

MUNICIPAL SOLID WASTE IN THE UNITED STATES



2007 FACTS AND FIGURES



**MUNICIPAL SOLID WASTE IN
THE UNITED STATES:
2007 FACTS AND FIGURES**

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**MUNICIPAL SOLID WASTE
IN THE UNITED STATES: 2007 FACTS AND FIGURES**

EXECUTIVE SUMMARY

OVERVIEW

This report describes the national municipal solid waste (MSW) stream based on data collected for 1960 through 2007. 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 254 million tons of MSW in 2007—similar to the amount generated in 2006. Excluding composting, the amount of MSW recycled increased to 63.3 million tons, an increase of 1.9 million tons from 2006. This is a 3 percent increase in the tons recycled. The tons recovered for composting rose to 21.7 million tons in 2007, up from 20.8 million tons in 2006. The recovery rate for recycling (including composting) was 33.4 percent in 2007, up from 32.3 percent in 2006. (See Tables ES-1 and ES-2 and Figures ES-1 and ES-2.)

MSW generation in 2007 declined to 4.62 pounds per person per day. This is a decrease of 0.6 percent from 2006 to 2007. The recycling rate in 2007 was 1.54 pounds per person per day (an increase of 2.7 percent over 2006). Discards sent for combustion with energy recovery remained steady at 0.58 pounds per person per day. Discards sent to landfills after recycling and combustion with energy recovery declined to 2.50 pounds per person per day in 2007. This is a decrease of 2.7 percent from 2006 to 2007 (Table ES-3).

Table ES-1
GENERATION, MATERIALS RECOVERY, COMPOSTING,
COMBUSTION WITH ENERGY RECOVERY, AND DISCARDS OF MUNICIPAL SOLID WASTE,
1960 - 2007
(in millions of tons)

| Activity | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
|--|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Generation | 88.1 | 121.1 | 151.6 | 205.2 | 239.1 | 249.8 | 250.4 | 254.2 | 254.1 |
| Recovery for recycling | 5.6 | 8.0 | 14.5 | 29.0 | 52.9 | 57.5 | 58.8 | 61.4 | 63.3 |
| Recovery for composting* | Neg. | Neg. | Neg. | 4.2 | 16.5 | 20.5 | 20.6 | 20.8 | 21.7 |
| Total materials recovery | 5.6 | 8.0 | 14.5 | 33.2 | 69.4 | 78.0 | 79.4 | 82.2 | 85.0 |
| Combustion with energy recovery† | 0.0 | 0.4 | 2.7 | 29.7 | 33.7 | 31.5 | 31.6 | 31.9 | 31.9 |
| Discards to landfill, other disposal‡ | 82.5 | 112.7 | 134.4 | 142.3 | 136.0 | 140.3 | 139.4 | 140.1 | 137.2 |

* 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). See Table 29 footnote for more detail.

‡ 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 - 2007
(in percent of total generation)

| Activity | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Generation | 100.0% | 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% | 22.1% | 23.0% | 23.5% | 24.1% | 24.9% |
| Recovery for composting* | Neg. | Neg. | Neg. | 2.0% | 6.9% | 8.2% | 8.2% | 8.2% | 8.5% |
| Total materials recovery | 6.4% | 6.6% | 9.6% | 16.2% | 29.0% | 31.2% | 31.7% | 32.3% | 33.4% |
| Combustion with energy recovery† | 0.0% | 0.3% | 1.8% | 14.5% | 14.1% | 12.6% | 12.6% | 12.6% | 12.6% |
| Discards to landfill, other disposal‡ | 93.6% | 93.1% | 88.6% | 69.3% | 56.9% | 56.2% | 55.7% | 55.1% | 54.0% |

* 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). See Table 29 footnote for more detail.

‡ 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 - 2007
(in pounds per person per day)**

| Activity | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Generation | 2.68 | 3.25 | 3.66 | 4.50 | 4.65 | 4.66 | 4.63 | 4.65 | 4.62 |
| Recovery for recycling | 0.17 | 0.22 | 0.35 | 0.64 | 1.03 | 1.07 | 1.09 | 1.12 | 1.15 |
| Recovery for composting* | Neg. | Neg. | Neg. | 0.09 | 0.32 | 0.38 | 0.38 | 0.38 | 0.39 |
| Total materials recovery | 0.17 | 0.22 | 0.35 | 0.73 | 1.35 | 1.45 | 1.47 | 1.50 | 1.54 |
| Combustion with energy recovery† | 0.00 | 0.01 | 0.07 | 0.65 | 0.66 | 0.59 | 0.58 | 0.58 | 0.58 |
| Discards to landfill, other disposal‡ | 2.51 | 3.02 | 3.24 | 3.12 | 2.64 | 2.62 | 2.58 | 2.57 | 2.50 |
| Population (millions) | 179.979 | 203.984 | 227.255 | 249.907 | 281.422 | 293.660 | 296.410 | 299.398 | 301.621 |

* 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). See Table 29 footnote for more detail.
 ‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery.
 Details may not add to totals due to rounding.

