
Total Product Wastes†	59.4%	66.6%	68.8%	68.3%	73.9%	73.3%	74.1%	73.3%
Other Wastes								
Food Scraps	14.8%	11.3%	9.5%	12.1%	15.3%	16.6%	16.7%	17.1%
Yard Trimmings	24.2%	20.5%	20.1%	17.9%	8.8%	7.9%	7.1%	7.3%
Miscellaneous Inorganic Wastes	1.6%	1.6%	1.6%	1.7%	2.1%	2.2%	2.2%	2.2%
Total Other Wastes	40.6%	33.4%	31.2%	31.7%	26.1%	26.7%	25.9%	26.7%
Total MSW Discarded - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Discards after materials and compost recovery. In this table, discards include combustion with energy recovery.

Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Not estimated separately prior to 1990.

*** Not estimated separately prior to 1999. Preliminary data; may undergo revision.

† Other than food products.

Neg. = Less than 5,000 tons or 0.05 percent. Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Carpets and Rugs. An industry publication, *Carpet and Rug Industrial Review*, publishes data on carpet sales in square yards. These data are converted to tons using various factors developed for this report. In recent years, carpet sales from the Department of Commerce Current Industrial Report Carpet and Rug series have been used. An estimated 3.0 million tons of carpets and rugs were generated in MSW in 2005, which was 1.2 percent of total generation.

A small amount of recycling of carpet fiber was identified—estimated to be about 2.0 percent of generation in 2005.

Vehicle Tires. The methodology for estimating generation of rubber tires for automobiles and trucks is based on data on replacement tires purchased and vehicles deregistered as reported by the U. S. Department of Commerce. It is assumed that for each replacement tire purchased, a used tire enters the waste management system, and that tires on deregistered vehicles also enter the waste management system. Retreaded tires are treated as a diversion out of the waste stream; they are assumed to re-enter the waste stream after two years of use.

The quantities of tires in units are converted to weight and materials composition using factors developed for this series of reports. In addition to rubber, tires include relatively small amounts of textiles and ferrous metals. Generation of rubber tires increased from 1.1 million tons in 1960 to 4.3 million tons in 2005 (1.8 percent of total MSW). In recent years, the generation of rubber tires has been declining.

Data on recovery of tires are based on data from the Scrap Tire Management Council⁴. The rubber recovery percentage has been increasing in recent years. In 2005, an estimated 34.7 percent of the weight of tires generated was recovered for recycling, leaving 2.8 million tons to be discarded. (Tires going to combustion facilities as fuel are included in the combustion estimates in Chapter 3.)

⁴ The 2005 recovery data are preliminary and may be revised in future publications of this report.

Lead-Acid Batteries. The methodology for estimating generation of lead-acid batteries is similar to the methodology for rubber tires as described above. An estimated 2.6 million tons of lead-acid batteries from automobiles, trucks, and motorcycles were generated in MSW in 2005 (one percent of total generation).

The Battery Council International provided data on recovery of batteries. Recovery of batteries for recycling has fluctuated between 60 percent 99 percent; recovery has increased since 1980 as a growing number of communities have restricted batteries from disposal at landfills or combustion facilities. In 2005, 98.8 percent of the lead in these batteries was estimated to be recovered for recycling as well as substantial quantities of the polypropylene battery casings. Discards after recycling of these batteries were 30,000 tons in 2005. (Some electrolytes and other materials in batteries are removed from the municipal solid waste stream along with recovered lead and polypropylene; these materials are counted as “recovered” along with the recyclable materials.)

Miscellaneous Durable Goods. Miscellaneous durable goods include consumer electronics such as television sets, videocassette recorders, and personal computers; luggage; sporting equipment; and the like. An estimated 17.1 million tons of these goods were generated in 2005, amounting to 7.0 percent of MSW generated.

As in recent previous updates of this report, generation of selected consumer electronic products was estimated as a subset of miscellaneous durable goods. In 2005, an estimated 2.6 million tons of these goods were generated. Of this, approximately 330,000 tons of selected consumer electronics were recovered for recycling. Selected consumer electronics include products such as TVs, VCRs, DVD players, video cameras, stereo systems, telephones, and computer equipment.

The miscellaneous durable goods category, as a whole, includes ferrous metals as well as plastics, glass, rubber, wood, and other metals. An estimated 620,000 tons of ferrous metals were estimated to have been recovered from this category through pre-combustion and post-combustion magnetic separation at MSW combustion facilities in 2005, bringing total recovery

from this category to 950,000 tons. Discards of miscellaneous durable goods were 16.2 million tons in 2005.

Nondurable Goods

The Department of Commerce defines nondurable goods as those having a lifetime of less than three years, and this definition was followed for this report to the extent possible.

Products made of paper and paperboard comprise the largest portion of nondurable goods. Other nondurable products include paper and plastic plates, cups, and other disposable food service products; disposable diapers; clothing and footwear; linens; and other miscellaneous products. (See Tables 15 through 17.)

Generation of nondurable goods in MSW was 63.7 million tons in 2005 (25.9 percent of total generation). Recovery of paper products in this category is quite significant, resulting in 20.5 million tons of nondurable goods recovered in 2005 (32.1 percent of nondurables generation). This means that 43.3 million tons of nondurable goods were discarded in 2005 (26.0 percent of total MSW discards).

Paper and Paperboard Products. Generation, recovery, and discards of paper and paperboard products in nondurable goods are summarized in Tables 15 through 17. A summary for 2005 was shown earlier in Table 4. Generation of paper and paperboard nondurable products declined from 47.8 million tons in 2000 to 44.9 million tons in 2005. Each of the paper and paperboard product categories in nondurable goods is discussed briefly below.

- Newspapers are by far the largest single component of the nondurable goods category, at 12.1 million tons generated in 2005 (4.9 percent of total MSW). In 2005, an estimated 88.9 percent of newspapers generated were recovered for recycling, leaving 1.3 million tons discarded. Estimates of newspaper generation are broken down into newsprint (the majority of the weight of the newspapers)

and groundwood⁵ inserts (primarily advertising) that are a significant portion of the total weight of newspapers. This breakdown is shown in Table 4.

- Books amounted to approximately 1.1 million tons, or 0.5 percent of total MSW generation, in 2005. Recovery of books is not well documented, but it was estimated that approximately 260,000 tons of books were recovered in 2005. Books are made of both groundwood and chemical pulp.
- Magazines accounted for an estimated 2.5 million tons, or 1.0 percent of total MSW generation, in 2005. Like books, recovery of magazines is not well documented. It was estimated that 970,000 tons of magazines were recovered in 2005. Magazines are predominately made of coated groundwood, but some uncoated groundwood and chemical pulps are also used.
- Many different kinds of papers are generated in offices. For this report, office-type paper estimates include the high grade papers such as copier paper, computer printout, stationery, etc. Generation of these office papers was 6.6 million tons, or 2.7 percent of total MSW generation in 2005. These papers are almost entirely made of uncoated chemical pulp, although some amounts of groundwood are also used. It should be noted that some of these office-type papers are generated at locations other than offices, including homes and institutions such as schools. Also, other kinds of papers (e.g., newspapers, magazines, and packaging) are generated in offices, but are accounted for in other categories. An estimated 4.1 million tons of office-type papers were recovered in 2005.

⁵ Groundwood papers, like newsprint, are made primarily from pulp prepared by a mechanical process. The nature of the pulp (groundwood vs. chemical) affects the potential uses for the recovered paper.

Table 15
PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(WITH DETAIL ON NONDURABLE GOODS)
(In thousands of tons and percent of total generation)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods (Detail in Table 12)	9,920	14,660	21,800	29,810	36,980	39,440	39,850	40,280
Nondurable Goods								
Newspapers	7,110	9,510	11,050	13,430	14,790	12,550	12,370	12,050
Books and Magazines	1,920	2,470	3,390					
Books**				970	1,240	1,030	1,270	1,120
Magazines**				2,830	2,230	2,270	2,470	2,520
Office-Type Papers	1,520	2,650	4,000	6,410	7,420	7,140	7,040	6,580
Directories**				610	680	640	640	660
Standard Mail***				3,820	5,570	5,410	5,570	5,830
Other Commercial Printing	1,260	2,130	3,120	4,460	7,380	6,950	7,680	7,340
Tissue Paper and Towels	1,090	2,080	2,300	2,960	3,220	3,250	3,220	3,430
Paper Plates and Cups	270	420	630	650	960	970	1,090	970
Plastic Plates and Cups†			190	650	870	730	970	930
Trash Bags**				780	850	1,020	1,090	1,060
Disposable Diapers	Neg.	350	1,930	2,700	3,340	3,470	3,530	3,600
Other Nonpackaging Paper	2,700	3,630	4,230	3,840	4,250	4,180	4,550	4,350
Clothing and Footwear	1,360	1,620	2,170	4,010	6,470	7,370	7,640	8,080
Towels, Sheets and Pillowcases**				710	820	940	940	950
Other Miscellaneous Nondurables	100	200	1,410	3,340	4,030	4,380	4,340	4,250
Total Nondurable Goods	17,330	25,060	34,420	52,170	64,120	62,300	64,410	63,720
Containers and Packaging (Detail in Table 18)	27,370	43,560	52,670	64,530	76,020	75,360	78,550	76,670
Total Product Wastes‡	54,620	83,280	108,890	146,510	177,120	177,100	182,810	180,670
Other Wastes	33,500	37,780	42,750	58,700	60,510	63,270	64,490	64,990
Total MSW Generated - Weight	88,120	121,060	151,640	205,210	237,630	240,370	247,300	245,660
	Percent of Total Generation							
Products	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods (Detail in Table 12)	11.3%	12.1%	14.4%	14.5%	15.6%	16.4%	16.1%	16.4%
Nondurable Goods								
Newspapers	8.1%	7.9%	7.3%	6.5%	6.2%	5.2%	5.0%	4.9%
Books and Magazines	2.2%	2.0%	2.2%					
Books**				0.5%	0.5%	0.4%	0.5%	0.5%
Magazines**				1.4%	0.9%	0.9%	1.0%	1.0%
Office-Type Papers***	1.7%	2.2%	2.6%	3.1%	3.1%	3.0%	2.8%	2.7%
Directories**				0.3%	0.3%	0.3%	0.3%	0.3%
Standard Mail§				1.9%	2.3%	2.3%	2.3%	2.4%
Other Commercial Printing	1.4%	1.8%	2.1%	2.2%	3.1%	2.9%	3.1%	3.0%
Tissue Paper and Towels	1.2%	1.7%	1.5%	1.4%	1.4%	1.4%	1.3%	1.4%
Paper Plates and Cups	0.3%	0.3%	0.4%	0.3%	0.4%	0.4%	0.4%	0.4%
Plastic Plates and Cups†			0.1%	0.3%	0.4%	0.3%	0.4%	0.4%
Trash Bags**				0.4%	0.4%	0.4%	0.4%	0.4%
Disposable Diapers	Neg.	0.3%	1.3%	1.3%	1.4%	1.4%	1.4%	1.5%
Other Nonpackaging Paper	3.1%	3.0%	2.8%	1.9%	1.8%	1.7%	1.8%	1.8%
Clothing and Footwear	1.5%	1.3%	1.4%	2.0%	2.7%	3.1%	3.1%	3.3%
Towels, Sheets and Pillowcases**				0.3%	0.3%	0.4%	0.4%	0.4%
Other Miscellaneous Nondurables	0.1%	0.2%	0.9%	1.6%	1.7%	1.8%	1.8%	1.7%
Total Nondurables	19.7%	20.7%	22.7%	25.4%	27.0%	25.9%	26.0%	25.9%
Containers and Packaging (Detail in Table 19)	31.1%	36.0%	34.7%	31.4%	32.0%	31.4%	31.8%	31.2%
Total Product Wastes‡	62.0%	68.8%	71.8%	71.4%	74.5%	73.7%	73.9%	73.5%
Other Wastes	38.0%	31.2%	28.2%	28.6%	25.5%	26.3%	26.1%	26.5%
Total MSW Generated - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Generation before materials recovery or combustion. Does not include construction & demolition debris, industrial process wastes, or certain other wastes. Details may not add to totals due to rounding.

** Not estimated separately prior to 1990.

*** High-grade paper such as printer paper; generated in both commercial and residential sources.

§ Not estimated separately prior to 1990. Formerly called Third Class Mail and Standard (A) Mail by the U.S. Postal Service.

† Not estimated separately prior to 1980.

‡ Other than food products.

Neg. = Less than 5,000 tons or 0.05 percent.

Source: Franklin Associates, A Division of ERG

Table 16
RECOVERY* OF PRODUCTS IN MUNICIPAL SOLID WASTE, 1960 TO 2005
(WITH DETAIL ON NONDURABLE GOODS)
(In thousands of tons and percent of generation of each product)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods (Detail in Table 13)	350	940	1,360	3,460	6,350	7,160	7,440	7,470
Nondurable Goods								
Newspapers	1,820	2,250	3,020	5,110	8,720	10,410	10,440	10,710
Books and Magazines	100	260	280					
Books**				100	240	190	250	260
Magazines**				300	710	750	890	970
Office-Type Papers	250	710	870	1,700	4,090	3,990	4,200	4,120
Directories**				40	120	100	100	120
Standard Mail***				200	1,830	1,750	1,830	2,090
Other Commercial Printing	130	340	350	700	810	900	840	760
Tissue Paper and Towels	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Paper Plates and Cups	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Plastic Plates and Cups†			Neg.	10	Neg.	Neg.	Neg.	Neg.
Trash Bags**				Neg.	Neg.	Neg.	Neg.	Neg.
Disposable Diapers				Neg.	Neg.	Neg.	Neg.	Neg.
Other Nonpackaging Paper	40	110	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Clothing and Footwear	50	60	150	520	900	1,040	1,250	1,250
Towels, Sheets and Pillowcases**				120	140	160	160	170
Other Miscellaneous Nondurables	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Nondurable Goods	2,390	3,730	4,670	8,800	17,560	19,290	19,960	20,450
Containers and Packaging (Detail in Table 20)	2,870	3,350	8,490	16,780	28,740	29,300	29,790	30,480
Total Product Wastes‡	5,610	8,020	14,520	29,040	52,650	55,750	57,190	58,400
Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	19,080	20,470	20,550
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,100	74,830	77,660	78,950
	Percent of Generation of Each Product							
Products	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods (Detail in Table 13)	3.5%	6.4%	6.2%	11.6%	17.2%	18.2%	18.7%	18.5%
Nondurable Goods								
Newspapers	25.6%	23.7%	27.3%	38.0%	59.0%	82.9%	84.4%	88.9%
Books and Magazines	5.2%	10.5%	8.3%					
Books**				10.3%	19.4%	18.4%	19.7%	23.2%
Magazines**				10.6%	31.8%	33.0%	36.0%	38.5%
Office-Type Papers***	16.4%	26.8%	21.8%	26.5%	55.1%	55.9%	59.7%	62.6%
Directories**				6.6%	17.6%	15.6%	15.6%	18.2%
Standard Mail§				5.2%	32.9%	32.3%	32.9%	35.8%
Other Commercial Printing	10.3%	16.0%	11.2%	15.7%	11.0%	12.9%	10.9%	10.4%
Tissue Paper and Towels	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Paper Plates and Cups	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Plastic Plates and Cups†			Neg.	1.5%	Neg.	Neg.	Neg.	Neg.
Trash Bags**				Neg.	Neg.	Neg.	Neg.	Neg.
Disposable Diapers				Neg.	Neg.	Neg.	Neg.	Neg.
Other Nonpackaging Paper	1.5%	3.0%	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Clothing and Footwear	Neg.	Neg.	Neg.	13.0%	13.9%	14.1%	16.4%	15.5%
Towels, Sheets and Pillowcases**				16.9%	17.1%	17.0%	17.0%	17.9%
Other Miscellaneous Nondurables	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Nondurables	13.8%	14.9%	13.6%	16.9%	27.4%	31.0%	31.0%	32.1%
Containers and Packaging (Detail in Table 21)	10.5%	7.7%	16.1%	26.0%	37.8%	38.9%	37.9%	39.8%
Total Product Wastes‡	10.3%	9.6%	13.3%	19.8%	29.7%	31.5%	31.3%	32.3%
Other Wastes	Neg.	Neg.	Neg.	7.2%	27.2%	30.2%	31.7%	31.6%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.2%	29.1%	31.1%	31.4%	32.1%

* Recovery of postconsumer wastes; does not include converting/fabrication scrap.

Details may not add to totals due to rounding.

** Not estimated separately prior to 1990.

*** High-grade paper such as printer paper; generated in both commercial and residential sources.

§ Not estimated separately prior to 1990. Formerly called Third Class Mail and Standard (A) Mail by the U.S. Postal Service.

† Not estimated separately prior to 1980.

‡ Other than food products.

Neg. = Less than 5,000 tons or 0.05 percent.

Source: Franklin Associates, A Division of ERG

Table 17
PRODUCTS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(WITH DETAIL ON NONDURABLE GOODS)
(In thousands of tons and percent of total discards)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods (Detail in Table 14)	9,570	13,720	20,440	26,350	30,630	32,280	32,410	32,810
Nondurable Goods								
Newspapers	5,290	7,260	8,030	8,320	6,070	2,140	1,930	1,340
Books and Magazines	1,820	2,210	3,110					
Books**				870	1,000	840	1,020	860
Magazines**				2,530	1,520	1,520	1,580	1,550
Office-Type Papers	1,270	1,940	3,130	4,710	3,330	3,150	2,840	2,460
Directories**				570	560	540	540	540
Standard Mail***				3,620	3,740	3,660	3,740	3,740
Other Commercial Printing	1,130	1,790	2,770	3,760	6,570	6,050	6,840	6,580
Tissue Paper and Towels	1,090	2,080	2,300	2,960	3,220	3,250	3,220	3,430
Paper Plates and Cups	270	420	630	650	960	970	1,090	970
Plastic Plates and Cups†			190	640	870	730	970	930
Trash Bags**				780	850	1,020	1,090	1,060
Disposable Diapers	Neg.	350	1,930	2,700	3,340	3,470	3,530	3,600
Other Nonpackaging Paper	2,660	3,520	4,230	3,840	4,250	4,180	4,550	4,350
Clothing and Footwear	1,310	1,560	2,020	3,490	5,570	6,330	6,390	6,830
Towels, Sheets and Pillowcases**				590	680	780	780	780
Other Miscellaneous Nondurables	100	200	1,410	3,340	4,030	4,380	4,340	4,250
Total Nondurable Goods	14,940	21,330	29,750	43,370	46,560	43,010	44,450	43,270
Containers and Packaging (Detail in Table 22)	24,500	40,210	44,180	47,750	47,280	46,060	48,760	46,190
Total Product Wastes‡	49,010	75,260	94,370	117,470	124,470	121,350	125,620	122,270
Other Wastes	33,500	37,780	42,750	54,500	44,060	44,190	44,020	44,440
Total MSW Discarded - Weight	82,510	113,040	137,120	171,970	168,530	165,540	169,640	166,710
	Percent of Total Discards							
Products	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods (Detail in Table 14)	11.6%	12.1%	14.9%	15.3%	18.2%	19.5%	19.1%	19.7%
Nondurable Goods								
Newspapers	6.4%	6.4%	5.9%	4.8%	3.6%	1.3%	1.1%	0.8%
Books and Magazines	2.2%	2.0%	2.3%					
Books**				0.5%	0.6%	0.5%	0.6%	0.5%
Magazines**				1.5%	0.9%	0.9%	0.9%	0.9%
Office-Type Papers***	1.5%	1.7%	2.3%	2.7%	2.0%	1.9%	1.7%	1.5%
Directories**				0.3%	0.3%	0.3%	0.3%	0.3%
Standard Mail§				2.1%	2.2%	2.2%	2.2%	2.2%
Other Commercial Printing	1.4%	1.6%	2.0%	2.2%	3.9%	3.7%	4.0%	3.9%
Tissue Paper and Towels	1.3%	1.8%	1.7%	1.7%	1.9%	2.0%	1.9%	2.1%
Paper Plates and Cups	0.3%	0.4%	0.5%	0.4%	0.6%	0.6%	0.6%	0.6%
Plastic Plates and Cups†			0.1%	0.4%	0.5%	0.4%	0.6%	0.6%
Trash Bags**				0.5%	0.5%	0.6%	0.6%	0.6%
Disposable Diapers	Neg.	0.3%	1.4%	1.6%	2.0%	2.1%	2.1%	2.2%
Other Nonpackaging Paper	3.2%	3.1%	3.1%	2.2%	2.5%	2.5%	2.7%	2.6%
Clothing and Footwear	1.6%	1.4%	1.5%	2.0%	3.3%	3.8%	3.8%	4.1%
Towels, Sheets and Pillowcases**				0.3%	0.4%	0.5%	0.5%	0.5%
Other Miscellaneous Nondurables	0.1%	0.2%	1.7%	1.9%	2.4%	2.6%	2.6%	2.5%
Total Nondurables	18.1%	18.9%	21.7%	25.2%	27.6%	26.0%	26.2%	26.0%
Containers and Packaging (Detail in Table 23)	29.7%	35.6%	32.2%	27.8%	28.1%	27.8%	28.7%	27.7%
Total Product Wastes‡	59.4%	66.6%	68.8%	68.3%	73.9%	73.3%	74.1%	73.3%
Other Wastes	40.6%	33.4%	31.2%	31.7%	26.1%	26.7%	25.9%	26.7%
Total MSW Discarded - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Discards after materials and compost recovery. In this table, discards include combustion with energy recovery. Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Not estimated separately prior to 1990.