**Figure ES-1: MSW Generation Rates,
1960 to 2007**

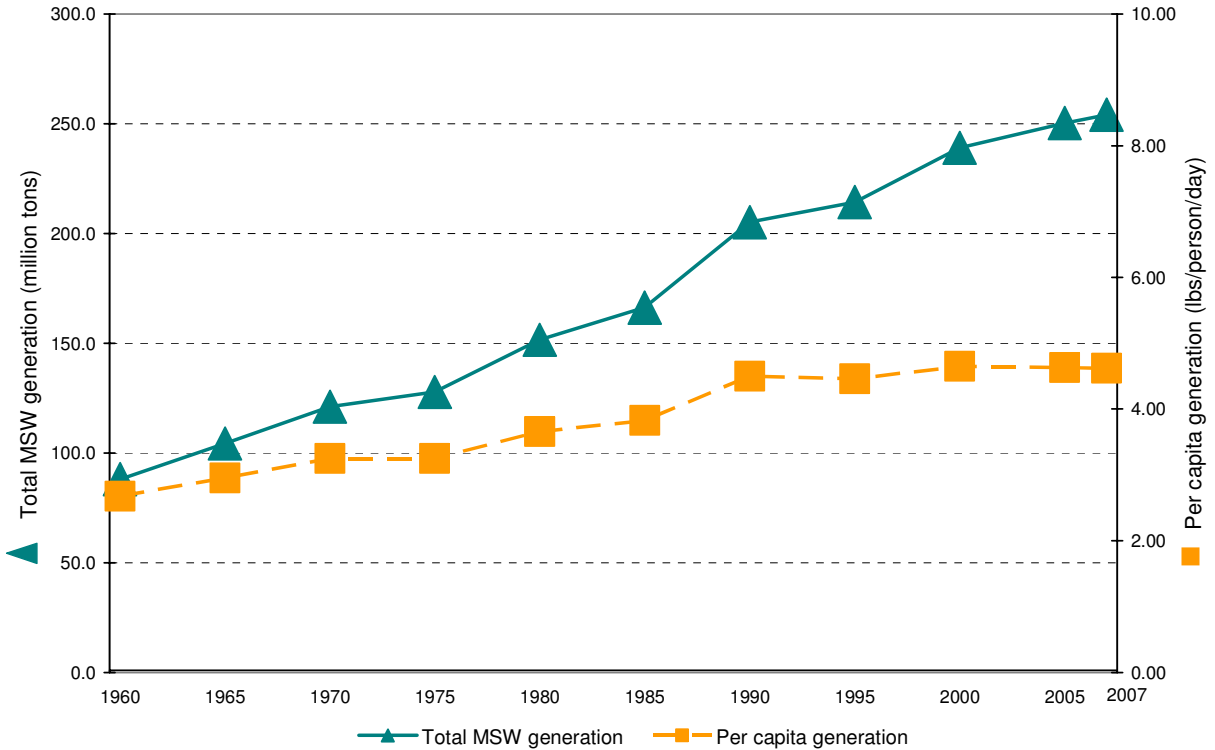
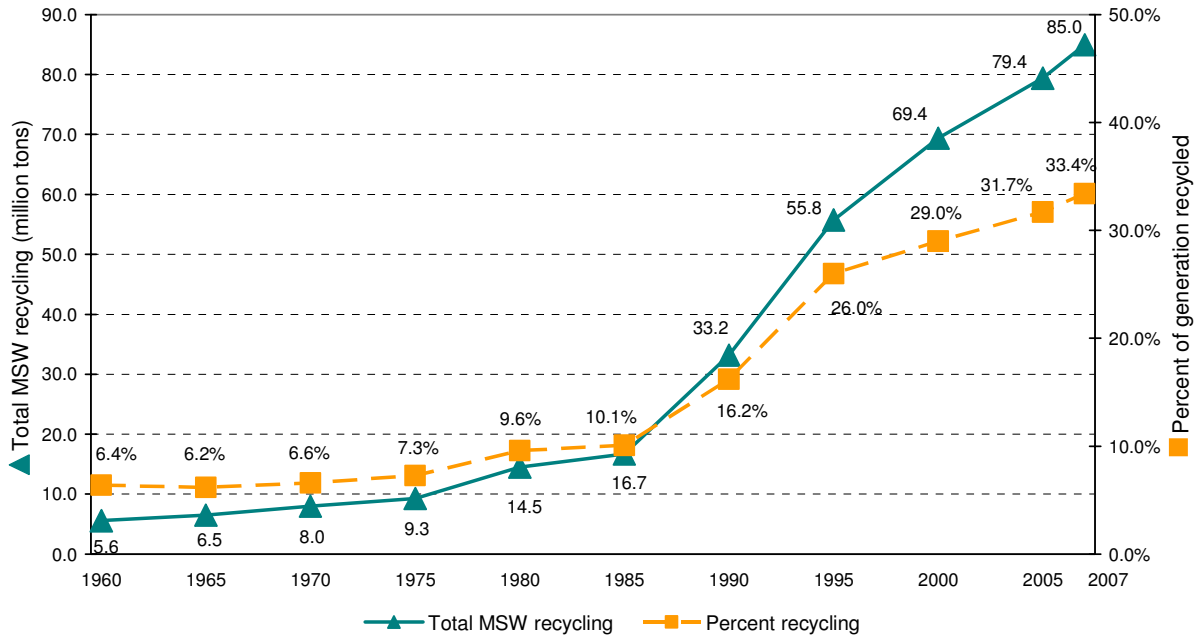


Figure ES-2: MSW Recycling Rates, 1960 to 2007



The state of the economy has a strong impact on consumption and waste generation. Waste generation increases during times of strong economic growth and decreases during times of economic decline.

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 materials, 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). Annual MSW generation has continued to increase from 1960, when it was 88 million tons. The generation rate in 1960 was just 2.68 pounds per person per day; it grew to 3.66 pounds per person per day in 1980, reached 4.50 pounds per person per day in 1990, and increased to 4.65 pounds per person per day in 2000. Since 2000, MSW generation has remained fairly steady. The generation rate was 4.62 pounds per person per day in 2007.

Over time, recycling rates have increased from just over 6 percent of MSW generated in 1960 to about 10 percent in 1980, to 16 percent in 2000, and to over 29 percent in 2007. Disposal of waste to land has decreased from 94 percent of the amount generated in 1960 to 54 percent of the amount generated in 2007.

OVERVIEW

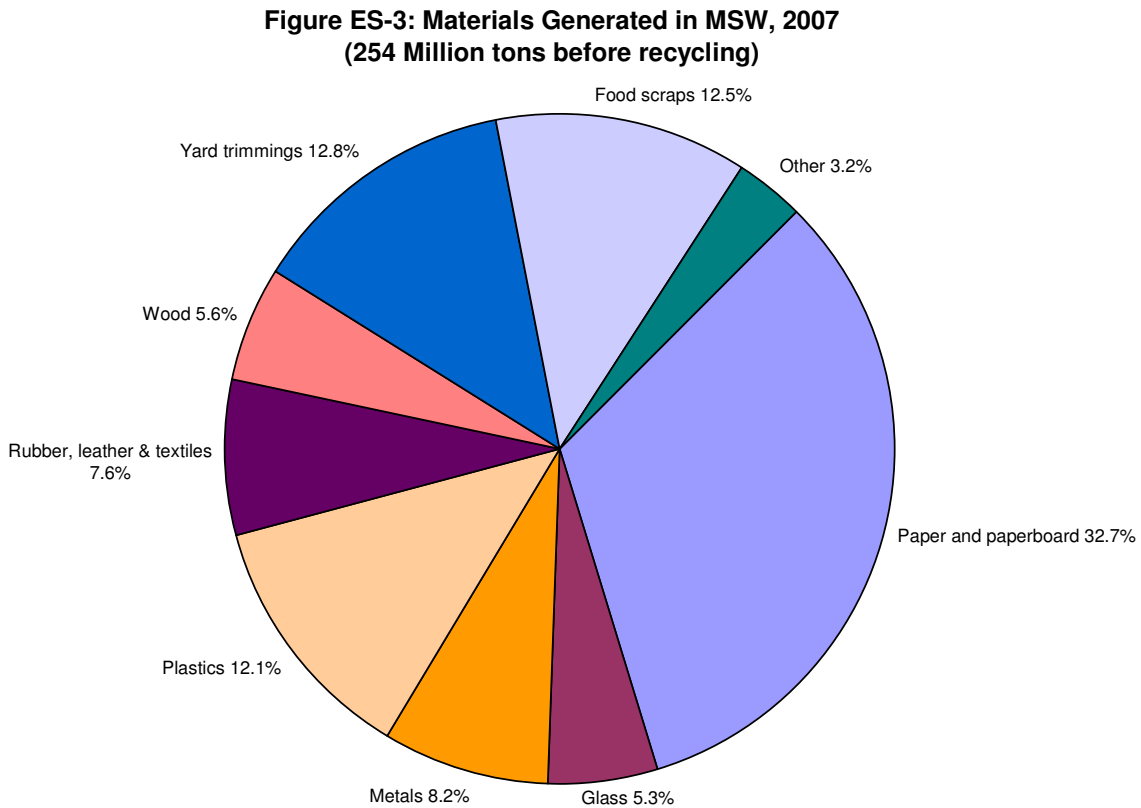
MUNICIPAL SOLID WASTE IN 2007

The U.S. Environmental Protection Agency (EPA) uses two methods to characterize the 254.1 million tons of MSW generated in 2007. 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. See Figure 1-B in Chapter 1 for product category definitions.

Materials in MSW

A breakdown, by weight, of the MSW **materials** generated in 2007 is provided in Figure ES-3. Paper and paperboard made up the largest component of MSW generated (32.7 percent),

yard trimmings were the second-largest component (12.8 percent) and food scraps were the third largest (12.5 percent). Glass, metals, plastics, and wood each constituted between 5 and 12 percent of the total MSW generated. Rubber, leather, and textiles combined made up 7.6 percent of MSW, while other miscellaneous wastes made up approximately 3 percent of the MSW generated in 2007.