*** High-grade paper such as printer paper; generated in both commercial and residential sources.

§ Not estimated separately prior to 1990. Formerly called Third Class Mail and Standard (A) Mail by the U.S. Postal Service.

† Not estimated separately prior to 1980.

‡ Other than food products.

Neg. = Less than 5,000 tons or 0.05 percent. Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

- Directories were estimated to generate 660,000 tons (0.3 percent of total MSW) in 2005. These directories are made of groundwood. It was estimated that 120,000 tons of directories were recovered in 2005.
- Standard mail⁶ includes catalogs and other direct bulk mailings; these amounted to an estimated 5.8 million tons, or 2.4 percent of MSW generation, in 2005. Both groundwood and chemical pulps are used in these mailings. It was estimated that 2.1 million tons were recovered in 2005. The U.S. Postal Service has implemented a program to increase recovery of bulk mail, and many curbside collection programs also include mail.
- Other commercial printing includes a wide range of paper items, including brochures, reports, menus, and invitations. Both groundwood and chemical pulps are used in these varied items. Generation was estimated at 7.3 million tons, or 3 percent of MSW generation, in 2005, with recovery estimated at 0.8 million tons.
- Tissue paper and towels generation includes facial and sanitary tissues and table napkins, but not bathroom tissue, which is nearly all diverted from MSW into the wastewater treatment system. Tissue paper and towels (not including bathroom tissue) amounted to 3.4 million tons (1.4 percent of total MSW generation) in 2005. No significant recovery of tissue products for recycling was identified, although there is some composting of these items.
- Paper plates and cups include paper plates, cups, bowls, and other food service products used in homes, in commercial establishments like restaurants, and in institutional settings such as schools. Generation of these products was estimated at 1.0 million tons (0.4 percent of total MSW generation) in 2005. No significant recovery for recycling of these products was identified.

⁶ Standard mail was formerly called Third Class mail and Standard (A) mail by the U.S. Postal Service.

- Other nonpackaging papers—including posters, photographic papers, cards, and games—accounted for 4.4 million tons (1.8 percent of total MSW generation) in 2005. No significant recovery for recycling of these papers was identified.

Overall, generation of paper and paperboard products in nondurable goods was 44.9 million tons in 2005 (Table 4). While newspapers were recovered at the highest rate, other paper products, such as books, magazines, and office papers, also were recovered for recycling, and the overall recovery rate for paper in nondurables was 42.4 percent in 2005. Thus 25.9 million tons of paper in nondurables were discarded in 2005.

Plastic Plates and Cups. This category includes plastic plates, cups, glasses, dishes and bowls, hinged containers, and other containers used in food service at home, in restaurants and other commercial establishments, and in institutional settings such as schools. These items are made primarily of polystyrene resin. An estimated 930,000 tons of these products were generated in 2005, or 0.4 percent of total MSW (see Table 15). No significant recovery for recycling was identified in 2005.

Trash Bags. This category includes plastic trash bags made of high-density polyethylene and low-density polyethylene for both indoor and outdoor use. Generation of plastic trash bags amounted to 1.1 million tons in 2005 (0.4 percent of MSW generation). No significant recovery for recycling was identified.

Disposable Diapers. This category includes estimates of both infant diapers and adult incontinence products. Generation was estimated using data on sales of the products along with information on average weights and composition. An estimated 3.6 million tons of disposable diapers were generated in 2005, or 1.5 percent of total MSW generation. (This tonnage includes an adjustment for the urine and feces contained within the discarded diapers.) The materials

portion of the diapers includes wood pulp, plastics (including the super-absorbent materials now present in most diapers), and tissue paper.

No significant recycling or composting of disposable diapers was identified in 2005.

Clothing and Footwear. Generation of clothing and footwear was estimated to be 8.1 million tons in 2005 (3.3 percent of total MSW). Textiles, rubber, and leather are major materials components of this category, with some plastics present as well. Generation estimates for these products are based on sales data from the Department of Commerce along with data on average weights for each type of products included. Adjustments are made for net imports of these products based on Department of Commerce data.

The Council for Textile Recycling has reported on recovery of textiles for exports, reprocessing, and reuse. Based on their data, it was estimated that 1.3 million tons of textiles in clothing were recovered for export or recycling in 2005. (Reuse is not counted as recycling and is included in the estimates in Chapter 3.)

Towels, Sheets, and Pillowcases. An estimated 950,000 tons of towels, sheets, and pillowcases were generated in 2005. Generation was estimated using a methodology similar to that for clothing. An estimated 170,000 tons of these textiles were recovered for export or recycling in 2005.

Other Miscellaneous Nondurables. Generation of other miscellaneous nondurables was estimated to be 4.3 million tons in 2005 (1.7 percent of MSW). The primary material component of miscellaneous nondurables is plastics, although some aluminum, rubber, and textiles also are present. Typical products in miscellaneous nondurables include shower curtains and other household items, disposable medical supplies, novelty items, and the like.

Generation of plastic products in miscellaneous nondurables is taken from resin sales data published annually by the American Plastics Council. Generation of other materials in these nondurable products is estimated based on information in past reports in this series.

Containers and Packaging

Containers and packaging make up a major portion of MSW, amounting to 76.7 million tons of generation in 2005 (31.2 percent of total generation). Generation in this category has remained fairly consistent in recent years. Paper and paperboard packaging generation declined by 1.4 million tons between 2000 and 2003, increasing in 2004 and declining again in 2005. There were small declines in generation of glass bottles and steel packaging, while aluminum packaging held steady. Plastics packaging generation showed an increase, and wood packaging (pallets) also increased. Generation, recovery, and discards of containers and packaging are shown in detail in Tables 18 through 23.

There is substantial recovery of many container and packaging products, especially corrugated containers. In 2005, 39.8 percent of containers and packaging generated was recovered for recycling. Because of this recovery, containers and packaging comprised 27.7 percent of total MSW discards in 2005.

Containers and packaging in MSW are made of several materials: paper and paperboard, glass, steel, aluminum, plastics, wood, and small amounts of other materials. Material categories are discussed separately below.

Glass Containers. Glass containers include beer and soft drink bottles (which include carbonated drinks and non-carbonated waters, teas, and flavored drinks containing not more than 10 percent fruit juice), wine and liquor bottles, and bottles and jars for food, cosmetics, and other products. Generation of glass containers is estimated using Department of Commerce data. Adjustments are made for imports and exports of both empty glass containers and containers holding products, e.g., imported beer.

Generation of these glass containers was 10.9 million tons in 2005, or 4.4 percent of MSW generation (Tables 18 and 19). This is less tonnage than was generated in 2000.

An estimated 2.8 million tons of glass containers were recovered for recycling, or 25.3 percent of generation, in 2005. Glass container discards were 8.2 million tons in 2005, or 4.9 percent of total MSW discards.

Steel Containers and Packaging. Steel food and other cans, and other steel packaging (e.g., strapping and steel barrels and drums), totaled 2.4 million tons in 2005 (1.0 percent of total MSW generation), with most of that amount being cans for food products (Tables 18 and 19). Generation estimates are based on data supplied by the Steel Recycling Institute (SRI), the Reusable Industrial Packaging Association, and the Can Manufacturers Institute (CMI). Estimates include adjustments for net imports.

The Steel Recycling Institute (SRI) provided recovery data for steel containers and packaging. An estimated 1.5 million tons of steel packaging were recovered in 2005, or 63.3 percent of generation. The SRI estimates include recovery from residential sources; pre-combustion and post-combustion magnetic separation of steel cans and other ferrous products at MSW combustion facilities; and recycling of drums and barrels not suitable for reconditioning.

Aluminum Containers and Packaging. Aluminum containers and packaging include beer and soft drink cans (including all carbonated and non-carbonated soft drinks, tea, tonic, waters, and juice beverages), other cans, and foil and closures. Aluminum can generation has been estimated based on can shipments data from the Can Manufacturers Institute and can weight data from the Aluminum Association, while data on other aluminum packaging is based on Department of Commerce data.

Table 18
PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In thousands of tons)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods (Detail in Table 12)	9,920	14,660	21,800	29,810	36,980	39,440	39,850	40,280
Nondurable Goods (Detail in Table 15)	17,330	25,060	34,420	52,170	64,120	62,300	64,410	63,720
Containers and Packaging								
Glass Packaging								
Beer and Soft Drink Bottles	1,400	5,580	6,740	5,640	5,710	6,840	7,010	7,150
Wine and Liquor Bottles	1,080	1,900	2,450	2,030	1,910	1,580	1,570	1,640
Food and Other Bottles & Jars	3,710	4,440	4,780	4,160	3,420	2,150	2,280	2,130
Total Glass Packaging	6,190	11,920	13,970	11,830	11,040	10,570	10,860	10,920
Steel Packaging								
Beer and Soft Drink Cans	640	1,570	520	150	Neg.	Neg.	Neg.	Neg.
Food and Other Cans	3,760	3,540	2,850	2,540	2,630	2,600	2,450	2,130
Other Steel Packaging	260	270	240	200	240	240	240	240
Total Steel Packaging	4,660	5,380	3,610	2,890	2,870	2,840	2,690	2,370
Aluminum Packaging								
Beer and Soft Drink Cans	Neg.	100	850	1,550	1,520	1,480	1,480	1,450
Other Cans	Neg.	60	40	20	50	50	50	50
Foil and Closures	170	410	380	330	380	380	390	400
Total Aluminum Packaging	170	570	1,270	1,900	1,950	1,910	1,920	1,900
Paper & Paperboard Pkg								
Corrugated Boxes	7,330	12,760	17,080	24,010	30,210	29,710	31,490	30,930
Milk Cartons**			790	510	550	450	470	420
Folding Cartons**			3,820	4,300	5,820	5,560	5,540	4,970
Other Paperboard Packaging	3,840	4,830	230	290	200	180	170	150
Bags and Sacks**			3,380	2,440	1,490	1,240	1,270	1,190
Wrapping Papers**			200	110	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	2,940	3,810	850	1,020	1,670	1,440	1,460	1,370
Total Paper & Board Pkg	14,110	21,400	26,350	32,680	39,940	38,580	40,400	39,030
Plastics Packaging								
Soft Drink Bottles**			260	430	830	870	850	850
Milk Bottles**			230	530	690	720	800	800
Other Containers	60	910	890	1,430	2,630	2,980	3,150	3,110
Bags and Sacks**			390	940	1,650	1,630	1,810	1,640
Wraps**			840	1,530	2,550	2,750	2,940	2,810
Other Plastics Packaging	60	1,180	790	2,040	3,510	3,930	4,410	4,440
Total Plastics Packaging	120	2,090	3,400	6,900	11,860	12,880	13,960	13,650
Wood Packaging	2,000	2,070	3,940	8,180	8,120	8,330	8,430	8,520
Other Misc. Packaging	120	130	130	150	240	250	290	280
Total Containers & Pkg	27,370	43,560	52,670	64,530	76,020	75,360	78,550	76,670
Total Product Wastes†	54,620	83,280	108,890	146,510	177,120	177,100	182,810	180,670
Other Wastes								
Food Scraps	12,200	12,800	13,000	20,800	26,480	28,180	29,070	29,230
Yard Trimmings	20,000	23,200	27,500	35,000	30,530	31,470	31,770	32,070
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,620	3,650	3,690
Total Other Wastes	33,500	37,780	42,750	58,700	60,510	63,270	64,490	64,990
Total MSW Generated - Weight	88,120	121,060	151,640	205,210	237,630	240,370	247,300	245,660

* Generation before materials recovery or combustion.

Details may not add to totals due to rounding.

** Not estimated separately prior to 1980. Paper wraps not reported separately after 1996.

† Other than food products.

Neg. = Less than 5,000 tons or 0.05 percent.

Source: Franklin Associates, A Division of ERG

Table 19
PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of total generation)

Products	Percent of Total Generation							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 12)</i>	11.3%	12.1%	14.4%	14.5%	15.6%	16.4%	16.1%	16.4%
Nondurable Goods <i>(Detail in Table 15)</i>	19.7%	20.7%	22.7%	25.4%	27.0%	25.9%	26.0%	25.9%
Containers and Packaging								
Glass Packaging								
Beer and Soft Drink Bottles	1.6%	4.6%	4.4%	2.7%	2.4%	2.8%	2.8%	2.9%
Wine and Liquor Bottles	1.2%	1.6%	1.6%	1.0%	0.8%	0.7%	0.6%	0.7%
Food and Other Bottles & Jars	4.2%	3.7%	3.2%	2.0%	1.4%	0.9%	0.9%	0.9%
Total Glass Packaging	7.0%	9.8%	9.2%	5.8%	4.6%	4.4%	4.4%	4.4%
Steel Packaging								
Beer and Soft Drink Cans	0.7%	1.3%	0.3%	0.1%	Neg.	Neg.	Neg.	Neg.
Food and Other Cans	4.3%	2.9%	1.9%	1.2%	1.1%	1.1%	1.0%	0.9%
Other Steel Packaging	0.3%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%
Total Steel Packaging	5.3%	4.4%	2.4%	1.4%	1.2%	1.2%	1.1%	1.0%
Aluminum Packaging								
Beer and Soft Drink Cans	Neg.	0.1%	0.6%	0.8%	0.6%	0.6%	0.6%	0.6%
Other Cans	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Foil and Closures	0.2%	0.3%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%
Total Aluminum Packaging	0.2%	0.5%	0.8%	0.9%	0.8%	0.8%	0.8%	0.8%
Paper & Paperboard Pkg								
Corrugated Boxes	8.3%	10.5%	11.3%	11.7%	12.7%	12.4%	12.7%	12.6%
Milk Cartons**			0.5%	0.2%	0.2%	0.2%	0.2%	0.2%
Folding Cartons**			2.5%	2.1%	2.4%	2.3%	2.2%	2.0%
Other Paperboard Packaging	4.4%	4.0%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%
Bags and Sacks**			2.2%	1.2%	0.6%	0.5%	0.5%	0.5%
Wrapping Papers**			0.1%	0.1%	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	3.3%	3.1%	0.6%	0.5%	0.7%	0.6%	0.6%	0.6%
Total Paper & Board Pkg	16.0%	17.7%	17.4%	15.9%	16.8%	16.1%	16.3%	15.9%
Plastics Packaging								
Soft Drink Bottles**			0.2%	0.2%	0.3%	0.4%	0.3%	0.3%
Milk Bottles**			0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Other Containers	0.1%	0.8%	0.6%	0.7%	1.1%	1.2%	1.3%	1.3%
Bags and Sacks**			0.3%	0.5%	0.7%	0.7%	0.7%	0.7%
Wraps**			0.6%	0.7%	1.1%	1.1%	1.2%	1.1%
Other Plastics Packaging	0.1%	1.0%	0.5%	1.0%	1.5%	1.6%	1.8%	1.8%
Total Plastics Packaging	0.1%	1.7%	2.2%	3.4%	5.0%	5.4%	5.6%	5.6%
Wood Packaging	2.3%	1.7%	2.6%	4.0%	3.4%	3.5%	3.4%	3.5%
Other Misc. Packaging	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Total Containers & Pkg	31.1%	36.0%	34.7%	31.4%	32.0%	31.4%	31.8%	31.2%
Total Product Wastes†	62.0%	68.8%	71.8%	71.4%	74.5%	73.7%	73.9%	73.5%
Other Wastes								
Food Scraps	13.8%	10.6%	8.6%	10.1%	11.1%	11.7%	11.8%	11.9%
Yard Trimmings	22.7%	19.2%	18.1%	17.1%	12.8%	13.1%	12.8%	13.1%
Miscellaneous Inorganic Wastes	1.5%	1.5%	1.5%	1.4%	1.5%	1.5%	1.5%	1.5%
Total Other Wastes	38.0%	31.2%	28.2%	28.6%	25.5%	26.3%	26.1%	26.5%
Total MSW Generated - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Generation before materials recovery or combustion.

Details may not add to totals due to rounding.

** Not estimated separately prior to 1980. Paper wraps not reported separately after 1996.

† Other than food products.

Neg. = Less than 5,000 tons or 0.05 percent.

Source: Franklin Associates, A Division of ERG

Table 20
RECOVERY* OF PRODUCTS IN MUNICIPAL SOLID WASTE, 1960 TO 2005
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In thousands of tons)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 13)</i>	350	940	1,360	3,460	6,350	7,160	7,440	7,470
Nondurable Goods <i>(Detail in Table 16)</i>	2,390	3,730	4,670	8,800	17,560	19,290	19,960	20,450
Containers and Packaging								
Glass Packaging								
Beer and Soft Drink Bottles	90	140	730	1,890	1,530	2,090	2,150	2,190
Wine and Liquor Bottles	10	10	20	210	430	240	240	250
Food and Other Bottles & Jars	Neg.	Neg.	Neg.	520	920	320	340	320
Total Glass Packaging	100	150	750	2,620	2,880	2,650	2,730	2,760
Steel Packaging								
Beer and Soft Drink Cans	10	20	50	40	Neg.	Neg.	Neg.	Neg.
Food and Other Cans	20	60	150	590	1,530	1,560	1,500	1,340
Other Steel Packaging	Neg.	Neg.	Neg.	60	160	160	160	160
Total Steel Packaging	30	80	200	690	1,690	1,720	1,660	1,500
Aluminum Packaging								
Beer and Soft Drink Cans	Neg.	10	310	990	830	650	670	650
Other Cans	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Foil and Closures	Neg.	Neg.	Neg.	20	30	40	40	40
Total Aluminum Pkg	Neg.	10	320	1,010	860	690	710	690
Paper & Paperboard Pkg								
Corrugated Boxes	2,520	2,760	6,390	11,530	20,330	21,180	21,440	22,100
Milk Cartons**			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Folding Cartons**			520	340	410	450	450	590
Other Paperboard Packaging			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Bags and Sacks**			Neg.	200	300	260	270	250
Wrapping Papers**			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	220	350	300	Neg.	Neg.	Neg.	Neg.	Neg.
Total Paper & Board Pkg	2,740	3,110	7,210	12,070	21,040	21,890	22,160	22,940
Plastics Packaging								
Soft Drink Bottles**			10	140	290	280	290	290
Milk Bottles**			Neg.	20	210	230	230	230
Other Containers	Neg.	Neg.	Neg.	20	260	290	440	440
Bags and Sacks**			Neg.	30	10	10	10	10
Wraps**			Neg.	30	170	170	180	220
Other Plastics Packaging	Neg.	Neg.	Neg.	20	90	90	90	90
Total Plastics Packaging	Neg.	Neg.	10	260	1,030	1,070	1,240	1,280
Wood Packaging	Neg.	Neg.	Neg.	130	1,240	1,280	1,290	1,310
Other Misc. Packaging	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Containers & Pkg	2,870	3,350	8,490	16,780	28,740	29,300	29,790	30,480
Total Product Wastes†	5,610	8,020	14,520	29,040	52,650	55,750	57,190	58,400
Other Wastes								
Food Scraps	Neg.	Neg.	Neg.	Neg.	680	750	660	690
Yard Trimmings	Neg.	Neg.	Neg.	4,200	15,770	18,330	19,810	19,860
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	19,080	20,470	20,550
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,100	74,830	77,660	78,950

* Recovery of postconsumer wastes; does not include converting/fabrication scrap.