A portion of each material category in MSW was recycled or composted in 2007. The highest rates of recovery were achieved with yard trimmings, paper and paperboard, and metals. About 64 percent (20.9 million tons) of yard trimmings was recovered for composting or mulching in 2007. This represents a five-fold increase since 1990. Over 54 percent (45.2 million tons) of paper and paperboard was recovered for recycling in 2007. Recycling these organic materials alone diverted 26 percent of municipal solid waste from landfills and combustion

facilities. In addition, about 7.2 million tons, or about 35 percent, of metals were recovered for recycling. Recycling rates for all materials categories in 2007 are listed in Table ES-4.

**Table ES-4
GENERATION AND RECOVERY OF MATERIALS IN MSW, 2007
(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 | 83.0 | 45.2 | 54.5% |
| Glass | 13.6 | 3.22 | 23.7% |
| Metals | | | |
| Steel | 15.6 | 5.28 | 33.8% |
| Aluminum | 3.35 | 0.73 | 21.8% |
| Other nonferrous metals* | 1.76 | 1.22 | 69.3% |
| <i>Total metals</i> | 20.8 | 7.23 | 34.8% |
| Plastics | 30.7 | 2.09 | 6.8% |
| Rubber and leather | 7.48 | 1.10 | 14.7% |
| Textiles | 11.9 | 1.90 | 15.9% |
| Wood | 14.2 | 1.32 | 9.3% |
| Other materials | 4.43 | 1.16 | 26.2% |
| <i>Total Materials in Products</i> | <i>186.1</i> | <i>63.3</i> | <i>34.0%</i> |
| Other wastes | | | |
| Food, other** | 31.7 | 0.81 | 2.6% |
| Yard trimmings | 32.6 | 20.9 | 64.1% |
| Miscellaneous inorganic wastes | 3.75 | Neg. | Neg. |
| <i>Total Other Wastes</i> | <i>68.0</i> | <i>21.7</i> | <i>31.9%</i> |
| <i>TOTAL MUNICIPAL SOLID WASTE</i> | <i>254.1</i> | <i>85.0</i> | <i>33.4%</i> |

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.

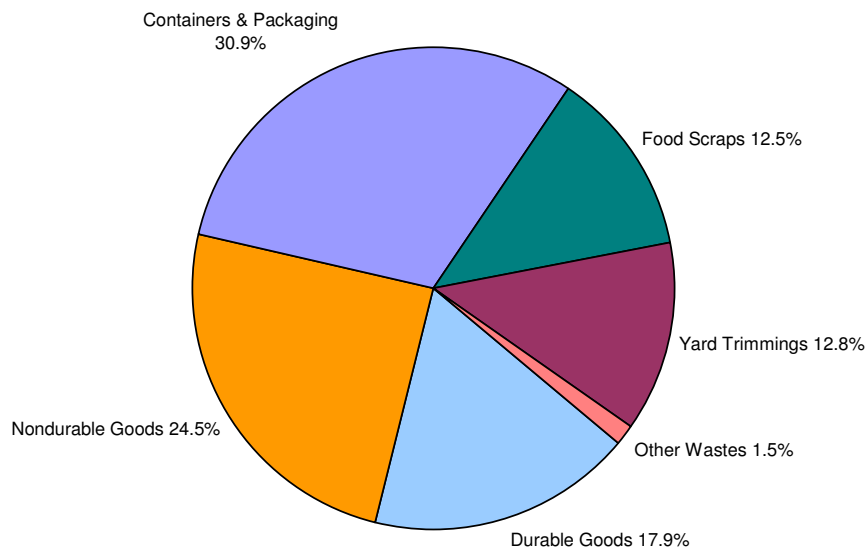
Neg. = Less than 5,000 tons or 0.05 percent.

Products in MSW

The breakdown, by weight, of **product categories** generated in MSW in 2007 is shown in Figure ES-4. Containers and packaging comprised the largest portion of products generated in

MSW, at about 31 percent (78.4 million tons). Nondurable goods were the second-largest fraction, at 24.5 percent (62.2 million tons). The third-largest category of products is durable goods, which made up 17.9 percent (45.4 million tons) of total MSW generation.

**Figure ES-4: Products Generated in MSW, 2007
(254 million tons before recycling)**



The generation and recovery of the product categories in MSW in 2007 are shown in Table ES-5. This table shows that recovery of containers and packaging was the highest of the three product categories—42.7 percent of containers and packaging generated in MSW in 2007 were recovered for recycling. About 49 percent of all aluminum cans in MSW was recovered (39 percent of all aluminum packaging, including foil), while 64.6 percent of steel packaging (mostly cans) in MSW was recovered. Paper and paperboard containers and packaging were recovered at a rate of 62.5 percent; corrugated containers accounted for most of that amount.

Table ES-5
GENERATION AND RECOVERY OF PRODUCTS IN MSW
BY MATERIAL, 2007
(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 | 13.0 | 3.55 | 27.3% |
| Aluminum | 1.26 | Neg. | Neg. |
| Other non-ferrous metals* | 1.76 | 1.22 | 69.3% |
| <i>Total metals</i> | 16.0 | 4.77 | 29.8% |
| Glass | 2.11 | Neg. | Neg. |
| Plastics | 10.4 | 0.50 | 4.8% |
| Rubber and leather | 6.48 | 1.10 | 17.0% |
| Wood | 5.63 | Neg. | Neg. |
| Textiles | 3.33 | 0.46 | 13.8% |
| Other materials | 1.41 | 1.16 | 82.3% |
| <i>Total durable goods</i> | 45.4 | 7.99 | 17.6% |
| Nondurable Goods | | | |
| Paper and paperboard | 43.1 | 20.3 | 47.1% |
| Plastics | 6.68 | Neg. | Neg. |
| Rubber and leather | 0.97 | Neg. | Neg. |
| Textiles | 8.34 | 1.44 | 17.3% |
| Other materials | 3.15 | Neg. | Neg. |
| <i>Total nondurable goods</i> | 62.2 | 21.8 | 35.0% |
| Containers and Packaging | | | |
| Steel | 2.68 | 1.73 | 64.6% |
| Aluminum | 1.87 | 0.73 | 39.0% |
| <i>Total metals</i> | 4.55 | 2.46 | 54.1% |
| Glass | 11.5 | 3.22 | 28.1% |
| Paper and paperboard | 39.9 | 24.9 | 62.4% |
| Plastics | 13.6 | 1.59 | 11.7% |
| Wood | 8.54 | 1.32 | 15.5% |
| Other materials | 0.31 | Neg. | Neg. |
| <i>Total containers and packaging</i> | 78.4 | 33.5 | 42.7% |
| Other Wastes | | | |
| Food, other** | 31.7 | 0.81 | 2.6% |
| Yard trimmings | 32.6 | 20.9 | 64.1% |
| Miscellaneous inorganic wastes | 3.75 | Neg. | Neg. |
| <i>Total other wastes</i> | 68.0 | 21.7 | 31.9% |
| TOTAL MUNICIPAL SOLID WASTE | 254.1 | 85.0 | 33.4% |

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.

Approximately 28 percent of glass containers in MSW were recovered, while about 16 percent of wood packaging (mostly wood pallets removed from service) was recovered for recycling. About 12 percent of plastic containers and packaging in MSW were recovered—mostly soft drink, milk, and water bottles.

Overall recovery of *nondurable goods* in MSW was at 35 percent in 2007. 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 77.8 percent of newspapers generated being recovered for recycling. An estimated 71.8 percent of high-grade office papers and 57.3 percent of other commercial printing was recovered in 2007. Newspaper, high-grade office paper, and other commercial printing recovery increased in percentage from 2006 to 2007.

Recovery percentages of the other paper products in the nondurable goods category also increased between 2006 and 2007, with standard mail* recovered at an estimated 40.3 percent, and magazines at an estimated 39.6 percent.

The nondurable goods category also includes clothing and other textile products—17.3 percent of these products were recovered for recycling or export in 2007.

Overall, *durable goods* were recovered at a rate of 17.6 percent in 2007. Nonferrous metals other than aluminum had one of the highest recovery rates, at 69.3 percent, due to the high rate of lead recovery from lead-acid batteries. Recovery of steel in all durable goods was 27.3 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 about 99 percent in 2007. Other products with particularly high recovery rates were newspapers (77.8 percent), corrugated boxes (73.6 percent), major appliances (67.1 percent), steel packaging (64.6 percent), and aluminum cans (48.6 percent). About 35 percent of rubber

tires in MSW were recovered for recycling. (Other tires were retreaded, and shredded rubber tires were made into tire-derived fuel.)

RESIDENTIAL AND COMMERCIAL 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, institutions, 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.

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

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

Our waste management hierarchy emphasizes 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).

Realizing the value of our resources, both financial and material, we have continued in our efforts to reduce waste generation.

Recycling

The second component of our waste management hierarchy is recycling, including off-site (or community) composting. Residential and commercial recycling turns materials and products that would otherwise become waste into valuable resources. Materials like glass, metal, plastics, paper, and yard trimmings are collected, separated, and sent to facilities that can process them into new materials or products.

- Recycling (including community composting) recovered 33.4 percent (85 million tons) of MSW generation in 2007.
- There were about 8,660 curbside recycling programs in the United States in 2006.
- In 2006, over 3,500 yard trimmings composting programs were reported.

Combustion with Energy Recovery

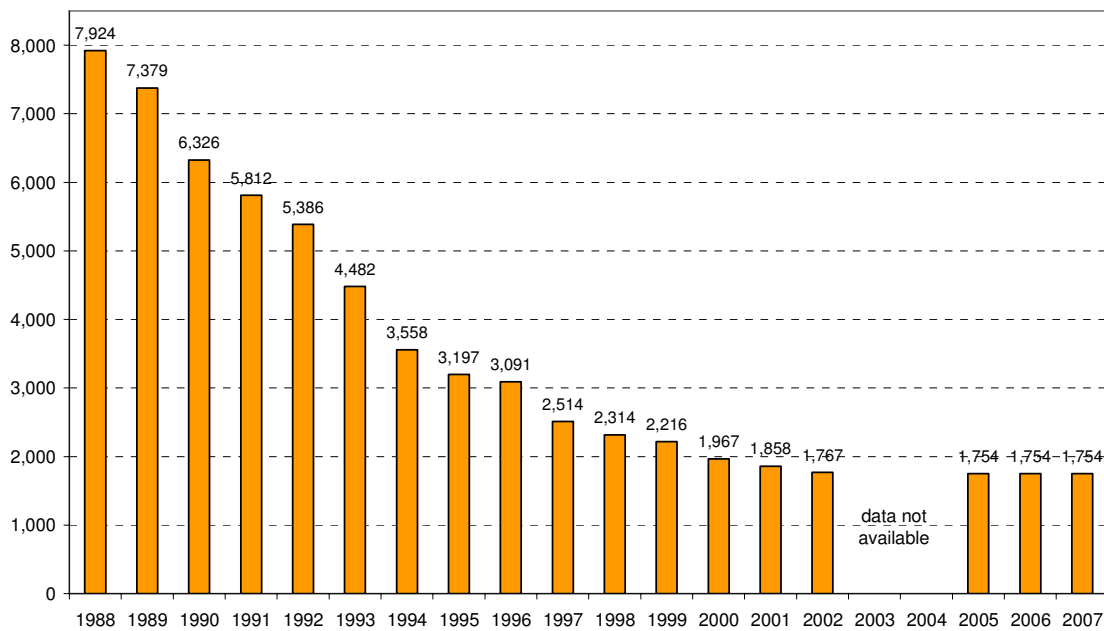
MSW combustion with energy recovery increased substantially between 1980 and 1990 (from 2.7 million tons in 1980 to 29.7 million tons in 1990). Since 1990, the quantity of MSW combusted with energy recovery has only increased slightly. An estimated 31.9 million tons (12.6 percent) of MSW was combusted with energy recovery in 2007 (see Tables ES-1 and ES-2), less than the 33.7 million tons estimated in 2000.

Disposal

During 2007, about 54 percent of MSW was landfilled, down somewhat from 55.1 percent in 2006. 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 1,754 in 2006—while average landfill size increased. At the national level, capacity does not appear to be a problem, although regional dislocations sometimes occur.

Figure ES-5: Number of Landfills in the United States, 1988-2007

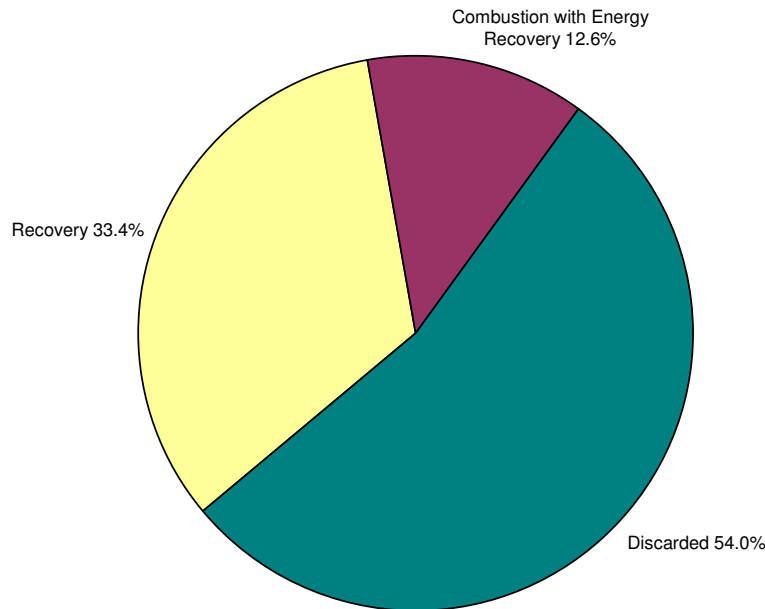


- The percentage of MSW landfilled decreased slightly from 2006 to 2007. Over time, the tonnage of MSW landfilled in 1990 was 142.3 million tons (see Table ES-1), but decreased to 136 million tons in 2000. The tonnage increased to 140.1 million tons in 2006, then declined to 137.2 in 2007. The tonnage landfilled results from an interaction among generation, recycling, and combustion with energy recovery, which do not necessarily rise and fall at the same time. In general, as recovery increases, discards decrease.

- In 2007, the net per capita discard rate (after materials recovery and combustion with energy recovery) was 2.50 pounds per person per day. The net per capita discard rate has decreased steadily since 1990. The 1990 rate was 3.12 pounds per person per day, the 2000 rate was 2.64 pounds per person per day, and the 2006 rate was 2.57 pounds per person per day (Table ES-3).