** Not estimated separately prior to 1980. Paper wraps not reported separately after 1996.

† Other than food products.

Details may not add to totals due to rounding.

Neg. = Less than 5,000 tons or 0.05 percent.

Source: Franklin Associates, A Division of ERG

Table 21
RECOVERY* OF PRODUCTS IN MUNICIPAL SOLID WASTE, 1960 TO 2005
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of generation of each product)

Percent of Generation of Each Product								
Products	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 13)</i>	3.5%	6.4%	6.2%	11.6%	17.2%	18.2%	18.7%	18.5%
Nondurable Goods <i>(Detail in Table 16)</i>	13.8%	14.9%	13.6%	16.9%	27.4%	31.0%	31.0%	32.1%
Containers and Packaging								
Glass Packaging								
Beer and Soft Drink Bottles	6.4%	2.5%	10.8%	33.5%	26.8%	30.6%	30.7%	30.6%
Wine and Liquor Bottles	Neg.	Neg.	Neg.	10.3%	22.5%	15.2%	15.3%	15.2%
Food and Other Bottles & Jars	Neg.	Neg.	Neg.	12.5%	26.9%	14.9%	14.9%	15.0%
Total Glass Packaging	1.6%	1.3%	5.4%	22.1%	26.1%	25.1%	25.1%	25.3%
Steel Packaging								
Beer and Soft Drink Cans	1.6%	1.3%	9.6%	26.7%	Neg.	Neg.	Neg.	Neg.
Food and Other Cans	Neg.	1.7%	5.3%	23.2%	58.2%	60.0%	61.2%	62.9%
Other Steel Packaging	Neg.	Neg.	Neg.	30.0%	66.7%	66.7%	66.7%	66.7%
Total Steel Packaging	Neg.	1.5%	5.5%	23.9%	58.9%	60.6%	61.7%	63.3%
Aluminum Packaging								
Beer and Soft Drink Cans	Neg.	10.0%	36.5%	63.9%	54.6%	43.9%	45.3%	44.8%
Other Cans	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Foil and Closures	Neg.	Neg.	Neg.	6.1%	7.9%	10.5%	10.3%	10.0%
Total Aluminum Pkg	Neg.	1.8%	25.2%	53.2%	44.1%	36.1%	37.0%	36.3%
Paper & Paperboard Pkg								
Corrugated Boxes	34.4%	21.6%	37.4%	48.0%	67.3%	71.3%	68.1%	71.5%
Milk Cartons**			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Folding Cartons**			Neg.	Neg.	7.0%	8.1%	8.1%	11.9%
Other Paperboard Packaging			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Bags and Sacks**			Neg.	Neg.	20.1%	21.0%	21.3%	21.0%
Wrapping Papers**			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	7.5%	9.2%	35.3%	Neg.	Neg.	Neg.	Neg.	Neg.
Total Paper & Board Pkg	19.4%	14.5%	27.4%	36.9%	52.7%	56.7%	54.9%	58.8%
Plastics Packaging								
Soft Drink Bottles**			3.8%	32.6%	34.9%	32.2%	34.1%	34.1%
Milk Bottles**			Neg.	3.8%	30.4%	31.9%	28.8%	28.8%
Other Containers	Neg.	Neg.	Neg.	1.4%	9.9%	9.7%	14.0%	14.1%
Bags and Sacks**			Neg.	3.2%	0.6%	0.6%	0.6%	0.6%
Wraps**			Neg.	2.0%	6.7%	6.2%	6.1%	7.8%
Other Plastics Packaging	Neg.	Neg.	Neg.	1.0%	2.6%	2.3%	2.0%	2.0%
Total Plastics Packaging	Neg.	Neg.	Neg.	3.8%	8.7%	8.3%	8.9%	9.4%
Wood Packaging	Neg.	Neg.	Neg.	1.6%	15.3%	15.4%	15.3%	15.4%
Other Misc. Packaging	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Containers & Pkg	10.5%	7.7%	16.1%	26.0%	37.8%	38.9%	37.9%	39.8%
Total Product Wastes†	10.3%	9.6%	13.3%	19.8%	29.7%	31.5%	31.3%	32.3%
Other Wastes								
Food Scraps	Neg.	Neg.	Neg.	Neg.	2.6%	2.7%	2.3%	2.4%
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	51.7%	58.2%	62.4%	61.9%
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	7.2%	27.2%	30.2%	31.7%	31.6%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.2%	29.1%	31.1%	31.4%	32.1%

* Recovery of postconsumer wastes; does not include converting/fabrication scrap.

** Not estimated separately prior to 1980. Paper wraps not reported separately after 1996.

† Other than food products.

Details may not add to totals due to rounding.

Neg. = Less than 5,000 tons or 0.05 percent.

Source: Franklin Associates, A Division of ERG

Table 22
PRODUCTS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In thousands of tons)

Products	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods <i>(Detail in Table 14)</i>	9,570	13,720	20,440	26,350	30,630	32,280	32,410	32,810
Nondurable Goods <i>(Detail in Table 17)</i>	14,940	21,330	29,750	43,370	46,560	43,010	44,450	43,270
Containers and Packaging								
Glass Packaging								
Beer and Soft Drink Bottles	1,310	5,440	6,010	3,750	4,180	4,750	4,860	4,960
Wine and Liquor Bottles	1,070	1,890	2,430	1,820	1,480	1,340	1,330	1,390
Food and Other Bottles & Jars	3,710	4,440	4,780	3,640	2,500	1,830	1,940	1,810
Total Glass Packaging	6,090	11,770	13,220	9,210	8,160	7,920	8,130	8,160
Steel Packaging								
Beer and Soft Drink Cans	630	1,550	470	110	Neg.	Neg.	Neg.	Neg.
Food and Other Cans	3,740	3,480	2,700	1,950	1,100	1,040	950	790
Other Steel Packaging	260	270	240	140	80	80	80	80
Total Steel Packaging	4,630	5,300	3,410	2,200	1,180	1,120	1,030	870
Aluminum Packaging								
Beer and Soft Drink Cans	Neg.	90	540	560	690	830	810	800
Other Cans	Neg.	60	40	20	50	50	50	50
Foil and Closures	170	410	380	310	350	340	350	360
Total Aluminum Pkg	170	560	950	890	1,090	1,220	1,210	1,210
Paper & Paperboard Pkg								
Corrugated Boxes	4,810	10,000	10,690	12,480	9,880	8,530	10,050	8,830
Milk Cartons**			790	510	550	450	470	420
Folding Cartons**			3,300	3,960	5,410	5,110	5,090	4,380
Other Paperboard Packaging	3,840	4,830	230	290	200	180	170	150
Bags and Sacks**			3,380	2,240	1,190	980	1,000	940
Wrapping Papers**			200	110	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	2,720	3,460	550	1,020	1,670	1,440	1,460	1,370
Total Paper & Board Pkg	11,370	18,290	19,140	20,610	18,900	16,690	18,240	16,090
Plastics Packaging								
Soft Drink Bottles**			250	290	540	590	560	560
Milk Bottles**			230	510	480	490	570	570
Other Containers	60	910	890	1,410	2,370	2,690	2,710	2,670
Bags and Sacks**			390	910	1,640	1,620	1,800	1,630
Wraps**			840	1,500	2,380	2,580	2,760	2,590
Other Plastics Packaging	60	1,180	790	2,020	3,420	3,840	4,320	4,350
Total Plastics Packaging	120	2,090	3,390	6,640	10,830	11,810	12,720	12,370
Wood Packaging	2,000	2,070	3,940	8,050	6,880	7,050	7,140	7,210
Other Misc. Packaging	120	130	130	150	240	250	290	280
Total Containers & Pkg	24,500	40,210	44,180	47,750	47,280	46,060	48,760	46,190
Total Product Wastes†	49,010	75,260	94,370	117,470	124,470	121,350	125,620	122,270
Other Wastes								
Food Scraps	12,200	12,800	13,000	20,800	25,800	27,430	28,410	28,540
Yard Trimmings	20,000	23,200	27,500	30,800	14,760	13,140	11,960	12,210
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,620	3,650	3,690
Total Other Wastes	33,500	37,780	42,750	54,500	44,060	44,190	44,020	44,440
Total MSW Discarded - Weight	82,510	113,040	137,120	171,970	168,530	165,540	169,640	166,710

* Discards after materials and compost recovery. In this table, discards include combustion with energy recovery. Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Not estimated separately prior to 1980. Paper wraps not reported separately after 1996.

† Other than food products.

Neg. = Less than 5,000 tons or 0.05 percent. Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Table 23
PRODUCTS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2005
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of total discards)

Products	Percent of Total Discards							
	1960	1970	1980	1990	2000	2003	2004	2005
Durable Goods (Detail in Table 14)	11.6%	12.1%	14.9%	15.3%	18.2%	19.5%	19.1%	19.7%
Nondurable Goods (Detail in Table 17)	18.1%	18.9%	21.7%	25.2%	27.6%	26.0%	26.2%	26.0%
Containers and Packaging								
Glass Packaging								
Beer and Soft Drink Bottles	1.6%	4.8%	4.4%	2.2%	2.5%	2.9%	2.9%	3.0%
Wine and Liquor Bottles	1.3%	1.7%	1.8%	1.1%	0.9%	0.8%	0.8%	0.8%
Food and Other Bottles & Jars	4.5%	3.9%	3.5%	2.1%	1.5%	1.1%	1.1%	1.1%
Total Glass Packaging	7.4%	10.4%	9.6%	5.4%	4.8%	4.8%	4.8%	4.9%
Steel Packaging								
Beer and Soft Drink Cans	0.8%	1.4%	0.3%	0.1%	Neg.	Neg.	Neg.	Neg.
Food and Other Cans	4.5%	3.1%	2.0%	1.1%	0.7%	0.6%	0.6%	0.5%
Other Steel Packaging	0.3%	0.2%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%
Total Steel Packaging	5.6%	4.7%	2.5%	1.3%	0.7%	0.7%	0.6%	0.5%
Aluminum Packaging								
Beer and Soft Drink Cans	Neg.	0.1%	0.4%	0.3%	0.4%	0.5%	0.5%	0.5%
Other Cans	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Foil and Closures	0.2%	0.4%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%
Total Aluminum Pkg	0.2%	0.5%	0.7%	0.5%	0.6%	0.7%	0.7%	0.7%
Paper & Paperboard Pkg								
Corrugated Boxes	5.8%	8.8%	7.8%	7.3%	5.9%	5.2%	5.9%	5.3%
Milk Cartons**			0.6%	0.3%	0.3%	0.3%	0.3%	0.3%
Folding Cartons**			2.4%	2.3%	3.2%	3.1%	3.0%	2.6%
Other Paperboard Packaging	4.7%	4.3%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
Bags and Sacks**			2.5%	1.3%	0.7%	0.6%	0.6%	0.6%
Wrapping Papers**			0.1%	0.1%	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	3.3%	3.1%	0.4%	0.6%	1.0%	0.9%	0.9%	0.8%
Total Paper & Board Pkg	13.8%	16.2%	14.0%	12.0%	11.2%	10.1%	10.8%	9.7%
Plastics Packaging								
Soft Drink Bottles**			0.2%	0.2%	0.3%	0.4%	0.3%	0.3%
Milk Bottles**			0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Other Containers	0.1%	0.8%	0.6%	0.8%	1.4%	1.6%	1.6%	1.6%
Bags and Sacks**			0.3%	0.5%	1.0%	1.0%	1.1%	1.0%
Wraps**			0.6%	0.9%	1.4%	1.6%	1.6%	1.6%
Other Plastics Packaging	0.1%	1.0%	0.6%	1.2%	2.0%	2.3%	2.5%	2.6%
Total Plastics Packaging	0.1%	1.8%	2.5%	3.9%	6.4%	7.1%	7.5%	7.4%
Wood Packaging	2.4%	1.8%	2.9%	4.7%	4.1%	4.3%	4.2%	4.3%
Other Misc. Packaging	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%
Total Containers & Pkg	29.7%	35.6%	32.2%	27.8%	28.1%	27.8%	28.7%	27.7%
Total Product Wastes†	59.4%	66.6%	68.8%	68.3%	73.9%	73.3%	74.1%	73.3%
Other Wastes								
Food Scraps	14.8%	11.3%	9.5%	12.1%	15.3%	16.6%	16.7%	17.1%
Yard Trimmings	24.2%	20.5%	20.1%	17.9%	8.8%	7.9%	7.1%	7.3%
Miscellaneous Inorganic Wastes	1.6%	1.6%	1.6%	1.7%	2.1%	2.2%	2.2%	2.2%
Total Other Wastes	40.6%	33.4%	31.2%	31.7%	26.1%	26.7%	25.9%	26.7%
Total MSW Discarded - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Discards after materials and compost recovery. In this table, discards include combustion with energy recovery.

Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Not estimated separately prior to 1980. Paper wraps not reported separately after 1996.

† Other than food products.

Neg. = Less than 5,000 tons or 0.05 percent. Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

In 1996, the Can Manufacturers Institute began publishing data on consumption of beverages in cans. The consumption data are adjusted for imports and exports of beverages in cans, and therefore are more accurate for generation calculations than shipments alone. Total aluminum container and packaging generation in 2005 was 1.9 million tons, or 0.8 percent of total MSW generation.

Aluminum can recovery data are published by the Aluminum Association; this recovery number includes imported used beverage cans (UBC). The imported UBC are subtracted from the tonnage of UBC reported by the Aluminum Association to have been melted by U.S. end-users and recovered for export. Thus, the aluminum can recovery rate reported here is somewhat less than that published by the Aluminum Association.

Recovery of aluminum beverage cans in 2005 was 0.7 million tons, or 44.8 percent of generation. Recovery of all aluminum packaging was estimated to be 36.3 percent of total generation in 2005. After recovery for recycling, 1.2 million tons of aluminum packaging were discarded in 2005.

Paper and Paperboard Containers and Packaging. Corrugated boxes are the largest single product category of MSW at 30.9 million tons generated, or 12.6 percent of total generation, in 2005. Corrugated boxes also represent the largest single category of product recovery, at 22.1 million tons of recovery in 2005 (71.5 percent of boxes generated were recovered). After recovery, 8.8 million tons of corrugated boxes were discarded, or 5.3 percent of MSW discards in 2005.)

Other paper and paperboard packaging in MSW includes milk cartons, folding boxes (e.g., cereal boxes, frozen food boxes, some department store boxes), bags and sacks, wrapping papers, and other paper and paperboard packaging (primarily set-up boxes such as shoe boxes). Overall, paper and paperboard containers and packaging totaled 39.0 million tons of MSW generation in 2005, or 15.9 percent of total generation.

While recovery of corrugated boxes is by far the largest component of paper packaging recovery, smaller amounts of other paper packaging products are recovered (estimated at 840,000 tons in 2005). The overall recovery rate for paper and paperboard packaging in 2005 was 58.8 percent. Other paper packaging such as folding boxes and sacks is mostly recovered as mixed papers.

Plastic Containers and Packaging. Many different plastic resins are used to make a variety of packaging products. Some of these include polyethylene terephthalate (PET) soft drink bottles, high-density polyethylene (HDPE) milk and water jugs, film products (including bags and sacks) made of low-density polyethylene (LDPE), and other containers and other packaging (including coatings, closures, etc.) made of polyvinyl chloride, polystyrene, polypropylene, and other resins. Estimates of generation of plastic containers and packaging are based on data on resin sales by end use published annually by the American Plastics Council's annual plastics resin survey.

Plastic containers and packaging have exhibited rapid growth in MSW, with generation increasing from 120,000 tons in 1960 (0.1 percent of generation) to 13.7 million tons in 2005 (5.6 percent of MSW generation). (Note: plastic packaging as a category in this report does not include single-service plates and cups and trash bags, which are classified as nondurable goods.)

Estimates of recovery of plastic products are based on data published annually by the American Plastics Council supplemented with additional industry data. Plastic soft drink bottles were estimated to have been recovered at a 34.1 percent rate in 2005 (290,000 tons). Recovery of plastic milk and water bottles was estimated to have been 230,000 tons, or 28.8 percent of generation. Overall, recovery of plastic containers and packaging was estimated to be 1.3 million tons, or 9.4 percent in 2005. Discards of plastic packaging thus were 12.4 million tons in 2005, or 7.4 percent of total MSW generation.

Wood Packaging. Wood packaging includes wood crates and pallets (mostly pallets). Data on production of wood packaging is from the National Wood Pallet and Container Association, and more recently, the USDA Forest Service Southern Research Station and Virginia Polytechnic Institute. In 2005, 8.5 million tons of wood pallets and other wood packaging were estimated to have been generated, or 3.5 percent of total MSW generation.

Wood pallet recovery for recycling (usually by chipping for uses such as mulch or bedding material, but excluding wood combusted as fuel) was estimated at 1.3 million tons in 2005.

Accounting for pallet reuse and recovery for recycling, wood packaging discards were 7.2 million tons in 2005, or 4.3 percent of total MSW discards.

Other Packaging. Estimates are included for some other miscellaneous packaging such as bags made of textiles, small amounts of leather, and the like. These latter quantities are not well documented; it was estimated that 280,000 tons were generated in 2005.

Summary of Products in Municipal Solid Waste

The materials composition of municipal solid waste generation by product category is illustrated in Figure 14. This figure shows graphically that generation of durable goods has increased very gradually over the years. Nondurable goods and containers and packaging have accounted for the large increases in MSW generation.

The materials composition of nondurable goods in 2005 is shown in Figure 15. Paper and paperboard made up 71 percent of nondurables in MSW generation, with plastics contributing 10 percent, and textiles 12 percent. Other materials contributed lesser percentages. After recovery for recycling, paper and paperboard were 60 percent of nondurable discards, with plastics being 15 percent, and textiles 15 percent.

The materials composition of containers and packaging in MSW in 2005 is shown in Figure 16. By weight, paper and paperboard products made up 51 percent of containers and packaging generation; plastics accounted for 18 percent. Glass was 14 percent, wood was 11 percent, and metals were 6 percent.

The percentage of materials discards from containers and packaging is affected by recovery for recycling. After recovery for recycling, paper and paperboard dropped to 34 percent of discards. Glass containers accounted for 18 percent of discards of containers and packaging, plastics were 27 percent, wood was 16 percent, and metals were 5 percent.