MSW management through recovery for recycling (including composting), combustion with energy recovery, and discard to disposal in 2007 is shown in Figure ES-6. In 2007, 85 millions tons (33.4 percent) of MSW were recycled, 31.9 million tons (12.6 percent) were combusted with energy recovery, and 137.2 million tons (54 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.)

Figure ES-6: Management of MSW in the United States, 2007



THE BENEFITS OF RECYCLING

Recycling has environmental benefits at every stage in the life cycle of a consumer product—from the raw material with which it's made to its final method of disposal. Aside from reducing GHG emissions, which contribute to global warming, recycling also reduces air and water pollution associated with making new products from raw materials. By utilizing used, unwanted, or obsolete materials as industrial feedstocks or for new materials or products, we can each do our part to make recycling work.

Nationally, we recycled 85 million tons of MSW. This provides an annual benefit of 193 million metric tons of carbon dioxide equivalent emissions reduced, comparable to removing the emissions from 35 million passenger cars. But the ultimate benefits from recycling are cleaner land, air, and water, overall better health, and a more sustainable economy.

The benefits of recycling and composting, such as elimination of GHG emissions, are calculated using EPA's WARM methodology. Please see: www.epa.gov/warm.

FOR FURTHER INFORMATION

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

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 47-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 management through combustion with energy recovery and landfilling 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.

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. The report 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 purposes 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 and the press. 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, and commercial sources such as restaurants and small businesses. 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. National data are also useful in areas where appropriate adjustments in the data can be made to account for regional conditions as mentioned above.

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 because site-specific approaches are problematic for national estimates.

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 other factors. 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 lead-acid 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-A: 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-B: Definition of Terms

The materials flow methodology produces an estimate of total municipal solid waste generation, recovery, and discards in the United States by materials 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 or 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 or composting. These discards presumably would be combusted with or 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.

For the analysis of municipal solid waste, products are divided into three basic categories: durable goods, nondurable goods, and containers and packaging. The durable goods and nondurable goods categories generally follow the definitions of the U.S. Department of Commerce.

Durable goods are those products that last 3 years or more. Products in this category include major and small appliances, furniture and furnishings, carpets and rugs, tires, lead-acid batteries, consumer electronics, and other miscellaneous durables.

Nondurable goods are those products that last less than 3 years. Products in this category include newspapers, books, magazines, office papers, directories, mail, other commercial printing, tissue paper and towels, paper and plastic plates and cups, trash bags, disposable diapers, clothing and footwear, towels, sheets and pillowcases, other nonpackaging paper, and other miscellaneous nondurables.

Containers and packaging are assumed to be discarded the same year the products they contain are purchased. Products in this category include bottles, containers, corrugated boxes, milk cartons, folding cartons, bags, sacks, and wraps, wood packaging, and other miscellaneous packaging.

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 2007 MSW generation, recovery, and discards of products in each material category are included.

In Chapter 3 of the report, estimates of MSW management by the various alternatives are summarized. These include recovery for recycling and 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.

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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 2007. The data presented also incorporate some revisions to previously reported data for 2000 through 2006. The revisions are generally due to 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 are 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 Figure 1-B in 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 these data over time. A snapshot, by material, for 2007 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 2007
(In thousands of tons and percent of total generation)

| | Thousands of Tons | | | | | | | | |
|-------------------------------------|-----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Materials | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Paper and Paperboard | 29,990 | 44,310 | 55,160 | 72,730 | 87,740 | 86,450 | 84,840 | 85,350 | 83,010 |
| Glass | 6,720 | 12,740 | 15,130 | 13,100 | 12,760 | 12,890 | 13,320 | 13,520 | 13,580 |
| Metals | | | | | | | | | |
| Ferrous | 10,300 | 12,360 | 12,620 | 12,640 | 14,110 | 14,990 | 14,990 | 15,500 | 15,640 |
| Aluminum | 340 | 800 | 1,730 | 2,810 | 3,200 | 3,280 | 3,330 | 3,400 | 3,350 |
| Other Nonferrous | 180 | 670 | 1,160 | 1,100 | 1,600 | 1,710 | 1,740 | 1,760 | 1,760 |
| <i>Total Metals</i> | <i>10,820</i> | <i>13,830</i> | <i>15,510</i> | <i>16,550</i> | <i>18,910</i> | <i>19,980</i> | <i>20,060</i> | <i>20,660</i> | <i>20,750</i> |
| Plastics | 390 | 2,900 | 6,830 | 17,130 | 25,540 | 29,480 | 29,240 | 29,810 | 30,730 |
| Rubber and Leather | 1,840 | 2,970 | 4,200 | 5,790 | 6,710 | 7,150 | 7,360 | 7,400 | 7,480 |
| Textiles | 1,760 | 2,040 | 2,530 | 5,810 | 9,440 | 10,980 | 11,380 | 11,870 | 11,920 |
| Wood | 3,030 | 3,720 | 7,010 | 12,210 | 13,110 | 13,890 | 14,080 | 14,100 | 14,210 |
| Other ** | 70 | 770 | 2,520 | 3,190 | 4,000 | 4,130 | 4,170 | 4,310 | 4,430 |
| Total Materials in Products | 54,620 | 83,280 | 108,890 | 146,510 | 178,210 | 184,950 | 184,450 | 187,020 | 186,110 |
| Other Wastes | | | | | | | | | |
| Food Scraps | 12,200 | 12,800 | 13,000 | 20,800 | 26,810 | 29,410 | 30,220 | 31,040 | 31,650 |
| Yard Trimmings | 20,000 | 23,200 | 27,500 | 35,000 | 30,530 | 31,770 | 32,070 | 32,400 | 32,630 |
| Miscellaneous Inorganic Wastes | 1,300 | 1,780 | 2,250 | 2,900 | 3,500 | 3,650 | 3,690 | 3,720 | 3,750 |
| Total Other Wastes | 33,500 | 37,780 | 42,750 | 58,700 | 60,840 | 64,830 | 65,980 | 67,160 | 68,030 |
| Total MSW Generated - Weight | 88,120 | 121,060 | 151,640 | 205,210 | 239,050 | 249,780 | 250,430 | 254,180 | 254,140 |
| | Percent of Total Generation | | | | | | | | |
| Materials | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Paper and Paperboard | 34.0% | 36.6% | 36.4% | 35.4% | 36.7% | 34.6% | 33.9% | 33.6% | 32.7% |
| Glass | 7.6% | 10.5% | 10.0% | 6.4% | 5.3% | 5.2% | 5.3% | 5.3% | 5.3% |
| Metals | | | | | | | | | |
| Ferrous | 11.7% | 10.2% | 8.3% | 6.2% | 5.9% | 6.0% | 6.0% | 6.1% | 6.2% |
| Aluminum | 0.4% | 0.7% | 1.1% | 1.4% | 1.3% | 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% | 0.7% |
| <i>Total Metals</i> | <i>12.3%</i> | <i>11.4%</i> | <i>10.2%</i> | <i>8.1%</i> | <i>7.9%</i> | <i>8.0%</i> | <i>8.0%</i> | <i>8.1%</i> | <i>8.2%</i> |
| Plastics | 0.4% | 2.4% | 4.5% | 8.3% | 10.7% | 11.8% | 11.7% | 11.7% | 12.1% |
| Rubber and Leather | 2.1% | 2.5% | 2.8% | 2.8% | 2.8% | 2.9% | 2.9% | 2.9% | 2.9% |
| Textiles | 2.0% | 1.7% | 1.7% | 2.8% | 3.9% | 4.4% | 4.5% | 4.7% | 4.7% |
| Wood | 3.4% | 3.1% | 4.6% | 6.0% | 5.5% | 5.6% | 5.6% | 5.5% | 5.6% |
| Other ** | 0.1% | 0.6% | 1.7% | 1.6% | 1.7% | 1.7% | 1.7% | 1.7% | 1.7% |
| Total Materials in Products | 62.0% | 68.8% | 71.8% | 71.4% | 74.5% | 74.0% | 73.7% | 73.6% | 73.2% |
| Other Wastes | | | | | | | | | |
| Food Scraps | 13.8% | 10.6% | 8.6% | 10.1% | 11.2% | 11.8% | 12.1% | 12.2% | 12.5% |
| Yard Trimmings | 22.7% | 19.2% | 18.1% | 17.1% | 12.8% | 12.7% | 12.8% | 12.7% | 12.8% |
| Miscellaneous Inorganic Wastes | 1.5% | 1.5% | 1.5% | 1.4% | 1.5% | 1.5% | 1.5% | 1.5% | 1.5% |
| Total Other Wastes | 38.0% | 31.2% | 28.2% | 28.6% | 25.5% | 26.0% | 26.3% | 26.4% | 26.8% |
| Total MSW Generated - % | 100.0% | 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 2007
(In thousands of tons and percent of generation of each material)