Figure 14. Generation of products in MSW, 1960 to 2005

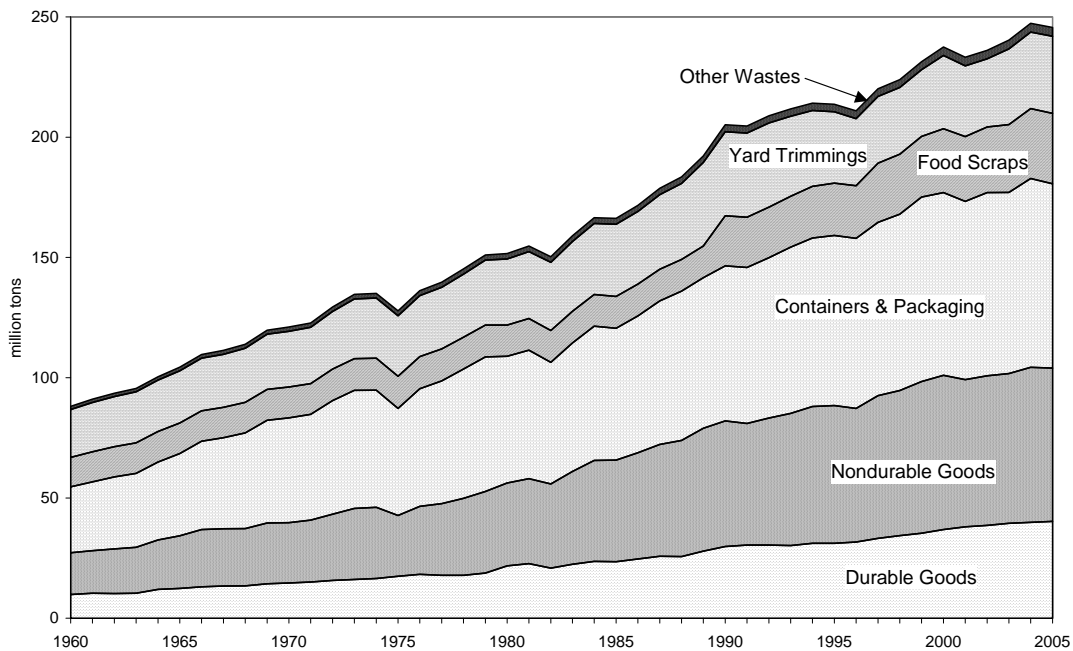
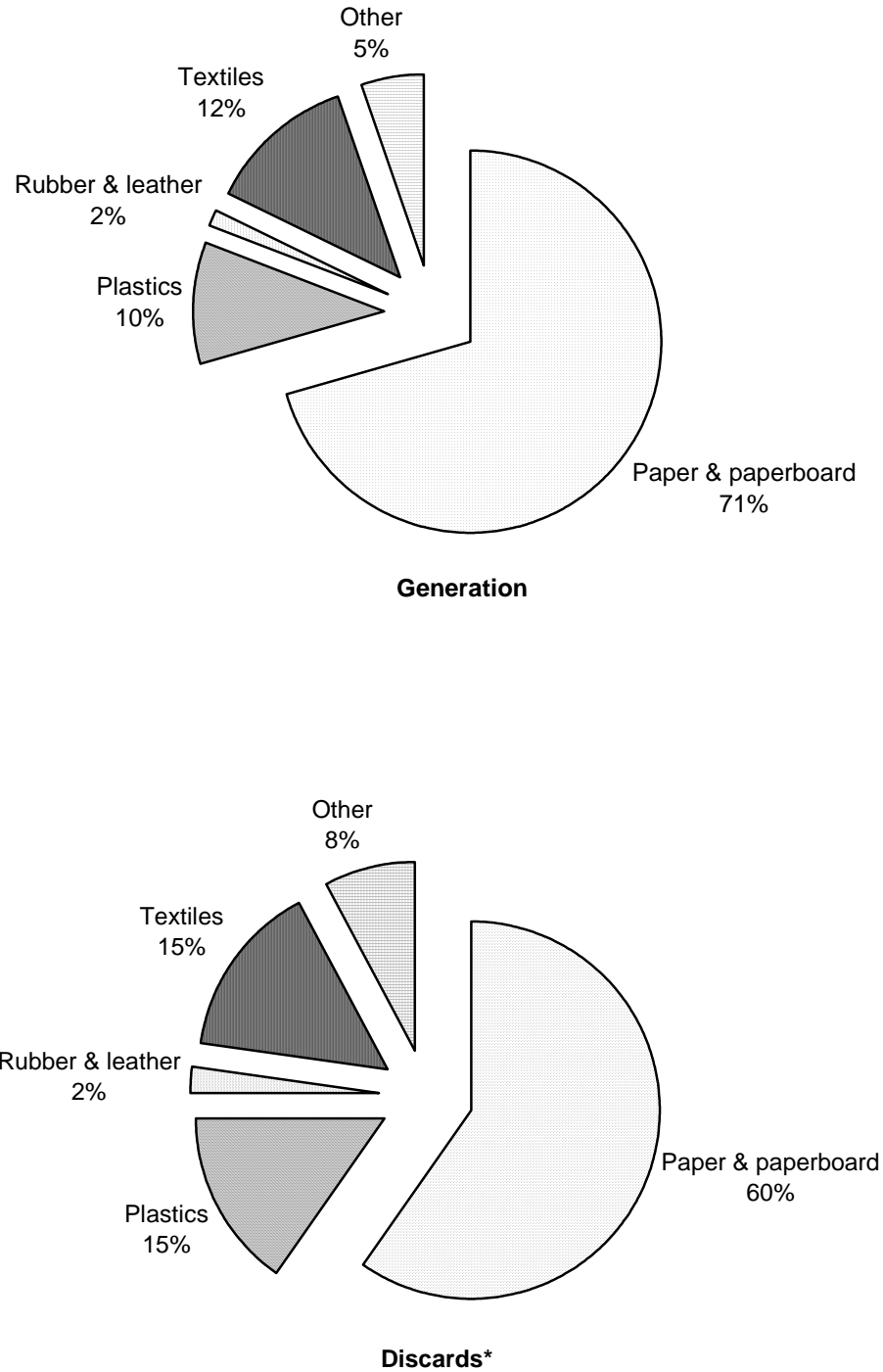
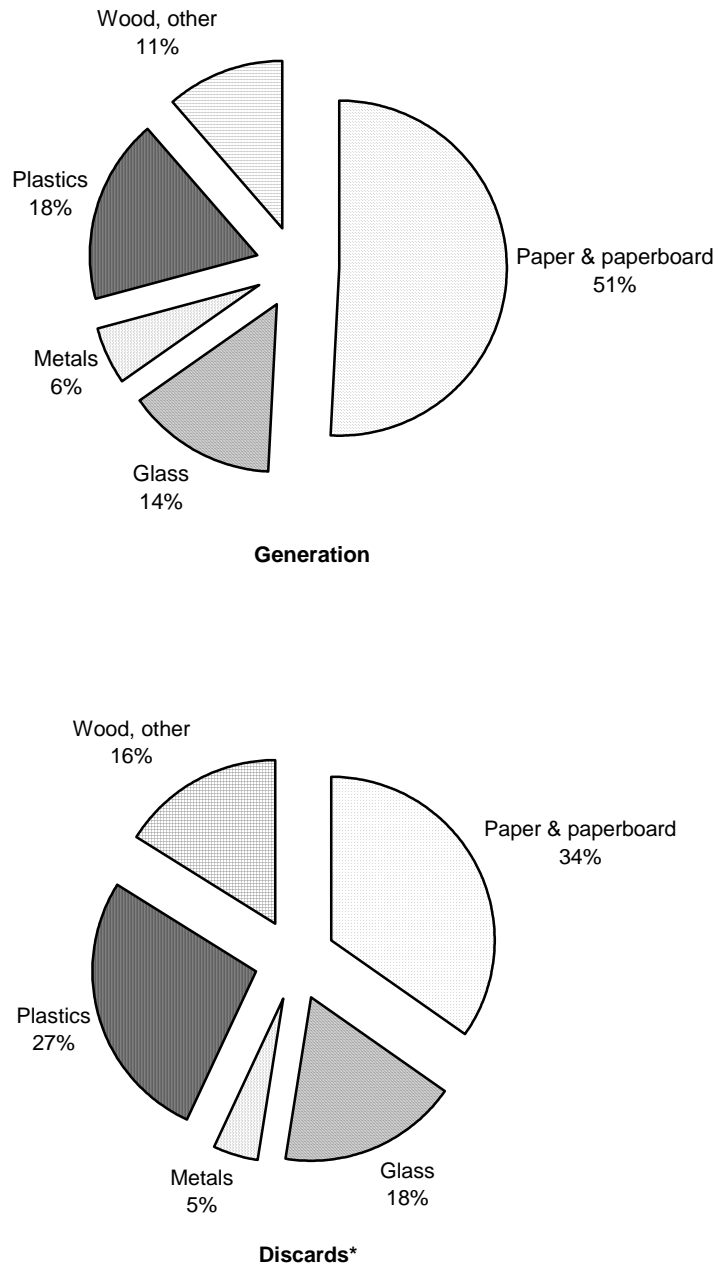


Figure 15. Nondurable goods generated and discarded* in municipal solid waste, 2005
 (In percent of total generation and discards)



*Discards in this figure include combustion with energy recovery.

Figure 16. Containers and packaging generated and discarded* in municipal solid waste, 2005
 (In percent of total generation and discards)



*Discards in this figure include combustion with energy recovery.

SUMMARY

The data presented in this chapter can be summarized by the following observations:

MSW Generation

- Total generation of municipal solid waste in 2005 was 245.7 million tons, which was 1.6 million tons less than in 2004, when 247.3 million tons were generated. This compares to 1990, when total generation of MSW was 205.2 million tons.
- Paper and paperboard products made up the largest percentage of all the materials in MSW, at 34.2 percent of total generation. Generation of paper and paperboard products declined from 87.7 million tons in 2000 to 84.0 million tons in 2005. Generation of newspapers has been declining since 1990, and this trend is expected to continue, partly due to decreased page size (source reduction), but also due to increased use of electronic communication of news. Generation of office-type (high grade) papers also has been in decline, due at least partially to increased use of electronic transmission of reports, etc. Paper and paperboard products have ranged between 34 and 35 percent of generation since 2003.
- Yard trimmings comprised the second largest material category, estimated at 32.1 million tons, or 13.1 percent of total generation, in 2005. This compares to 35.0 million tons (17.1 percent of total generation) in 1990. This decline is largely due to state legislation discouraging yard trimmings disposal in landfills, including source reduction measures such as backyard composting and leaving grass trimmings on the yard.

- Plastic products generation in 2005 was 28.9 million tons, or 11.8 percent of generation. This was a decrease of 250,000 tons from 2004 to 2005. This decrease in plastics generation came from the containers and packaging category. Plastics generation has grown from 8.3 percent in 1990 to 11.8 percent in 2005.

MSW Recovery

- Recovery of materials in MSW increased from 69.1 million tons in 2000 (29.1 percent of total generation) to 79.0 million tons in 2005 (32.1 percent of generation).
- Recovery of products and other wastes in MSW increased by 1.3 million tons from 2004 to 2005. Recovery of paper and paperboard products, the largest component of recovery, increased from 47.1 percent in 2004 to 50.0 percent in 2005.
- The increase in recovery of paper and paperboard products over the longer term has been due to increases in recovery, over time, from all categories: newspapers, books, magazines, office papers, directories, Standard mail (advertisements, circulars, etc.), and other commercial printing. Between 2004 and 2005, the key categories showing increases in recovery were newspapers, mail, and corrugated boxes.
- Tonnage of newspapers recovered increased by 270,000 tons between 2004 and 2005; percentage recovered increased from 84.4 percent to 88.9 percent. As generation of newspapers declines, this raises a question as to whether much increase in tonnage of newspapers recovered can be achieved.

- Containers and packaging recovery increased from 29.8 million tons in 2004 to 30.5 million tons in 2005; percentage recovery increased from 37.9 percent to 39.8 percent. Nondurable goods recovery increased from 20.0 million tons in 2004 to 20.5 million tons in 2005; percentage recovery increased from 31.0 percent to 32.1 percent.
- Measured by tonnage, the most recovered products and materials in 2005 were corrugated boxes (22.1 million tons), yard trimmings (19.9 million tons), newspapers (10.7 million tons), high grade office papers (4.1 million tons), glass containers (2.8 million tons), steel from large appliances (2.4 million tons), rubber tires (1.5 million tons), Standard mail (2.1 million tons), and wood packaging (1.3 million tons). Collectively, these products accounted for about 85 percent of total MSW recovery in 2005.
- Measured by percentage of generation, products with the highest recovery rates in 2005 were lead-acid batteries (98.8 percent), steel in major appliances (90.0 percent), newspapers (88.9 percent), corrugated boxes (71.5 percent), steel packaging (63.3 percent), office-type papers (62.6 percent), yard trimmings (61.9 percent), aluminum cans (44.8 percent), magazines (38.5 percent), Standard mail (35.8 percent), and PET soft drink bottles (34.1 percent).

Long Term Trends

- Generation of MSW has increased (except in recession years), from 88.1 million tons in 1960 to 247.3 million tons in 2004. It decreased somewhat, to 245.7 million tons in 2005.
- Generation of paper and paperboard, the largest material component of MSW, fluctuates from year to year, but has decreased from 87.7 million tons in 2000 to 84.0 million tons in 2005. Generation of yard trimmings, the second largest

component, has increased since 2000. Generation of other material categories also fluctuates from year to year, but overall MSW generation has increased each year since 2000, except for 2005, which saw a decline from 2004 to 2005, primarily due to the decline in paper and paperboard generation between 2004 and 2005.

- In percentage of total MSW generation, recovery for recycling (including composting) did not exceed 15 percent until 1990. Growth in the recovery rate to current levels (32.1 percent) reflects a rapid increase in the infrastructure for recovery over the last decade.
- Recovery (as a percentage of generation) of most materials in MSW has increased dramatically over the last 35 years. Some examples:

	1970	1980	1990	2000	2005
Paper and paperboard	15%	21%	28%	43%	50%
Glass	1%	5%	20%	23%	22%
Metals	4%	8%	24%	36%	37%
Plastics	Neg.	<1%	2%	5%	6%
Yard trimmings	Neg.	Neg.	12%	52%	62%
Rubber in tires	13%	6%	12%	26%	35%
Lead-acid batteries	76%	70%	97%	93%	99%

Neg. = less than 5,000 tons or 0.05 percent.

CHAPTER 2**REFERENCES****GENERAL**

U.S. Environmental Protection Agency. *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2003*. EPA530-F-05-003. April 2005.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2001 Facts and Figures*. EPA/530-R-03-011. October 2003.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2000 Facts and Figures*. EPA/530-R-02-001. June 2002.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 1999 Facts and Figures*. EPA/530-R-01-014. July 2001.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1997 Update*. EPA/530-R-98-007. May 1998.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1996 Update*. EPA/530-R-97-015. June 1997.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1995 Update*. EPA/530-R-96-001. November 1995.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1994 Update*. EPA/530-R-94-042. November 1994.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1992 Update*. EPA/530-R-92-019. July 1992.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1990 Update*. EPA/530-SW-90-042. June 1991.

Franklin, M.A. *Characterization of Municipal Solid Waste in the United States, 1960 to 2000 (Update 1988)*. U.S. Environmental Protection Agency. EPA/530-SW-88-033. NTIS PB88-232780/WEP. March 1988.

Franklin, M.A. *Characterization of Municipal Solid Waste in the United States, 1960 to 2000*. U.S. Environmental Protection Agency. REPT-15-3490-00. NTIS PB87-178323/WEP. July 1986.

ALUMINUM CONTAINERS AND PACKAGING

The Aluminum Association. *Aluminum Statistical Review*. Various years.

The Aluminum Association. www.aluminum.org.

Can Manufacturers Institute. *Can Shipments Report*. Various years.

Personal Communication with a representative of the Can Manufacturers Institute. February 2006.

Resource Recycling's Container Recycling Update. Various issues.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. "Closures for Containers." MQ34H. Various years.

U.S. Department of Commerce, Bureau of the Census. Merchandise Trade (7602.00.0030 – Aluminum Used Beverage Container Scrap SEC 9100).

CARPETS AND RUGS

Carpet America Recovery Effort (CARE). Annual Report. Various years.
www.carpetrecovery.org.

The Carpet and Rug Institute. *Carpet & Rug Industry Review*. Various years.

The Carpet and Rug Institute. *Sustainability Report 2000*. 2001.

Modern Plastics. “Resin Statistics.” January issue. Various years.

Personal communication with a representative of the Carpet and Rug Institute. July 2002.

Rauch Associates, Inc. *The Rauch Guide to the U.S. Adhesives and Sealants Industry*. ISBN 0-932157-05-X.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. “Carpets and Rugs.” MA22Q. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. “Carpets and Rugs.” MA314Q. Various years.

DISPOSABLE DIAPERS

Franklin Associates, Ltd. Confidential industry sources.

Kimberly-Clark. *Annual Report*. Various years.

Ninner, N.R., A.M. Sterling, and A.R. Liss. *Female Incontinence*. 1980.

U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. National Center for Health Statistics.

FOOD SCRAPS

California Integrated Waste Management Board. "Waste Disposal Rates for Business Types." www.ciwmb.ca.gov/.

Connecticut Department of Environmental Protection. *Garbage Gazette*. Jan/Feb, 2002.

Connecticut Department of Environmental Protection. *Identifying, Quantifying, and Mapping Food Residuals from Connecticut Businesses and Institutions*. Draper/Lennon, Inc. September, 2001.

Farrell, Molly. Evaluating Residential Organics Collection Pilot. *BioCycle*. March 2001.

Food Manufacturers Institute. "Reducing Waste Disposal Costs: How to Evaluate the Benefits of Composting in the Supermarket Industry." *Composting Workbook*. 1994.

Goldstein, Nora. "National Trends in Food Residuals Composting Part I." *BioCycle*. July 1997.

Goldstein, Nora and Dave Block. "Nationwide Inventory of Food Residuals Composting Part II." *BioCycle*. August 1997.

Goldstein, Nora, Jim Glenn, and Kevin Gray. "Nationwide Overview of Food Residuals Composting." *BioCycle*. August 1998.

Grocery Committee on Solid Waste. *Composting Task Force Report*. October 24, 1991.

Hinshaw, Jane, and Ivan Braun. "Targeting Commercial Businesses for Recycling." *Resource Recycling*. November 1991.

Kunzler, Conni, and Molly Farrell. "Food Service Composting Projects Update." *BioCycle*. May 1996.

Kunzler, Conni, and Rebecca Roe. "Food Service Composting Projects on the Rise." *BioCycle*. April 1995.

Luboff, Christine, and Karen May. "Measuring Generation of Food Residuals." July 1995.

Marion, James, New York State Department of Corrections. Presentation at the *BioCycle* conference. Philadelphia, Pennsylvania. 1994.

Newell, Ty, Elizabeth Markstahler, and Matthew Snyder. "Commercial Food Waste from Restaurants and Grocery Stores." *Resource Recycling*. February 1993.

Savage, George M. "The History and Utility of Waste Characterization Studies." *MSW Management*. May/June 1994.

Shanklin, Carol W. Targeting the Food Service Sector. *BioCycle*. April 2001.

Tucker, Marvin. Examining Collection of all Residential Organics. *Resource Recycling*. November 2001.

U.S. Department of Agriculture. "Estimating and Addressing America's Food Losses." Economic Research Service. www.econ.ag.gov/. July 1997.

U.S. Department of Agriculture. "Food Consumption, Prices, and Expenditures, 1996." Economic Research Service. Judith Jones Putnam. April 1996.

U.S. Department of Commerce, Bureau of the Census. "Combined Annual and Revised Monthly Retail Trade." *Current Business Reports*. BR/95-RV.

U.S. EPA. "Quantification of Food Residual Composted – 2004 and 2005." Summary report. Nora Goldstein, JG Press. October 2006.

U.S. Department of Commerce, Bureau of the Census. "Monthly Retail Trade." *Current Business Reports*. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Population Reports*. Various years.

U.S. Department of Commerce, Bureau of the Census. *Statistical Abstract of the United States*. Various years.

U.S. Department of Commerce. "Trends and Forecasts: Retail Sales." *U.S. Industrial Outlook 1994*.

Walsh, Patrick, Wayne Pferdehirt, and Phil O'Leary. "Collection of Recyclables from Multifamily Housing and Businesses." *Waste Age*. April 1993.

FURNITURE AND FURNISHINGS

Smith, F.L. *A Solid Waste Estimation Procedure: Material Flows Approach*. U.S. Environmental Protection Agency. EPA/530-SW-147. May 1974.

Spendlove, M.J. "A Profile of the Nonferrous Secondary Metals Industry." U.S. Bureau of Mines. Proceedings of the Second Mineral Waste Utilization Symposium. 1970.

U.S. Department of Commerce, Bureau of the Census. *Economic Census of Manufactures and Annual Survey of Manufactures*. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. “Average Weight and Width of Broadwoven Fabrics (Gray).” MC-22T. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. “Office Furniture.” MA-25H. Various years.

GLASS CONTAINERS

Bingham, T.H., et al. *An Evaluation of the Effectiveness and Cost of Regulatory and Fiscal Policy Instruments on Product Packaging*. Research Triangle Institute for the U.S. Environmental Protection Agency, Office of Solid Waste Management. March 1974.

Brewers Almanac. Various years.

Egan, Katherine. “Glass Recycling Rate Drops Seven Percent in 1997.” *Waste Age’s Recycling Times*. June 1, 1998.

Franklin Associates, Ltd. *Post-consumer Solid Waste and Resource Recovery Baseline*. Prepared for the Resource Conservation Committee. May 16, 1979.

Franklin, W.E., et al. *Base Line Forecasts of Resource Recovery, 1972 to 1990*. Midwest Research Institute for the U.S. Environmental Protection Agency, Office of Solid Waste Management Programs. March 1975.

Glass Packaging Institute. *Annual Report*. Various years.

Personal communication with Kevin Dietly of Northbridge Environmental Management Consultants. May 2006.

Personal communication with a representative of Strategic Materials. 2000.

Resource Recycling, Container Recycling Update. Various issues.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports.* "Glass Containers." M32G. Various years.

U.S. Department of Commerce, Bureau of the Census. National Trade Data Bank. Various years.

U.S. Department of Commerce. *U.S. Exports, Schedule B Commodity by Country - Domestic Merchandise.* FT 447. Various years.

U.S. Department of Commerce. *U.S. Imports for Consumption.* FT 247. Various years.

U.S. Department of Commerce. *U.S. Imports of Merchandise for Consumption.* FT 110 and FT 125. Various years.

LEAD-ACID BATTERIES

American Automobile Manufacturers Association. *AAMA Motor Vehicle Facts and Figures.* Various years.

Battery Council International. *Industry Statistics.* Various years.

Battery Council International. *National Recycling Rate Study.* Various years.

Franklin Associates, Ltd. *Characterization of Products Containing Lead and Cadmium in Municipal Solid Waste in the United States, 1970 to 2000.* U.S. Environmental Protection Agency. EPA/530-SW-89-015A. NTIS PB89-151039/WEP. January 1989.

Motorcycle Industry Council, Inc. *Motorcycle Statistical Annual.* Various years.

National Petroleum News. *Market Facts*. Various years.

Personal communication with a representative of R. L. Polk & Company.

Rubber Manufacturers Association. *Scrap Tire Markets*. July 2004. www.rma.org.

Teck Cominco Market Research. *The Lead Market*. www.teckcominco.com.

U.S. Bureau of Transportation Statistics. Table 4-54. www.bts.gov/publications/national_transportation_statistics/2005/html/table_04_54.html.

U. S. Department of Commerce. *Statistical Abstract of the United States*. Various years.

U.S. Department of Commerce. *U.S. Imports By Commodity*. Various years.

U.S. Department of Commerce. *U.S. Industrial Outlook* “Metals.” Various years.

Ward Communications, Inc. *Ward’s Motor Vehicle Facts & Figures*. 2001.

MAJOR APPLIANCES

American Iron and Steel Institute *Annual Statistical Report*. Various years.

Appliance Magazine. Corcoran Communications. September 1983.

Appliance Manufacturer. Annual Industry Marketing Guide, March issue of various years.

Appliance Manufacturer. *Market Profile*. Various years.

Appliance Recycling Information Center. INFOBulletin #1, #2, and #7. July 2001.

Association of Home Appliance Manufacturers. *Trends and Forecasts*. 1971 to 1988.

Best Buy website. www.bestbuy.com.

Electrical Merchandising. January 1951.

Gas Appliance Manufacturers Association. *Statistical Highlights*. Various years.

Maytag Corporation. www.amana.com.

National Industrial Pollution Control Council. *The Disposal of Major Appliances*. June 1971.

Personal communication with a representative of Amana, Inc. November 1991.

Personal communication with a representative of Steel Recycling Institute. August 1997.

Rheem Manufacturing Company. www.rheem.com.

Sears, Roebuck and Co. Spring and Fall Retail Catalogs and website www.sears.com. Various years.

Steel Recycling Institute. www.recycle-steel.org.

Target Brands, Inc. www.target.com.

U.S. Department of Commerce, Bureau of the Census. *Census of Manufactures*. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. "Major Household Appliances." MA36F. Various years.

U.S. Department of Commerce, Bureau of the Census. *Statistical Abstract of the United States*. Various years.

PAPER AND PAPERBOARD

American Forest & Paper Association, Paper Recycling Group. *Annual Statistical Summary Waste Paper Utilization*. Various years.

American Forest & Paper Association. *Statistics of Paper, Paperboard & Wood Pulp*. Various years.

American Forest & Paper Association. *Paper, Paperboard, Pulp Capacity and Fiber Consumption*. Various years.

American Forest & Paper Association. *Monthly Statistical Report*. Various issues.

Mies, Will, Editor. *Pulp & Paper Global Fact & Price Book, 2005*. Paperloop, Inc. 2005.

Franklin Associates, Ltd. *Evaluation of Proposed New Recycled Paper Standards and Definitions*. Special Task Force on Standards and Definitions, Recycled Paper Committee, Recycling Advisory Council. January 27, 1992.

U.S. Postal Service. *Annual Report of the Postmaster General*. Various years.

Yellow Pages Publishers Association. *Yellow Pages Publishers Environmental Network: Progress Report for the Year 1996*. March 1997.

PLASTICS

Alliance of Foam Packaging Recyclers. 2004 EPS Recycling Report. www.epspackaging.org.

American Plastics Council, Inc. "Production and Sales & Captive Use of Thermosetting & Thermoplastic Resins." Various years.

Modern Plastics. Resin Statistics. January and February issues. Various years.

National Association of PET Container Resources (NAPCOR). "Report on Post Consumer PET Container Recycling Activity." Various years.

Plastics Recycling Update. January 2004.

R.W. Beck and Associates. "Postconsumer Plastics Recycling Rate Study." American Plastics Council. Various years.

Schedler, Mke.. "A PET Bottle Recycling Status Report." *Resource Recycling*. February 2006.

U.S. Department of Commerce. *U.S. Industrial Outlook*. Various years.

U.S. Department of Commerce. Value of Product Shipments. Various years.

U.S. Department of Commerce. International Trade Statistics. Various years.

RUBBER

American Automobile Manufacturers Association. *AAMA Motor Vehicle Facts and Figures*. Various years.

Franklin Associates, Ltd. *Markets for Scrap Tires*. U.S. Environmental Protection Agency EPA/530-SW-90-07A. October 1991.

International Tire and Rubber Association, Inc. *formerly* American Retreader's Association, Inc. Louisville, Kentucky.

International Tire and Rubber Association, Inc. *The Tire Retreading/Repair Journal*. April 1997.

McRee, Robert E. "Recap – Recapture: Incineration of Rubber for Energy Recovery" Presented at the Joint NTDR/RMA International Symposium. Washington, DC. October 22, 1982.

National Petroleum News Market Facts. Mid-June issue. Various years.

Personal communication with a representative of RL Polk Company. 2000.

Personal communication with the Scrap Tire Management Council. September 1996.

Retreader's Journal. April 1987.

Rubber Manufacturers Association. *Passenger Replacement Shipments To Set Record In 2005*. December 7, 2005.

Rubber Manufacturers Association. *U.S. Scrap Tire Markets 2003 Edition*. July 2004.

Rubber Manufacturers Association. www.rma.org/scraptires/characteristics.html.
www.rma.org/scraptires/facts_figures.html.

Scrap Tire Management Council. *1994 Scrap Tire Use/Disposal Study*. Results published in *Scrap Tire News*. March 1995.

Scrap Tire Management Council. *Scrap Tire Use/Disposal Study 1996 Update*. April 1997.

U.S. Bureau of Transportation Statistics. Motor Vehicles Scrapped. Table 4-54. Various years.

U.S. Department of Commerce, Bureau of the Census. *Census of Manufactures*. Industry series 30A-30. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. “Rubber Mechanical Goods.” MA30C. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. “Rubber: Production, Shipments, and Stocks.” MA30A. various years.

U.S. Department of Commerce, Bureau of the Census. *Statistical Abstract of the United States*. various years.

U.S. Department of Commerce, Bureau of the Census. *U.S. Imports for Consumption*. FT 247. Table 1. various years.

U.S. Department of Commerce. *U.S. Industrial Outlook*. “Plastics and Rubber.” Also earlier editions. Various years.

U.S. Environmental Protection Agency. *Markets for Scrap Tires*. EPA/530-SW-90-074A. October 1991.

Wards. *Motor Vehicle Facts & Figures*. Various years.

STEEL CONTAINERS AND PACKAGING

American Iron and Steel Institute. *Annual Statistical Report*. Various years.

Can Manufacturers Institute. *Can Shipments Report*. Various years.

Personal communication with a representative of the Association of Container Reconditioning. June 1994.

Personal communication with a representative of the Reusable Industrial Packaging Association. September 2004.

Personal communications with representatives of the Steel Recycling Institute. Various years.

Resource Recycling. Container Recycling Report. Various issues.

Smith, F.L. *A Solid Waste Estimation Procedure: Material Flows Approach*. U.S. Environmental Protection Agency. EPA/530-SW-147. May 1974.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. "Closures for Containers." MQ34H. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. "Steel Barrels and Drums." MA34K, MA332K. Various years.

TEXTILES AND FOOTWEAR

Council for Textile Recycling. *Textile Recycling Fact Sheet*. Various years.

J.C. Penney's Catalog. 1990 and 2000.

National Association of Hosiery Manufacturers. *Fact Sheet*. Various years.

Riggle, David. "Tapping Textile Recycling." *BioCycle*. February 1992.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. "Apparel." MA23A, MA23E, MA23G, MQ315A, MQ315D. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. "Bed and Bath Furnishings." MQ314X. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. "Sheets, Towels and Pillowcases." MQ23X. Various years.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. MA31A, MQ31A, MA23E, MA23G, and MA23A. Various years.

U.S. Department of Commerce, Bureau of the Census. International Trade Data Bank. Various years.

U.S. Department of Commerce, Bureau of the Census. *Statistical Abstract of the United States*. Various years.

Spiegel Catalog. Fall/winter 1997.

WOOD PACKAGING

Araman, Phillip, and Robert Bush. "An Update on the Pallet Industry." Brooks Forest Products Center, Virginia Polytechnic Institute. Release pending.

Araman, Phillip, and Robert Bush. "Use of New Wood Pallets, Containers is Stagnant to Declining." *Pallet Enterprise*. September 1997.

Clarke, John W., Marshall S. White, and Philip A. Araman. "Comparative Performance of New, Repaired, and Remanufactured 48- by 40-inch GMA-style Wood Pallets". *Forest Products Journal*. December 2005.

Eshbach, Ovid, Ed. *Handbook of Engineering Fundamentals*. Second Edition. John Wiley & Sons, Inc.

Hardwood Market Report. February 28, 1998.

Personal communication with representative of the National Wooden Pallet and Container Association. September 1996.

Personal communication with representative of the U.S. Forestry Service Laboratory, Princeton, WV. December 1991.

Personal communication with representative of U.S. Department of Agriculture Forest Service, Forest Products Laboratory. December 1991.

Personal communication with representative of Virginia Polytechnic Institute. December 1991 and October 2002.

U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. *Wood Used in U.S. Manufacturing Industries, 1977*. December 1983.

U.S. Department of Agriculture, Forest Service Southern Research Center and Brooks Forest Products Center, Virginia Polytechnic Institute. www.srs4702.forprod.vt.edu/pallets/new.asp.

U.S. Department of Commerce. *U.S. Industrial Outlook*. "Wood Products." Various years.

YARD TRIMMINGS

California Integrated Waste Management Board. "Waste Disposal and Diversion Findings for Selected Industry Groups." Cascadia Consulting Group. June 2006.

California Integrated Waste Management Board. "Detailed Characterization of Commercial Self-Haul and Drop-box Waste" Cascadia Consulting Group. June 2006.

California Integrated Waste Management Board. "Statewide Waste Characterization Study." Cascadia Consulting Group. December 2004.

California Integrated Waste Management Board. "Second Assessment of California's Compost- and Mulch-Producing Infrastructure." May 2004.

Composting Council Research and Education Foundation. "1995 Compost Capacity Survey." James Butler and Associates. October 1996.

Composting Council. Fact Sheet. "Yard Waste Legislation: Disposal Bans and Similar Bills as of July, 1993." July 1993.

Connecticut Department of Environmental Protection. "State Solid Waste Management Plan." Appendix D: "Current Waste Diversion Practices, Preliminary Draft." RW Beck. 2006.

Delaware Solid Waste Authority. "Analysis of the Impact of a Yard Waste Ban on Landfill Quantities and Household Costs." DSM Environmental Services, Inc. September 15, 2004.

Florida Department of Environmental Protection. "Solid Waste Management in Florida." 1998.

Florida Department of Environmental Protection. WasteCalc solid waste model. Franklin Associates, Ltd. subcontractor to TIA. Background model worksheet. Analysis of state and county sampling data. 2000.

Franklin Associates, Ltd. *The Role of Recycling in Integrated Solid Waste Management to the Year 2000*. Appendix J and Appendix K. Keep America Beautiful, Inc. September 1994.

Franklin Associates, Ltd. Survey of Selected State Officials. Various years.

Franklin Associates, A Division of ERG. Survey of Selected State Officials. Various years.

Glenn, Jim. "The State of Garbage in America Part I." *BioCycle*. April 1998.

Goldstein, Nora. "The State of Garbage in America." *BioCycle*. December 2002.

Goldstein, Nora. "The State of Garbage in America Part II." *BioCycle*. November 2000.

Goldstein, Nora and Jim Glenn. "The State of Garbage in America Part I." *BioCycle*. April 1997.

Goldstein, Nora and Jim Glenn. "The State of Garbage in America Part II." *BioCycle*. May 1997.

Georgia Department of Community Affairs. "Georgia Statewide Waste Characterization Study." RW Beck. June 2005.

Iowa Department of Natural Resources. Waste Management Assistance Division. "Iowa Solid Waste Characterization Study." RW Beck. October 1998.

Kansas Department of Health and Environment. "State of Kansas Waste Characterization Study." Engineering Solutions & Design, Inc. March 2003.

King County Department of Natural Resources and Parks. Solid Waste Division. "Waste Monitoring Program. 2002/2003 Comprehensive Waste Stream Characterization and Transfer Station Customer Surveys - Final Report." Cascadia Consulting Group, Inc. April 2004.

King County Department of Natural Resources and Parks. Solid Waste Division. "2003 Annual Report Blueprint for the Future." September 2003

Massachusetts DEP Residential Organic Waste Management Study. October 1999. Research International/Cambridge.

Minnesota Pollution Control Agency Solid Waste Management Coordinating Board, Office of Environmental Assistance. "Statewide MSW Composition Study." RW Beck. March 2000.

New Jersey Department of Environment. "Draft Statewide Solid Waste Management Plan 2005."

New Mexico Environment Department Solid Waste Bureau. 2004 and 2005 Landfill Summary Report. Received May 2006.

Ohio Department of Natural Resources, Division of Recycling & Litter Prevention. "What's In Our Garbage?: Ohio's Waste Characterization Study Executive Summary." Engineering Solutions & Design, Inc. 2005.

Oregon Department of Environmental Quality. "2004 Oregon Material Recovery and Waste Generation Report." March 2006.

Oregon Department of Environmental Quality. "2002 Oregon Solid Waste Characterization and Composition." Sky Valley Associates. 2002.

Pennsylvania Department of Environmental Protection. "Statewide Waste Composition Study." RW Beck. April 2003.

Raymond Communications. "State Recycling Laws Update." Various years.

Rhode Island Resource Recovery Corporation, Rhode Island Department of Environmental Management. "Rhode Island Comprehensive Solid Waste Management Plan May 24, 2005 Draft."

San Francisco Department of the Environment. "Waste Characterization Study". Environmental Science Associates (ESA). August 2005.

Savage, George M. "The History and Utility of Waste Characterization Studies." *MSW Management*. May/June 1994.

Simmons, Phil, et al. "The State of Garbage in America." *BioCycle*. April 2006.

Steuteville, Robert. "The State of Garbage in America, Part I." *BioCycle*. April 1995.

Steuteville, Robert. "The State of Garbage in America, Part II." *BioCycle*. May 1995.

Steuteville, Robert. "The State of Garbage in America, Part II." *BioCycle*. May 1996.

U.S. Environmental Protection Agency. "Region 7 MSW Generation, Recycling (including Composting), and Disposal." Eastern Research Group, Inc. September 2005.

Wake County, N.C. Solid Waste Management. "Wake County Waste Characterization Study." RW Beck. April 1999.

Wisconsin Department of Natural Resources. "Wisconsin Statewide Waste Characterization Study." Cascadia Consulting Group, Inc. May 2003.

Wisconsin Department of Natural Resources. 2000 annual recycling data. Staff document.

CHAPTER 3

MANAGEMENT OF MUNICIPAL SOLID WASTE

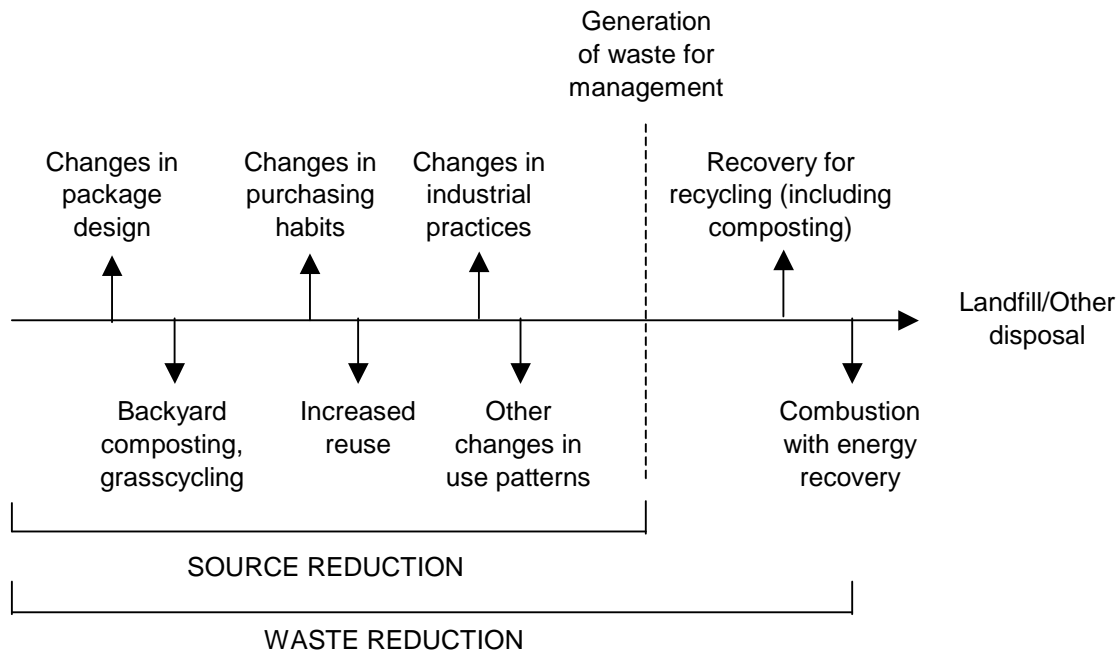
INTRODUCTION

EPA's tiered integrated waste management strategy includes the following components:

1. Source reduction (or waste prevention), including reuse of products and on-site (or backyard) composting of yard trimmings.
2. Recycling, including off-site (or community) composting.
3. Combustion with energy recovery.
4. Disposal through landfilling or combustion without energy recovery.