| Materials | Thousands of Tons | | | | | | | | |
|-------------------------------------|--|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Paper and Paperboard | 5,080 | 6,770 | 11,740 | 20,230 | 37,560 | 40,730 | 41,960 | 43,830 | 45,240 |
| Glass | 100 | 160 | 750 | 2,630 | 2,880 | 2,730 | 2,800 | 2,880 | 3,220 |
| Metals | | | | | | | | | |
| Ferrous | 50 | 150 | 370 | 2,230 | 4,680 | 5,160 | 5,030 | 5,260 | 5,280 |
| Aluminum | Neg. | 10 | 310 | 1,010 | 860 | 710 | 690 | 690 | 730 |
| Other Nonferrous | Neg. | 320 | 540 | 730 | 1,060 | 1,190 | 1,200 | 1,220 | 1,220 |
| <i>Total Metals</i> | <i>50</i> | <i>480</i> | <i>1,220</i> | <i>3,970</i> | <i>6,600</i> | <i>7,060</i> | <i>6,920</i> | <i>7,170</i> | <i>7,230</i> |
| Plastics | Neg. | Neg. | 20 | 370 | 1,480 | 1,720 | 1,760 | 2,050 | 2,090 |
| Rubber and Leather | 330 | 250 | 130 | 370 | 820 | 1,090 | 1,100 | 1,090 | 1,100 |
| Textiles | 50 | 60 | 160 | 660 | 1,320 | 1,780 | 1,850 | 1,880 | 1,900 |
| Wood | Neg. | Neg. | Neg. | 130 | 1,240 | 1,290 | 1,310 | 1,310 | 1,320 |
| Other ** | Neg. | 300 | 500 | 680 | 980 | 1,120 | 1,140 | 1,170 | 1,160 |
| Total Materials in Products | 5,610 | 8,020 | 14,520 | 29,040 | 52,880 | 57,520 | 58,840 | 61,380 | 63,260 |
| Other Wastes | | | | | | | | | |
| Food Scraps | Neg. | Neg. | Neg. | Neg. | 680 | 660 | 690 | 680 | 810 |
| Yard Trimmings | Neg. | Neg. | Neg. | 4,200 | 15,770 | 19,810 | 19,860 | 20,100 | 20,900 |
| Miscellaneous Inorganic Wastes | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Other Wastes | Neg. | Neg. | Neg. | 4,200 | 16,450 | 20,470 | 20,550 | 20,780 | 21,710 |
| Total MSW Recovered - Weight | 5,610 | 8,020 | 14,520 | 33,240 | 69,330 | 77,990 | 79,390 | 82,160 | 84,970 |
| Materials | Percent of Generation of Each Material | | | | | | | | |
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Paper and Paperboard | 16.9% | 15.3% | 21.3% | 27.8% | 42.8% | 47.1% | 49.5% | 51.4% | 54.5% |
| Glass | 1.5% | 1.3% | 5.0% | 20.1% | 22.6% | 21.2% | 21.0% | 21.3% | 23.7% |
| Metals | | | | | | | | | |
| Ferrous | 0.5% | 1.2% | 2.9% | 17.6% | 33.2% | 34.4% | 33.6% | 33.9% | 33.8% |
| Aluminum | Neg. | 1.3% | 17.9% | 35.9% | 26.9% | 21.6% | 20.7% | 20.3% | 21.8% |
| Other Nonferrous | Neg. | 47.8% | 46.6% | 66.4% | 66.3% | 69.6% | 69.0% | 69.3% | 69.3% |
| <i>Total Metals</i> | <i>0.5%</i> | <i>3.5%</i> | <i>7.9%</i> | <i>24.0%</i> | <i>34.9%</i> | <i>35.3%</i> | <i>34.5%</i> | <i>34.7%</i> | <i>34.8%</i> |
| Plastics | Neg. | Neg. | 0.3% | 2.2% | 5.8% | 5.8% | 6.0% | 6.9% | 6.8% |
| Rubber and Leather | 17.9% | 8.4% | 3.1% | 6.4% | 12.2% | 15.2% | 14.9% | 14.7% | 14.7% |
| Textiles | 2.8% | 2.9% | 6.3% | 11.4% | 14.0% | 16.2% | 16.3% | 15.8% | 15.9% |
| Wood | Neg. | Neg. | Neg. | 1.1% | 9.5% | 9.3% | 9.3% | 9.3% | 9.3% |
| Other ** | Neg. | 39.0% | 19.8% | 21.3% | 24.5% | 27.1% | 27.3% | 27.1% | 26.2% |
| Total Materials in Products | 10.3% | 9.6% | 13.3% | 19.8% | 29.7% | 31.1% | 31.9% | 32.8% | 34.0% |
| Other Wastes | | | | | | | | | |
| Food, Other^ | Neg. | Neg. | Neg. | Neg. | 2.5% | 2.2% | 2.3% | 2.2% | 2.6% |
| Yard Trimmings | Neg. | Neg. | Neg. | 12.0% | 51.7% | 62.4% | 61.9% | 62.0% | 64.1% |
| Miscellaneous Inorganic Wastes | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Other Wastes | Neg. | Neg. | Neg. | 7.2% | 27.0% | 31.6% | 31.1% | 30.9% | 31.9% |
| Total MSW Recovered - % | 6.4% | 6.6% | 9.6% | 16.2% | 29.0% | 31.2% | 31.7% | 32.3% | 33.4% |