The four components are put into context in Figure 17.

This chapter addresses the major activities within an integrated waste management system: source reduction, recycling (including composting), combustion with energy recovery, and disposal. Source reduction activities have the effect of reducing MSW generation, while other management alternatives deal with MSW once it is generated.

Figure 17. Diagram of solid waste management

Source: Franklin Associates, A Division of ERG

Estimates of the historical recovery of materials for recycling, including yard trimmings for composting, are presented in Chapter 2. Chapter 3 discusses the current MSW management infrastructure. Current solid waste collection, processing, combustion with energy recovery, and disposal programs and facilities are highlighted with tables and figures. It also presents estimates for quantities of waste landfilled, which are obtained by subtracting the amounts recovered for recycling (including composting) and the amounts combusted with energy recovery from total MSW generation.

SOURCE REDUCTION

During the past 45 years, the amount of waste each person creates has doubled from 2.7 to 4.54 pounds per day. The most effective way to stop this trend is by preventing waste from being generated in the first place.

Source reduction is gaining more attention as an important solid waste management option. Source reduction, often called “waste prevention,” is defined by EPA as “any change in

the design, manufacturing, purchase, or use of materials or products (including packaging) to reduce their amount or toxicity before they become municipal solid waste. Prevention also refers to the reuse of products or materials.” Thus, source reduction activities affect the waste stream before the point of generation. In this report, MSW is considered to have been generated if it is placed at curbside or in a receptacle such as a dumpster for pickup, or if it is taken by the generator to another site for recycling (including composting) or disposal.

Source reduction encompasses a very broad range of activities by private citizens, communities, commercial establishments, institutional agencies, and manufacturers and distributors. Examples of source reduction actions (Table 24) include:

- Redesigning products or packages so as to reduce the quantity of materials or the toxicity of the materials used, by substituting lighter materials for heavier ones and lengthening the life of products to postpone disposal.
- Using packaging that reduces the amount of damage or spoilage to the product.
- Reducing amounts of products or packages used through modification of current practices by processors and consumers.
- Reusing products or packages already manufactured.
- Managing non-product organic wastes (food scraps, yard trimmings) through backyard composting or other on-site alternatives to disposal.

Source Reduction Through Redesign

Since source reduction of products and packages can save money by reducing materials and energy costs, manufacturers and packaging designers have been pursuing these activities for many years. Combined with other source reduction measures, redesign can have a significant effect on material use and eventual discards. Design for source reduction can take several approaches.

Table 24
SELECTED EXAMPLES OF SOURCE REDUCTION PRACTICES

Source Reduction Practice	MSW Product Categories			
	Durable Goods	Nondurable Goods	Containers & Packaging	Organics
Redesign				
Materials reduction	<ul style="list-style-type: none"> Downgauge metals in appliances 	<ul style="list-style-type: none"> Paperless purchase orders 	<ul style="list-style-type: none"> Concentrates 	<ul style="list-style-type: none"> Xeriscaping
Materials substitution	<ul style="list-style-type: none"> Use of composites in appliances and electronic circuitry 		<ul style="list-style-type: none"> Cereal in bags Coffee brick Multi-use products 	
Lengthen life	<ul style="list-style-type: none"> High mileage tires Electronic components reduce moving parts 	<ul style="list-style-type: none"> Regular servicing Look at warranties Extend warranties 	<ul style="list-style-type: none"> Design for secondary uses 	
Consumer Practices				
	<ul style="list-style-type: none"> Purchase long lived products 	<ul style="list-style-type: none"> Repair Duplexing Sharing Reduce unwanted mail 	<ul style="list-style-type: none"> Purchasing: products in bulk, concentrates 	
Reuse				
By design	<ul style="list-style-type: none"> Modular design 	<ul style="list-style-type: none"> Envelopes 	<ul style="list-style-type: none"> Reusable pallets Returnable secondary packaging 	
Secondary	<ul style="list-style-type: none"> Borrow or rent for temporary use Give to charity Buy or sell at garage sales 	<ul style="list-style-type: none"> Clothing Waste paper scratch pads 	<ul style="list-style-type: none"> Loosefill Grocery sacks Dairy containers Glass and plastic jars 	
Reduce/Eliminate Toxins				
	<ul style="list-style-type: none"> Eliminate PCBs 	<ul style="list-style-type: none"> Soy ink, waterbased Waterbased solvents Reduce mercury 	<ul style="list-style-type: none"> Replace lead foil on wine bottles 	
Reduce Organics				
Food scraps				<ul style="list-style-type: none"> Backyard composting Vermi-composting
Yard trimmings				<ul style="list-style-type: none"> Backyard composting Grasscycling

Source: Franklin Associates, A Division of ERG

Materials substitution can make a product or package lighter. For example, there has been a continuous trend of substitution of lighter materials such as plastics and aluminum for materials such as glass and steel. The substitution also may involve a flexible package instead of a rigid package. A product or package can be redesigned to reduce weight or volume. Toxic materials in products or packaging can be replaced with non-toxic substitutes. Considerable efforts have been made in this area in the past few years.

Lengthening product life delays the time when the product enters the municipal waste stream. The responsibility for lengthening product life lies partly with manufacturers and partly with consumers. Manufacturers can design products to last longer and be easier to repair. Since some of these design modifications may make products more expensive, at least initially, manufacturers must be willing to invest in new product development, and consumers must demand the products and be willing to pay for them to make the goal work. Consumers and manufacturers also must be willing to care for and repair products.

Modifying Practices to Reduce Materials Use

Businesses and individuals often can modify their current practices to reduce the amounts of waste generated. In a business office, electronic mail can replace printed memoranda and data. Reports can be copied on both sides of the paper (duplexed). Modifying practices can be combined with other source reduction measures to reduce generation and limit material use.

Individuals and businesses can request removal from mailing lists to reduce the amount of mail received and discarded. When practical, products can be purchased in large sizes or in bulk to minimize the amount of packaging per unit of product. Concentrated products also can reduce packaging requirements.

Reuse of Products and Packages

Similar to lengthening product life, reuse of products and packaging delays the time when the items must finally be discarded as waste. When a product is reused, presumably purchase and use of a new product is delayed, although this may not always be true.

Many of the products characterized for this report are reused in sizable quantities (e.g., furniture, wood pallets, and clothing). The recovery of products and materials for recycling (including composting) as characterized in Chapter 2 does *not* include reuse of products, but reuse is discussed in this section.

Durable Goods. There is a long tradition of reuse of durable goods such as large and small appliances, furniture, and carpets. Often this is done informally as individuals pass on used goods to family members and friends. Other durable goods are donated to charitable organizations for resale or use by needy families. Some communities and other organizations have facilitated exchange programs for citizens, and there are for-profit retail stores that deal in used furniture, appliances, and carpets. Individuals resell other goods at garage sales, flea markets, and the like. Borrowing and sharing items like tools can also reduce the number of products ultimately discarded. There is generally a lack of data on the volume of durable goods reused in the United States, and what the ultimate effect on MSW generation might be.

Nondurable Goods. While nondurable goods by their very nature are designed for short-term use and disposal, there is considerable reuse of some items classified as nondurable. In particular, footwear, clothing, and other textile goods often are reused. Much of the reuse is accomplished through the same types of channels as those described above for durable goods. That is, private individuals, charitable organizations, and retail outlets (consignment shops) all facilitate reuse of discarded clothing and footwear. In addition, considerable amounts of textiles are reused as wiping cloths before being discarded.

Another often-cited waste prevention measure is the use of washable plates, cups, napkins, towels, diapers, and other such products, instead of the disposable variety. (This will

reduce solid waste but will have other environmental effects, such as increased water and energy use.) Other reusable items are available, for example: reusable air filters, reusable coffee filters, and reconditioned printer cartridges.

Containers and Packaging. Containers and packaging can be reused in two ways: they can be used again for their original purpose, or they can be used in other ways.

Glass bottles are a prime example of reuse of a container for its original purpose. Refillable glass beer and soft drink bottles can be collected, washed, and refilled for use again. Some years ago large numbers of refillable glass soft drink bottles were used, but single-use glass bottles, plastic bottles, and aluminum cans have largely replaced these. Considerable numbers of beer bottles are collected for refilling, often by restaurants and taverns, where the bottles can easily be collected and returned by the distributor. The Glass Packaging Institute estimates that refillable glass bottles achieve a rate of eight trips (refillings) per bottle.

Another example in this category is the use of refurbished wood pallets for shipping palletized goods. It is estimated that over 10 million tons of wood pallets were refurbished and returned to service in 2005. It is also common practice to recondition steel drums and barrels for reuse.

Many other containers and packages can be recycled, but are not often reused, although this practice can achieve a notable source reduction in packaging. As an example, some grocery stores will allow customers to reuse grocery sacks, perhaps allowing a refund for each sack brought back for reuse. Also, many parcel shippers will take back plastic packaging “peanuts” for reuse.

Many ingenious reuses for containers and packaging are possible in the home. People reuse boxes, bags, jars, jugs, and cans for many purposes around the house. There are no reliable estimates as to how these specific activities affect the waste stream.

Management of Organic Materials

Food scraps and yard trimmings combined made up about 25 percent of MSW generation in 2005, so source reduction measures aimed at these products can have an important effect on waste generation. Composting is the usual methodology for recovering these organic materials. As defined in this report, composting of organic materials after they are taken to a central composting facility is a recycling activity. Estimates for these off-site composting activities are included in this chapter.

There are several types of source reduction that take place at the point of generation (e.g., the yard of a home or business). The backyard composting of yard trimmings and certain food discards is a growing source reduction practice. There also is a trend toward leaving grass clippings on lawns, often through the use of mulching mowers. Other actions contributing to reduced organics disposal are: establishment of variable fees for collection of wastes (also known as unit-based pricing or Pay-As-You-Throw), which encourage residents to reduce the amount of wastes set out; improved technology (mulching mowers); xeriscaping (landscaping with plants that use minimal water and generate minimal waste); and certain legislation such as bans on disposal of yard trimmings in landfills.

Part of the impetus for source reduction and recycling of yard trimmings is the large number of state regulations discouraging landfilling or other disposal of yard trimmings. The Composting Council and other sources reported that in 1992, 12 states (amounting to over 28 percent of the nation's population) had in effect legislation affecting management of yard trimmings. In 2005, 21 states (amounting to about 50 percent of the nation's population) had legislation discouraging the disposal of yard trimmings.

Measuring Source Reduction

Although source reduction has been an increasingly important aspect of municipal solid waste programs since the late 1980s, the goal of actually measuring how much source reduction has taken place—how much waste prevention there has been—has proved elusive. Early

attempts by localities and states often consisted of measuring a single waste stream in a single community. In time, additional research enabled proxy, or estimated values, to be developed for specific waste streams, to use on a state-wide or national level. EPA's *Source Reduction Program Potential Manual* and planning packet, published in 1997 (EPA530-E-97-001) provides an example of this approach. Unlike recycling, where there are actual materials to weigh all through the process, measuring source reduction means trying to measure something that no longer exists.

The November 1999 *National Source Reduction Characterization Report for Municipal Solid Waste in the United States* (EPA 530-R-99-034) provides additional information including an explanation of a methodology that has been used to generate source reduction estimates.

RECOVERY FOR RECYCLING (INCLUDING COMPOSTING)

Recyclables Collection

Before recyclable materials can be processed and recycled into new products, they must be collected. Most residential recycling involves curbside recyclables collection, drop-off programs, buy-back operations, and/or container deposit systems. Collection of recyclables from commercial establishments is usually separate from residential recyclables collection programs.

Curbside Recyclables Collection. In 2005, more than 8,500 curbside recyclables collection programs were reported in the United States. As shown in Table 25 and Figure 18, the extent of residential curbside recycling programs varies tremendously by geographic region, with the most extensive curbside collection occurring in the Northeast.

Curbside collection programs typically require residents to do at least some sorting of the recyclable materials put at the curb. In recent years, however, there has been a trend toward single-stream curbside collections programs, in which no sorting is required of the residents. These programs require that the materials be taken to a materials recovery facility (MRF) for processing.

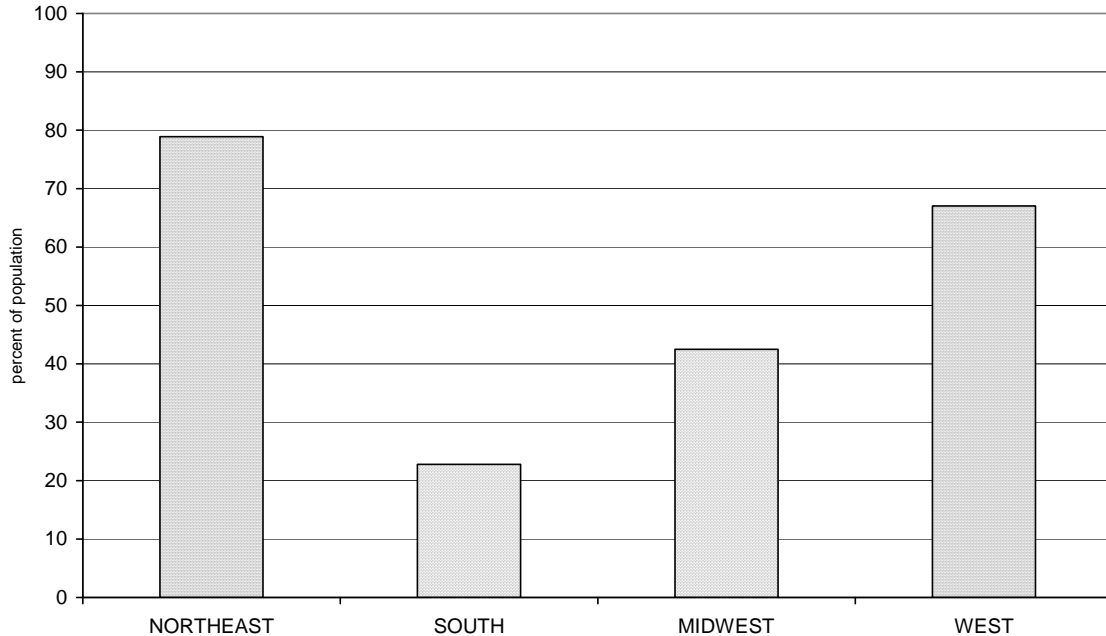
Table 25
NUMBER AND POPULATION SERVED BY
CURBSIDE RECYCLABLES COLLECTION PROGRAMS, 2005

Region	Number of Programs	Population (in thousands)	Population Served (in thousands)	Percent*
NORTHEAST	3,288	54,582	43,061	79%
SOUTH	797	105,994	24,144	23%
MIDWEST	3,742	65,694	27,928	43%
WEST	723	65,467	43,892	67%
Total	<u>8,550</u>	<u>241,372</u>	<u>139,026</u>	58%
Percent of Total U.S. Population				48%

* Percent of population served by curbside programs was calculated using population of states reporting data.

Source: U.S. Census Bureau 2006, *BioCycle* April 2006, California Integrated Waste Management Board, Illinois Recycling Association.

Figure 18. Population served by curbside recycling, 2005



Source: U.S. Census Bureau, *BioCycle* April 2006, California Integrated Waste Management Board, Illinois Recycling Association.

In 2005, nearly one-half (48 percent) of the U.S. population, or 139 million persons, had access to curbside recyclables collection programs. The Northeast region had the largest population served – 43 million persons. In the Northeast about 79 percent of the population had access to curbside recyclables collection, while in the West 67 percent of the population had access to curbside recycling. The largest numbers of programs were located in the Northeast and Midwest regions of the country.

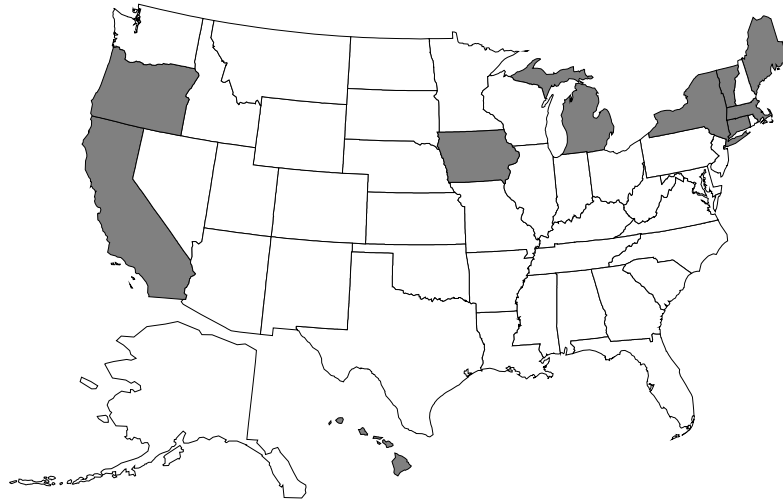
Drop-off Centers. Drop-off centers typically collect residential materials, although some accept materials from businesses. They are found in locations such as grocery stores, sheltered workshops, charitable organizations, city-sponsored sites, and apartment complexes. Types of materials collected vary greatly; however, drop-off centers can usually accept a greater variety of materials than a curbside collection program.

It is difficult to quantify drop-off centers in the United States. It is estimated that there were 12,694 programs in 1997, according to a *BioCycle* survey. In some areas, particularly those with sparse population, drop-off centers may be the only option for collection of recyclable materials. In other areas, they supplement other collection methods.

Buy-Back Centers. A buy-back center is typically a commercial operation that pays individuals for recovered materials. This could include scrap metal dealers, aluminum can centers, waste haulers, or paper dealers. Materials are collected by individuals, small businesses, and charitable organizations.

Deposit Systems. Ten states have container deposit systems: Connecticut, Delaware, Hawaii, Iowa, Maine, Massachusetts, Michigan, New York, Oregon, and Vermont (Figure 19). In these programs, the consumer pays a deposit on beverage containers at the point of purchase, which is redeemed on return of the empty containers. In addition, California has a similar system where containers can be redeemed, but the consumer pays no deposit.

Deposit systems generally target beverage containers (primarily beer and soft drink), which account for less than 6 percent of total MSW generation. It is estimated that about 35 percent of all recovery of beverage containers comes from the traditional deposit states mentioned above, and an additional 20 percent of recovered beverage containers comes from California. (Note: These recovery estimates reflect not only containers redeemed by consumers for deposit, but also containers recovered through existing curbside and drop-off recycling programs. Containers recovered through these programs eventually are credited to the distributor and counted towards the redemption rate.)

Figure 19. States With Bottle Deposit Rules

Commercial Recyclables Collection. The largest quantity of recovered materials comes from the commercial sector. Old corrugated containers (OCC) and office papers are widely collected from commercial establishments. Grocery stores and other retail outlets that require corrugated packaging are part of an infrastructure that brings in the most recovered material. OCC is often baled at the retail outlet and picked up by a paper dealer.

Office paper (e.g., white, mixed color, computer paper, etc.) is part of another commercial recyclables collection infrastructure. Depending on the quantities generated, businesses (e.g., banks, institutions, schools, printing operations, etc.) can sort materials and have them picked up by a paper dealer, or self deliver the materials to the recycler. It should be noted that commercial operations also make recycling available for materials other than paper.

Multi-family residence recycling could be classified as either residential or commercial recyclables collection. Multi-family refuse is usually handled as a commercial account by waste haulers. These commercial waste haulers may handle recycling at multi-family dwellings (typically five or more units) as well.

Recyclables Processing

Processing recyclable materials is performed at materials recovery facilities (MRFs), mixed waste processing facilities, and mixed waste composting facilities. Some materials are sorted at the curb and require less attention. Other materials are sorted into categories at the curb, such as a paper category and a container category, with additional sorting at a facility (MRF). There is a more recent trend towards MRFs that can sort recyclable materials that are picked up unsorted (single-stream recycling). Mixed waste can also be processed to pull out recyclable and compostable materials.