* 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 and mixed MSW 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 2007
(In thousands of tons and percent of total discards)

| Materials | Thousands of Tons | | | | | | | | |
|-------------------------------------|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Paper and Paperboard | 24,910 | 37,540 | 43,420 | 52,500 | 50,180 | 45,720 | 42,880 | 41,520 | 37,770 |
| Glass | 6,620 | 12,580 | 14,380 | 10,470 | 9,880 | 10,160 | 10,520 | 10,640 | 10,360 |
| Metals | | | | | | | | | |
| Ferrous | 10,250 | 12,210 | 12,250 | 10,410 | 9,430 | 9,830 | 9,960 | 10,240 | 10,360 |
| Aluminum | 340 | 790 | 1,420 | 1,800 | 2,340 | 2,570 | 2,640 | 2,710 | 2,620 |
| Other Nonferrous | 180 | 350 | 620 | 370 | 540 | 520 | 540 | 540 | 540 |
| <i>Total Metals</i> | <i>10,770</i> | <i>13,350</i> | <i>14,290</i> | <i>12,580</i> | <i>12,310</i> | <i>12,920</i> | <i>13,140</i> | <i>13,490</i> | <i>13,520</i> |
| Plastics | 390 | 2,900 | 6,810 | 16,760 | 24,060 | 27,760 | 27,480 | 27,760 | 28,640 |
| Rubber and Leather | 1,510 | 2,720 | 4,070 | 5,420 | 5,890 | 6,060 | 6,260 | 6,310 | 6,380 |
| Textiles | 1,710 | 1,980 | 2,370 | 5,150 | 8,120 | 9,200 | 9,530 | 9,990 | 10,020 |
| Wood | 3,030 | 3,720 | 7,010 | 12,080 | 11,870 | 12,600 | 12,770 | 12,790 | 12,890 |
| Other ** | 70 | 470 | 2,020 | 2,510 | 3,020 | 3,010 | 3,030 | 3,140 | 3,270 |
| Total Materials in Products | 49,010 | 75,260 | 94,370 | 117,470 | 125,330 | 127,430 | 125,610 | 125,640 | 122,850 |
| Other Wastes | | | | | | | | | |
| Food Scraps | 12,200 | 12,800 | 13,000 | 20,800 | 26,130 | 28,750 | 29,530 | 30,360 | 30,840 |
| Yard Trimmings | 20,000 | 23,200 | 27,500 | 30,800 | 14,760 | 11,960 | 12,210 | 12,300 | 11,730 |
| Miscellaneous Inorganic Wastes | 1,300 | 1,780 | 2,250 | 2,900 | 3,500 | 3,650 | 3,690 | 3,720 | 3,750 |
| Total Other Wastes | 33,500 | 37,780 | 42,750 | 54,500 | 44,390 | 44,360 | 45,430 | 46,380 | 46,320 |
| Total MSW Discarded - Weight | 82,510 | 113,040 | 137,120 | 171,970 | 169,720 | 171,790 | 171,040 | 172,020 | 169,170 |
| Materials | Percent of Total Discards | | | | | | | | |
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Paper and Paperboard | 30.2% | 33.2% | 31.7% | 30.5% | 29.6% | 26.6% | 25.1% | 24.1% | 22.3% |
| Glass | 8.0% | 11.1% | 10.5% | 6.1% | 5.8% | 5.9% | 6.2% | 6.2% | 6.1% |
| Metals | | | | | | | | | |
| Ferrous | 12.4% | 10.8% | 8.9% | 6.1% | 5.6% | 5.7% | 5.8% | 6.0% | 6.1% |
| Aluminum | 0.4% | 0.7% | 1.0% | 1.0% | 1.4% | 1.5% | 1.5% | 1.6% | 1.5% |
| Other Nonferrous | 0.2% | 0.3% | 0.5% | 0.2% | 0.3% | 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>7.3%</i> | <i>7.5%</i> | <i>7.7%</i> | <i>7.8%</i> | <i>8.0%</i> |
| Plastics | 0.5% | 2.6% | 5.0% | 9.7% | 14.2% | 16.2% | 16.1% | 16.1% | 16.9% |
| Rubber and Leather | 1.8% | 2.4% | 3.0% | 3.2% | 3.5% | 3.5% | 3.7% | 3.7% | 3.8% |
| Textiles | 2.1% | 1.8% | 1.7% | 3.0% | 4.8% | 5.4% | 5.6% | 5.8% | 5.9% |
| Wood | 3.7% | 3.3% | 5.1% | 7.0% | 7.0% | 7.3% | 7.5% | 7.4% | 7.6% |
| Other ** | 0.1% | 0.4% | 1.5% | 1.5% | 1.8% | 1.8% | 1.8% | 1.8% | 1.9% |
| Total Materials in Products | 59.4% | 66.6% | 68.8% | 68.3% | 73.8% | 74.2% | 73.4% | 73.0% | 72.6% |
| Other Wastes | | | | | | | | | |
| Food Scraps | 14.8% | 11.3% | 9.5% | 12.1% | 15.4% | 16.7% | 17.3% | 17.6% | 18.2% |
| Yard Trimmings | 24.2% | 20.5% | 20.1% | 17.9% | 8.7% | 7.0% | 7.1% | 7.2% | 6.9% |
| Miscellaneous Inorganic Wastes | 1.6% | 1.6% | 1.6% | 1.7% | 2.1% | 2.1% | 2.2% | 2.2% | 2.2% |
| Total Other Wastes | 40.6% | 33.4% | 31.2% | 31.7% | 26.2% | 25.8% | 26.6% | 27.0% | 27.4% |
| Total MSW Discarded - % | 100.0% | 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.

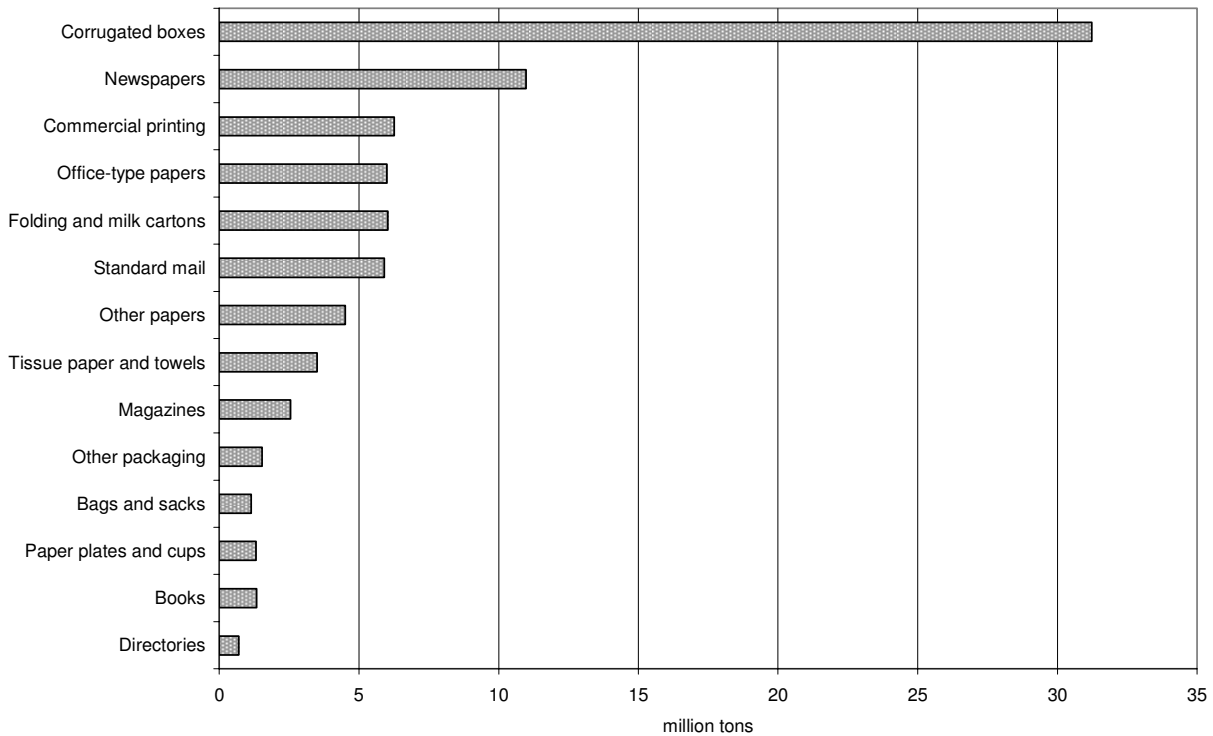
Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Paper and Paperboard

Collectively, the many products made of paper and paperboard¹ 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).