Materials Recovery Facilities. Materials recovery facilities vary widely across the United States, depending on the incoming materials and the technology and labor used to sort the materials. In 2005, 504 MRFs were operating in the United States, with an estimated total daily throughput of 50,000 tons per day (Table 26). The most extensive recyclables processing throughput occurs in the Northeast and West (Figure 20).

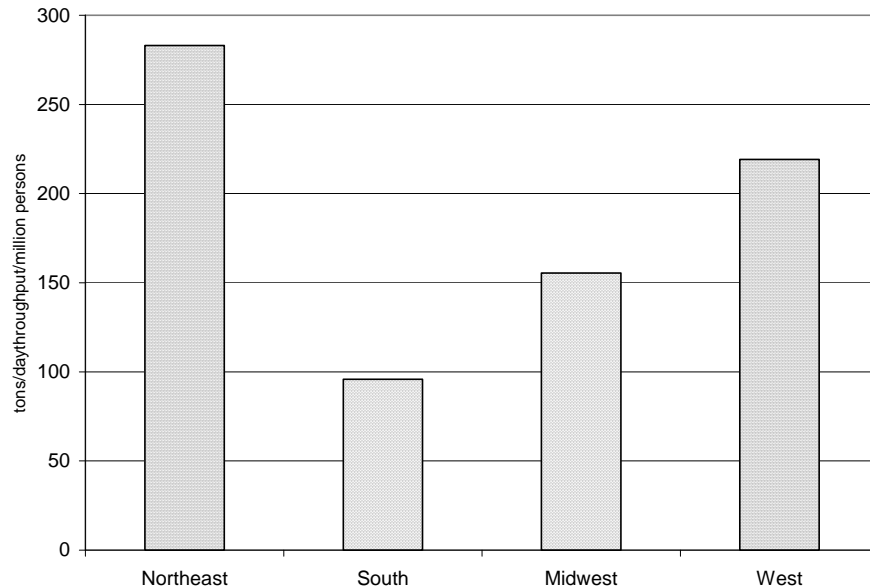
Table 26
MATERIALS RECOVERY FACILITIES, 2005

Region	Number	Estimated Throughput (tpd)
NORTHEAST	133	15,450
SOUTH	147	10,165
MIDWEST	119	10,210
WEST	105	14,354
<i>U.S. Total</i>	<u>504</u>	<u>50,180</u>

Throughput estimated at 70% of capacity.

Source: Governmental Advisory Associates, Inc.

**Figure 20. Estimated MRF Throughput, 2005
(tons per day per million persons)**



Source: U.S. Census Bureau, Governmental Advisory Associates, Inc.

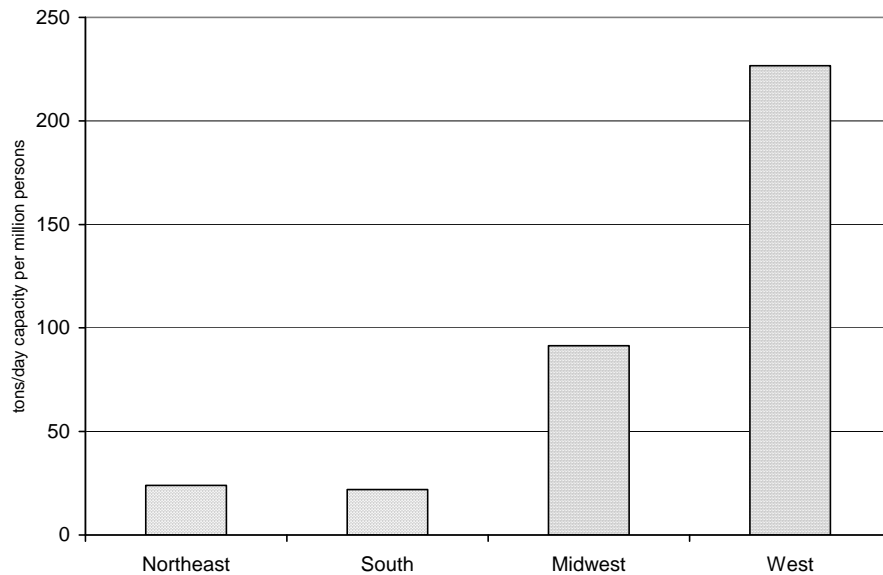
Many MRFs are considered low technology, meaning the materials are predominantly sorted manually. MRFs classified as high technology sort recyclables using eddy currents, magnetic pulleys, optical sensors, and air classifiers. As MRFs change and grow, many low technology MRFs add high tech features. However, high technology MRFs usually include manual sorting, reducing the distinction between high and low technology MRFs.

Mixed Waste Processing. Mixed waste processing facilities are less common than conventional MRFs, but there are several facilities in operation in the United States, as shown in Figure 21. Mixed waste processing facilities receive solid waste, which is then loaded on conveyors. Using both mechanical and manual (high and low technology) sorting, recyclable materials are removed for further processing. In 2005, there were reported 46 mixed waste processing facilities in the U.S., handling about 25,000 tons of waste per day. The Western region has the largest concentration of these processing facilities.

Mixed Waste Composting. Mixed waste composting starts with unsorted MSW. Large items are removed, as well as ferrous and other metals, depending on the type of operation. Mixed waste composting takes advantage of the high percentage of organic components of MSW, such as paper, food scraps and yard trimmings, wood, and other materials. In 2005, there were 14 mixed waste composting facilities, one less than was reported in 2000.

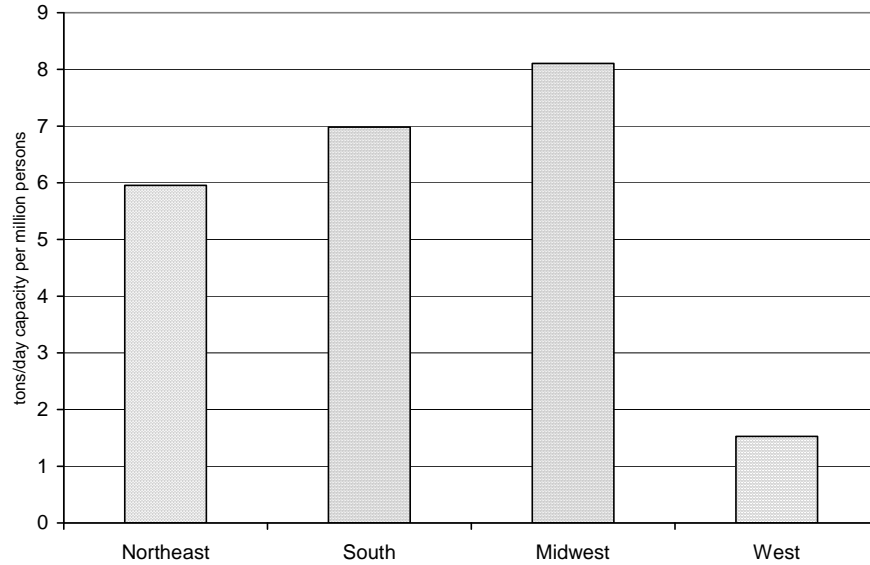
Nationally, mixed waste composting facilities handled about 1,200 tons per day in 2005, up from 1,100 tons per day in 2000. In 2005, the highest processing capacity per million persons was found in the South and Midwest, as shown in Figure 22.

**Figure 21. Mixed Waste Processing Estimated Capacity, 2005
(tons per day per million persons)**



Source: U.S. Census Bureau, Governmental Advisory Associates, Inc.

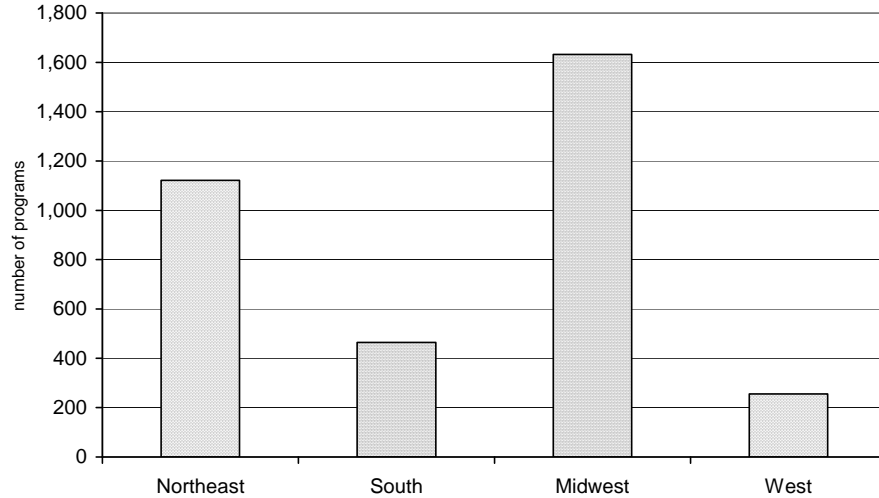
**Figure 22. MSW Composting Capacity, 2005
(Capacity in tons per day per million persons)**



Source: U.S. Census Bureau, *BioCycle* December 2005.

Yard Trimmings Composting. Yard trimmings composting is much more prevalent than mixed waste composting. On-site management of yard trimmings (back yard composting) is discussed later in this chapter, and is classified as source reduction, not recycling. In 2005, 3,474 yard trimmings composting programs were reported. In 2005, about 80 percent of these programs were in the Northeast and Midwest regions, as shown in Figure 23. Based on 19.9 million tons of yard trimmings recovered for composting in the United States (Table 2, Chapter 2), yard trimmings composting facilities handled approximately 54,500 tons per day in 2005.

**Figure 23. Yard Trimmings Composting Programs, 2005
(In number of programs)**



Source: *BioCycle* April 2006.

COMBUSTION WITH ENERGY RECOVERY

Most of the municipal solid waste combustion currently practiced in this country incorporates recovery of an energy product (generally steam or electricity). The resulting energy reduces the amount needed from other sources, and the sale of the energy helps to offset the cost of operating the facility. In past years, it was common to burn municipal solid waste in incinerators solely as a volume reduction practice; energy recovery became more prevalent in the 1980s.

Total U.S. MSW combustion with energy recovery, referred to as waste-to-energy (WTE) combustion, had a 2005 design capacity of 98,765 tons per day. There were 88 WTE facilities in 2005 (Table 27), down from 102 in 2000. In tons of capacity per million persons, the Northeast region had the most MSW combustion capacity in 2005 (Figure 24).

In addition to facilities combusting mixed MSW (processed or unprocessed), there is a small but growing amount of combustion of source-separated MSW. In particular, rubber tires have been used as fuel in cement kilns, utility boilers, pulp and paper mills, industrial boilers, and dedicated scrap tire-to-energy facilities. In addition, there is combustion of wood wastes and some paper and plastic wastes, usually in boilers that already burn some other type of solid fuel. For this report, it was estimated that about 2.8 million tons of MSW were combusted in this manner in 2005, with tires contributing a majority of the total.

Table 27
MUNICIPAL WASTE-TO-ENERGY PROJECTS, 2005

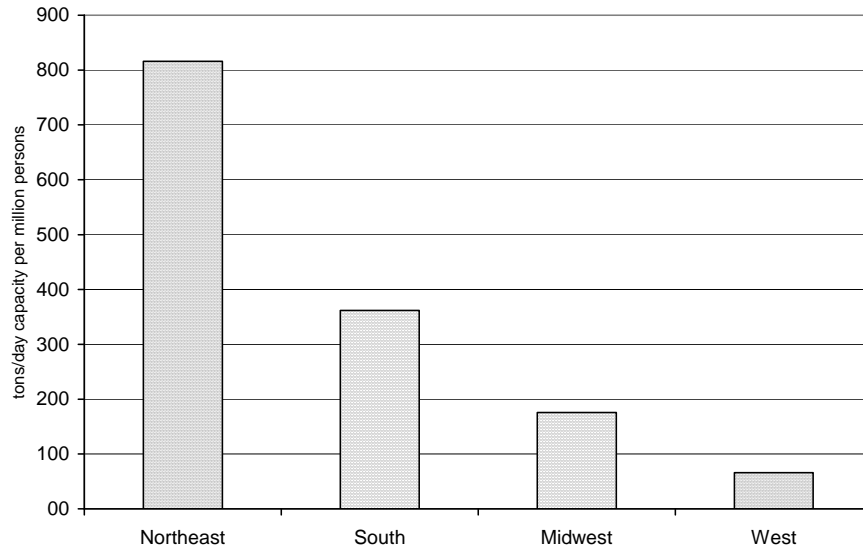
Region	Number Operational	Design Capacity (tpd)
NORTHEAST	39	44,561
SOUTH	26	38,359
MIDWEST	17	11,535
WEST	6	4,310
U.S. Total*	88	98,765

* Projects on hold or inactive were not included.
Facilities in Hawaii and Alaska not included.
WTE includes mass burn, modular, and refuse-derived fuel-combustion facilities.
Facilities shown in the 2004 directory were assumed to be operational in 2005.

Source: "The IWSA Directory of Waste-To-Energy Plants."
Integrated Waste Services Association, 2004.

In most cases the facilities have a stated daily capacity, but they normally operate at less than capacity over the course of a year. It was assumed for this report that throughput over a year of operation is 85 percent of rated capacity. In 2005 the total throughput of MSW through all combustion facilities with energy recovery was estimated at 33.4 million tons, or 13.6 percent of MSW generation.

**Figure 24. Municipal Waste-to-Energy Capacity, 2005
(Capacity in tons per million persons)**



Source: U.S. Census Bureau, Integrated Waste Services Association 2004.

RESIDUES FROM WASTE MANAGEMENT FACILITIES

Whenever municipal wastes are processed, residues will remain. For the purposes of this report, it is assumed that most of these residues are landfilled. Materials processing facilities (MRFs) and compost facilities generate some residues when processing various recovered materials. These residues include materials that are unacceptable to end users (e.g., broken glass, wet newspapers), other contaminants (e.g., products made of plastic resins that are not wanted by the end user), or dirt. While residue generation varies widely, 5 to 10 percent is probably typical for a MRF. Residues from a MRF or compost facility are generally landfilled. Since the recovery estimates in this report are based on recovered materials purchased by end users rather than materials entering a processing facility, the residues are counted with other disposed materials.

When municipal solid waste is combusted, a residue (usually called ash) is left behind. Years ago this ash was commonly disposed of along with municipal solid waste, but combustor

ash is *not* counted as MSW in this report because it generally is managed separately⁷. (There are a number of efforts underway to reuse ash.) As a general “rule of thumb,” MSW combustor ash amounts to about 25 percent (by weight) of unprocessed MSW input. This percentage will vary from facility to facility depending upon the types of waste input and the efficiency and configuration of the facility.

LANDFILLS

In 2005, there were 1,654 municipal solid waste landfills reported in the contiguous United States.

Table 28 and Figure 25 show the number of landfills in each region. The Southeast and West had the largest number of landfills. Thirty-five percent of the landfills are located in the Southeast, 31 percent in the West, and 26 percent in the Midwest. Only 8 percent are located in the Northeast.

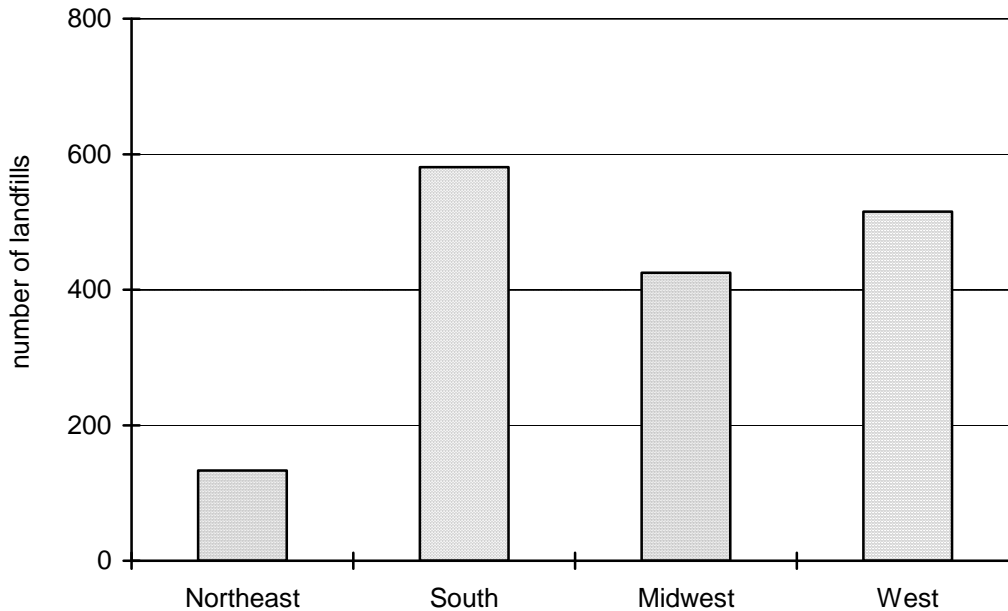
Table 28
LANDFILL FACILITIES, 2005

Region	Number of Landfills *
NORTHEAST	133
SOUTH	581
MIDWEST	425
WEST	<u>515</u>
<i>U.S. Total</i> *	1,654

* Excludes landfills in Alaska and Hawaii.
Facilities shown for 2004 were assumed
to be operational in 2005.

Source: BioCycle April 2006.

⁷ Note that many combustion facilities do magnetic separation of residues to recover ferrous metals, e.g., steel cans and steel in other miscellaneous durable goods. This recovered steel is included in the total recovery of ferrous metals in MSW reported in Chapter 2.

Figure 25. Number of Landfills in the U.S., 2005

Source: BioCycle April 2006.

SUMMARY OF HISTORICAL AND CURRENT MSW MANAGEMENT

This summary provides some perspective on historical and current municipal solid waste management practices in the United States. The results are summarized in Table 29 and Figure 26.

Table 29
GENERATION, MATERIALS RECOVERY, COMPOSTING, COMBUSTION,
AND DISCARDS OF MUNICIPAL SOLID WASTE, 1960 TO 2005
(In thousands of tons and percent of total generation)

	Thousands of Tons							
	1960	1970	1980	1990	2000	2003	2004	2005
Generation	88,120	121,060	151,640	205,210	237,630	240,370	247,300	245,660
Recovery for recycling	5,610	8,020	14,520	29,040	52,650	55,750	57,190	58,400
Recovery for composting*	Neg.	Neg.	Neg.	4,200	16,450	19,080	20,470	20,550
Total Materials Recovery	5,610	8,020	14,520	33,240	69,100	74,830	77,660	78,950
Combustion with energy recovery**	0	400	2,700	29,700	33,730	33,650	34,130	33,400
Discards to landfill, other disposal†	82,510	112,640	134,420	142,270	134,800	131,890	135,510	133,310
	Pounds per Person per Day							
	1960	1970	1980	1990	2000	2003	2004	2005
Generation	2.68	3.25	3.66	4.50	4.63	4.53	4.61	4.54
Recovery for recycling	0.17	0.22	0.35	0.64	1.03	1.05	1.07	1.08
Recovery for composting*	Neg.	Neg.	Neg.	0.09	0.32	0.36	0.38	0.38
Total Materials Recovery	0.17	0.22	0.35	0.73	1.35	1.41	1.45	1.46
Combustion with energy recovery**	0.00	0.01	0.07	0.65	0.66	0.63	0.64	0.62
Discards to landfill, other disposal†	2.51	3.02	3.24	3.12	2.62	2.48	2.52	2.46
Population (thousands)	179,979	203,984	227,255	249,907	281,422	290,850	293,660	296,410
	Percent of Total Generation							
	1960	1970	1980	1990	2000	2003	2004	2005
Generation	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Recovery for recycling	6.4%	6.6%	9.6%	14.2%	22.2%	23.2%	23.1%	23.8%
Recovery for composting*	Neg.	Neg.	Neg.	2.0%	6.9%	7.9%	8.3%	8.4%
Total Materials Recovery	6.4%	6.6%	9.6%	16.2%	29.1%	31.1%	31.4%	32.1%
Combustion with energy recovery**	0.0%	0.3%	1.8%	14.5%	14.2%	14.0%	13.8%	13.6%
Discards to landfill, other disposal†	93.6%	93.1%	88.6%	69.3%	56.7%	54.9%	54.8%	54.3%

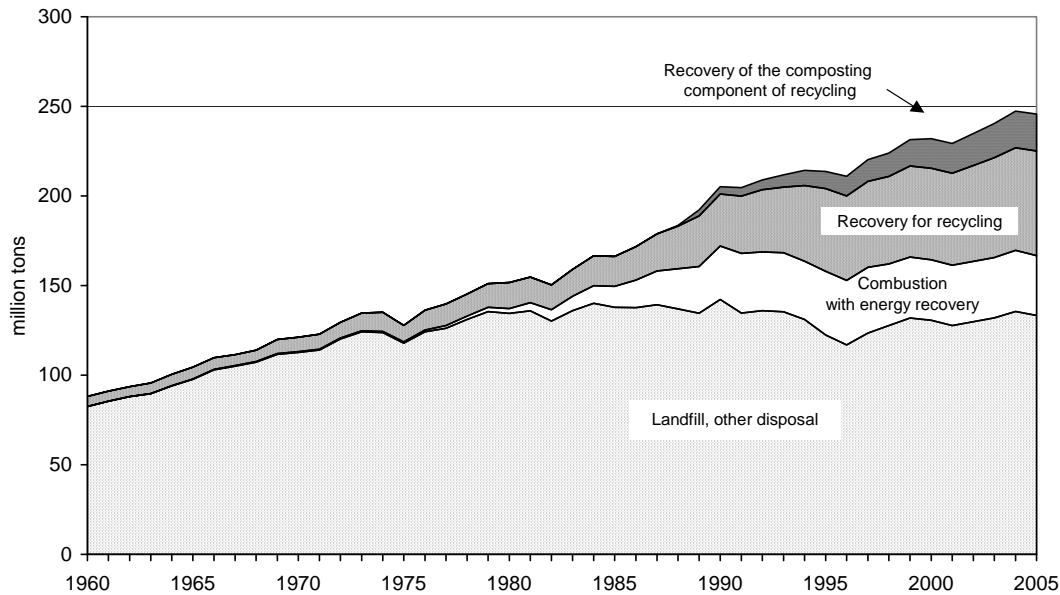
* Composting of yard trimmings, food scraps and other MSW organic material. Does not include backyard composting.

** Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets and tire-derived fuel).

† Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery. Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Figure 26. Municipal solid waste management, 1960 to 2005



Source: Franklin Associates, A Division of ERG

Historically, municipal solid waste generation has grown steadily (from 88 million tons in 1960 to 246 million tons at present). In the 1960s and early 1970s a large percentage of MSW was burned, with little recovery for recycling. Landfill disposal typically consisted of open dumping, often accompanied with open burning of the waste for volume reduction. Through the mid-1980s, incineration declined considerably and landfills became difficult to site, and waste generation continued to increase. Materials recovery rates increased very slowly in this time period, and the burden on the nation's landfills grew dramatically. As Figure 26 shows, discards of MSW to landfill or other disposal apparently peaked in 1990, then began to decline as materials recovery and combustion with energy recovery increased.

Recovery has increased steadily. Combustion with energy recovery, as a percentage of generation, has been declining (13.6 percent of generation in 2005). MSW discards to landfills rose to about 135.5 million tons in 2004, and then declined to 133.3 million tons in 2005. As a percentage of total MSW generation, discards to landfills or other disposal has consistently decreased—from 89 percent of generation in 1980 to 54.3 percent in 2005.

CHAPTER 3**REFERENCES****GENERAL**

Franklin Associates, Ltd. *Solid Waste Management at the Crossroads*. December 1997.

U.S. Bureau of the Census. *Statistical Abstract of the United States*. Various years.

U.S. Environmental Protection Agency, Municipal Solid Waste Task Force, Office of Solid Waste. *The Solid Waste Dilemma: An Agenda for Action*. February 1989.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1990 Update*. EPA/530-SW-90-042. June 1991.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1992 Update*. EPA/530-R-92-019. July 1992.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1994 Update*. EPA/530-R-94-042. November 1994.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1995 Update*. EPA/530-R-945-001. March 1996.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1996 Update*. EPA/530-R-97-015. June 1997.

U.S. Environmental Protection Agency. *Characterization of Municipal Solid Waste in the United States: 1997 Update*. EPA/530-R-98-007. May 1998.

U.S. Environmental Protection Agency. *Municipal Solid Waste in the United States: 1999 Facts and Figures*. EPA/530-R-01-014. July 2001.

U.S. Environmental Protection Agency. *Municipal Solid Waste in the United States: 2000 Facts and Figures*. EPA/530-R-02-001. June 2002.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2001 Facts and Figures*. EPA/530-R-03-011. October 2003.

SOURCE REDUCTION

Congress of the United States, Office of Technology Assessment. *Green Products by Design: Choices for a Cleaner Environment*. OTA-E-541. October 1992.

Council on Packaging in the Environment. "COPE Backgrounder: Source Reduction." March 1995.

Franklin Associates, Ltd. *Materials Technology: Packaging Design and the Environment*. Congress of the United States, Office of Technology Assessment. April 1991.

Franklin Associates, Ltd. *The Role of Recycling in Integrated Solid Waste Management to the Year 2000*. Keep America Beautiful, Inc. 1994.

Rattray, Tom. "Source Reduction—An Endangered Species?" *Resource Recycling*. November 1990.

Raymond Communications Inc. *State Recycling Laws Update Year-End Edition 1998*.

U.S. Environmental Protection Agency. *The Consumer's Handbook for Reducing Solid Waste*. EPA/530-K-92-003. August 1992.

U.S. Environmental Protection Agency. *Waste Wise: Second Year Progress Report*. EPA/530-R-96-016. September 1996.

RECOVERY FOR RECYCLING AND COMPOSTING

Block, Dave, and Nora Goldstein. "Solid Waste Composting Trends in the U.S." *BioCycle*. November 2000.

Glenn, Jim. "The State of Garbage in America." *BioCycle*. April 1998.

Glenn, Jim. "MSW Composting in the United States." *BioCycle*. November 1997.

Glenn, Jim. "The State of Garbage in America." *BioCycle*. April 1998.

Goldstein, Nora, and Celeste Madtes. "The State of Garbage in America." *BioCycle*. November 2000.

Goldstein, Nora. "The State of Garbage in America." *BioCycle*. December 2001.

Governmental Advisory Associates. *The Materials Recycling and Processing Industry in the United States: 1995-96 Yearbook, Atlas, and Directory*. 1995.

Governmental Advisory Associates. *1997 Update to the Materials Recycling and Processing Industry in the United States*. 1997.

Governmental Advisory Associates. Communications with Franklin Associates. 1998, 2002.

Governmental Advisory Associates. Custom report. 2006.

Kreith, Frank. *Handbook of Solid Waste Management*. McGraw-Hill, Inc. 1994.

Personal communication with California Integrated Waste Management staff. August 2006.

Personal communication with a representative of the Illinois Recycling Association. August 2006.

Simmons, Phil, et al. "The State of Garbage in America." *BioCycle*. April 2006.

The Composting Council. "MSW Composting Facilities." Fall 1995.

U.S. Department of Commerce, Bureau of the Census. *Statistical Abstract of the United States*. Various years.

COMBUSTION WITH ENERGY RECOVERY

"1991-1992 Energy-From-Waste Report." *Solid Waste & Power*. HCI Publications. October 1991, December 1990.

Integrated Waste Services Association. "High Court Rules Ash Not Exempt from Subtitle C Regulation." *Update*. Summer 1994.

Integrated Waste Services Association. *The IWSA Directory of Waste-to-Energy Plants*. Various years.

Kiser, Jonathan V.L. "A Comprehensive Report on the Status of Municipal Waste Combustion." *Waste Age*. November 1990.

Kiser, Jonathan V.L. "Municipal Waste Combustion in North America: 1992 Update." *Waste Age*. November 1992.

Kiser, Jonathan V.L. "The 1992 Municipal Waste Combustion Guide." National Solid Wastes Management Association. February 1992.

Kiser, Jonathan V.L. "The IWSA Municipal Waste Combustion Directory: 1993." Integrated Waste Services Association. February 1994.

Kiser, Jonathan V.L., and John Menapace. "The 1995 IWSA Municipal Waste Combustion Directory of United States Facilities." Integrated Waste Services Association. March 1995.

Kiser, Jonathan V.L., and John Menapace. "The 1996 IWSA Municipal Waste Combustion Directory of United States Facilities." Integrated Waste Services Association. March 1996.

Rigo, Greg and Maria Zannes. "The 1997-1998 IWSA Waste-to-Energy Director of United States Facilities." Integrated Waste Services Association. November 1997.

Levy, Steven J. *Municipal Waste Combustion Inventory*. U.S. Environmental Protection Agency, Office of Solid Waste, Municipal & Industrial Solid Waste Division. November 22, 1991.

National Solid Wastes Management Association. "The 1992 Municipal Waste Combustion Guide." *Waste Age*. November 1992.

"The 1991 Municipal Waste Combustion Guide." *Waste Age*. November 1991.

APPENDIX A

MATERIALS FLOW METHODOLOGY

The materials flow methodology is illustrated in Figures A-1 and A-2. The crucial first step is making estimates of the generation of the materials and products in MSW (Figure A-1).

DOMESTIC PRODUCTION

Data on domestic production of materials and products were compiled using published data series. U.S. Department of Commerce sources were used where available, but in several instances more detailed information on production of goods by end use is available from industry associations. The goal is to obtain a consistent historical data series for each product and/or material.

CONVERTING SCRAP

The domestic production numbers were then adjusted for converting or fabrication scrap generated in the production processes. Examples of these kinds of scrap would be clippings from plants that make boxes from paperboard, glass scrap (cullet) generated in a glass bottle plant, or plastic scrap from a fabricator of plastic consumer products. This scrap typically has a high value because it is clean and readily identifiable, and it is almost always recovered and recycled within the industry that generated it. Thus, recovered converting/fabrication scrap is *not* counted as part of the postconsumer recovery of waste.

ADJUSTMENTS FOR IMPORTS/EXPORTS

In some instances imports and exports of products are a significant part of MSW, and adjustments were made to account for this.

DIVERSION

Various adjustments were made to account for diversions from MSW. Some consumer products are permanently diverted from the municipal waste stream because of the way they are used. For example, some paperboard is used in building materials, which are not counted as MSW. Another example of diversion is toilet tissue, which is disposed in sewer systems rather than becoming MSW.

In other instances, products are temporarily diverted from the municipal waste stream. For example, textiles reused as rags are assumed to enter the waste stream the same year the textiles are initially discarded.

ADJUSTMENTS FOR PRODUCT LIFETIME

Some products (e.g., newspapers and packaging) normally have a very short lifetime; these products are assumed to be discarded in the same year they are produced. In other instances (e.g., furniture and appliances), products have relatively long lifetimes. Data on average product lifetimes are used to adjust the data series to account for this.

RECOVERY

Data on recovery of materials and products for recycling are compiled using industry data adjusted, when appropriate, with U.S. Department of Commerce import/export data. Recovery estimates of yard trimmings or food scraps for composting are developed from data provided by state officials.

DISCARDS

Mathematically, discards equal that portion of generation remaining after recovery for recycling and composting. Discards can be disposed through combustion with or without energy recovery or landfilling. The amount of MSW consumed at combustion facilities with energy recovery is estimated, and the difference between total discards and the amount sent to combustion for energy recovery is assumed to be landfilled or combusted without energy recovery. (This assumption is not quite accurate, as some MSW is littered or disposed on-site, e.g., by backyard burning. These amounts are believed to be a small fraction of total discards.)

MUNICIPAL SOLID WASTE GENERATION, RECOVERY, AND DISCARDS

The result of these estimates and calculations is a material-by-material and product-by-product estimate of MSW generation, recovery, and discards.

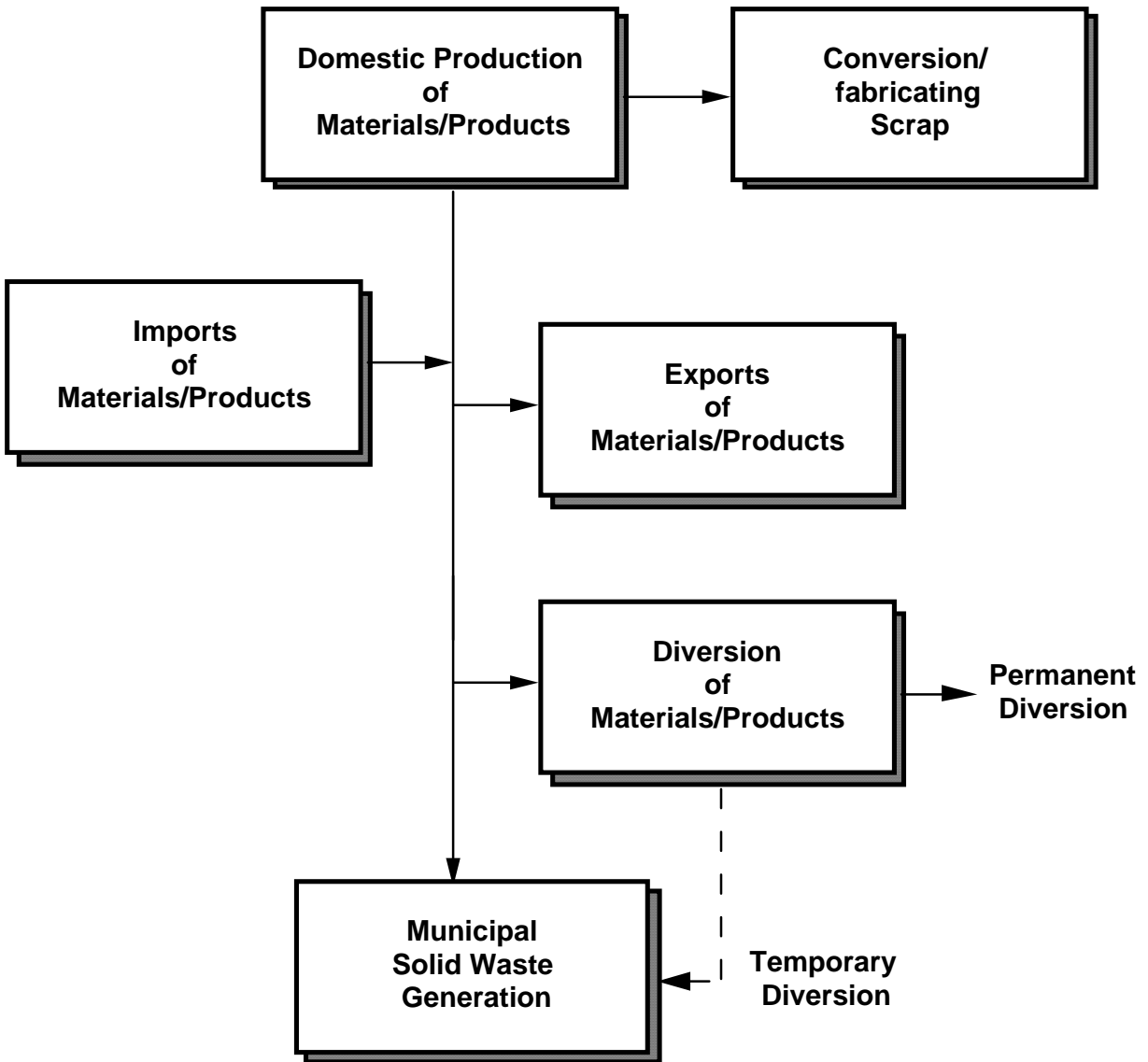


Figure A-1. Material flows methodology for estimating generation of products and materials in municipal solid waste.

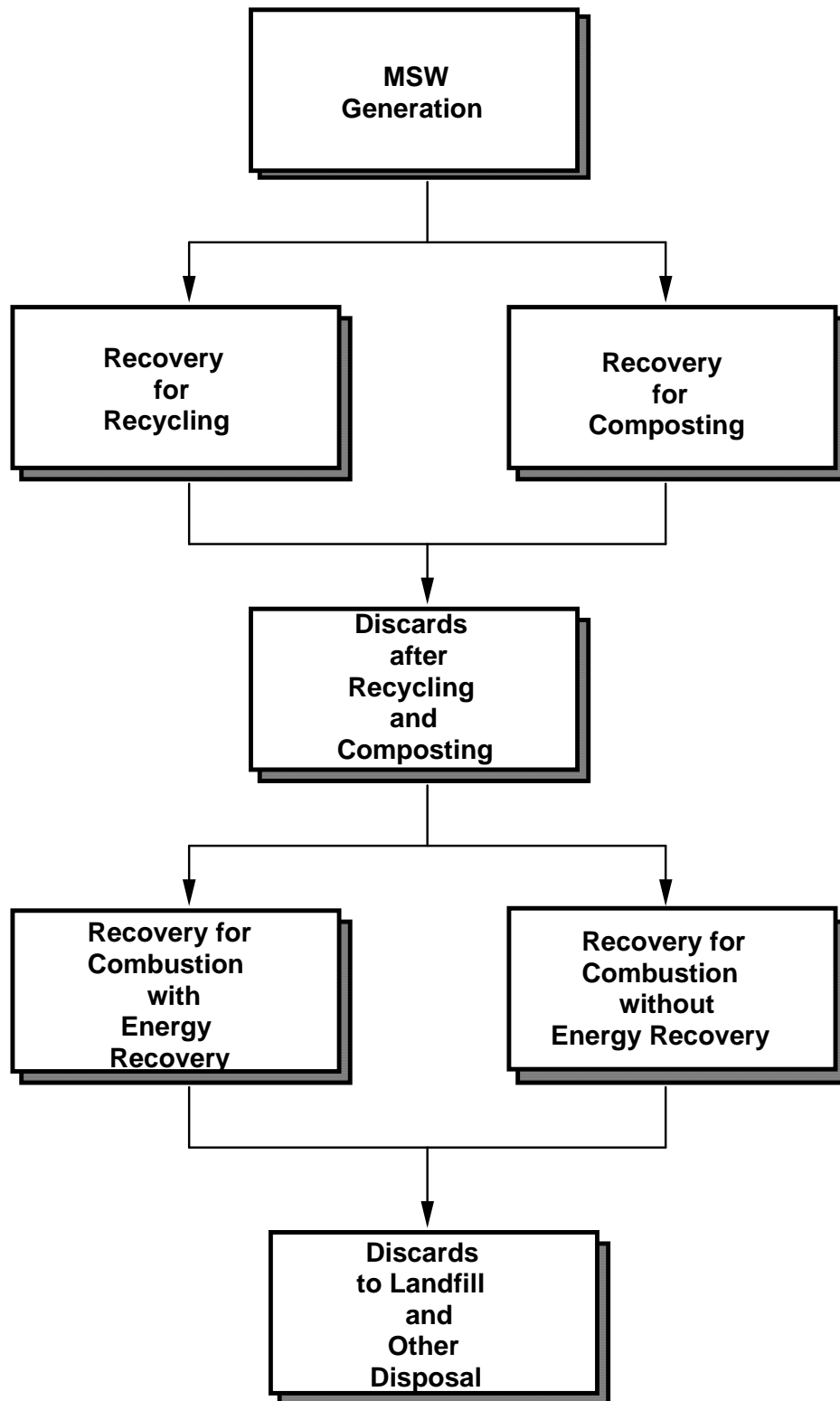


Figure A-2. Material flows methodology for estimating discards of products and materials in municipal solid waste.



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