Figure 2. Paper and paperboard products generated in MSW, 2007



Total generation of paper and paperboard in MSW has grown from 30 million tons in 1960 to 83 million tons in 2007 (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 32.7 percent of total MSW generation in 2007.

¹ 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.

Table 4
PAPER AND PAPERBOARD PRODUCTS IN MSW, 2007
(In thousands of tons and percent of generation)

| Product Category | Generation | Recovery | | Discards |
|--|--------------------|--------------------|----------------------------|--------------------|
| | (Thousand tons) | (Thousand tons) | (Percent of generation) | (Thousand tons) |
| Nondurable Goods | | | | |
| Newspapers | | | | |
| Newsprint | 7,840 | 6,160 | 78.6% | 1,680 |
| Groundwood Inserts | 3,140 | 2,380 | 75.8% | 760 |
| Total Newspapers | <u>10,980</u> | <u>8,540</u> | <u>77.8%</u> | <u>2,440</u> |
| Books | 1,340 | 350 | 26.1% | 990 |
| Magazines | 2,550 | 1,010 | 39.6% | 1,540 |
| Office-type Papers* | 6,000 | 4,310 | 71.8% | 1,690 |
| Telephone Directories | 700 | 140 | 20.0% | 560 |
| Standard Mail** | 5,910 | 2,380 | 40.3% | 3,530 |
| Other Commercial Printing | 6,260 | 3,590 | 57.3% | 2,670 |
| Tissue Paper and Towels | 3,500 | Neg. | Neg. | 3,500 |
| Paper Plates and Cups | 1,310 | Neg. | Neg. | 1,310 |
| Other Nonpackaging Paper*** | 4,510 | Neg. | Neg. | 4,510 |
| Total Paper and Paperboard Nondurable Goods | <u>43,060</u> | <u>20,320</u> | <u>47.2%</u> | <u>22,740</u> |
| Containers and Packaging | | | | |
| Corrugated Boxes | 31,230 | 22,990 | 73.6% | 8,240 |
| Milk Cartons | 500 | Neg. | Neg. | 500 |
| Folding Cartons | 5,530 | 1,510 | 27.3% | 4,020 |
| Other Paperboard Packaging | 150 | Neg. | Neg. | 150 |
| Bags and Sacks | 1,140 | 420 | 36.8% | 720 |
| Other Paper Packaging | 1,390 | Neg. | Neg. | 1,390 |
| Total Paper and Paperboard Containers and Packaging | <u>39,940</u> | <u>24,920</u> | <u>62.4%</u> | <u>15,020</u> |
| Total Paper and Paperboard[^] | <u>83,000</u> | <u>45,240</u> | <u>54.5%</u> | <u>37,760</u> |

* High-grade papers such as copy paper and printer paper; both residential and commercial.

** 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).

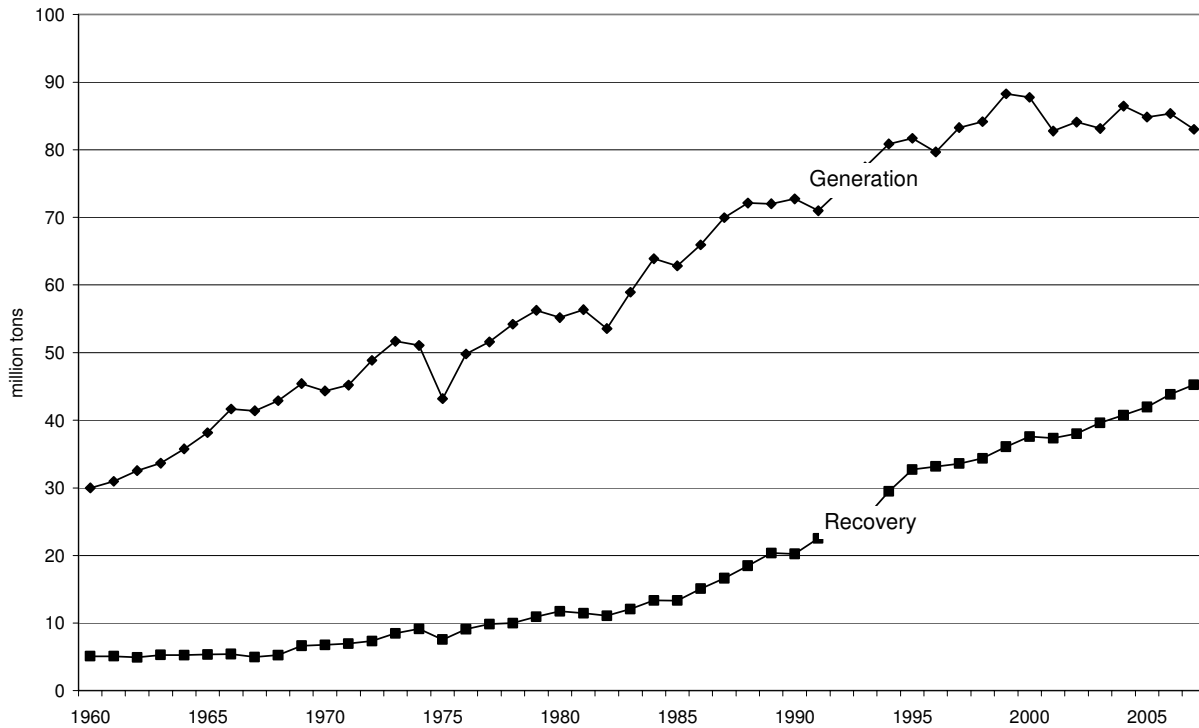
Neg. = Less than 5,000 tons or 0.05 percent.

Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

As Figure 3 illustrates, paper generation has generally increased since 1960, peaked at about 88 million tons in 1999, and declined after 1999 to 83 million tons in 2007.

Figure 3. Paper and paperboard generation and recovery, 1960 to 2007



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.

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 (preconsumer industrial process waste) 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 2007. 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 among the highest rates overall compared to other materials in MSW (Table 2). As Table 4 shows, 73.6 percent of all corrugated boxes were recovered for recycling in 2007; this is up from 67.3 percent in 2000 (Table 21). Newspapers were recovered at a rate of 77.8 percent, and high grade office papers at 71.8 percent, with lesser percentages of other papers being recovered also. Approximately 45 million tons of postconsumer paper were recovered in 2007—54.5 percent of total paper and paperboard generation. This is up from 42.8 percent in 2000 (Table 2).

Discards After Recovery. After recovery of paper and paperboard for recycling, discards were 37.8 million tons in 2007, or 22.3 percent of total MSW discards (Table 3).

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, 2007
(In thousands of tons and percent of generation)

| Product Category | Generation | Recovery | | Discards |
|---------------------------------|-----------------|-----------------|-------------------------|-----------------|
| | (Thousand tons) | (Thousand tons) | (Percent of generation) | (Thousand tons) |
| Durable Goods* | 2,110 | Neg. | Neg. | 2,110 |
| Containers and Packaging | | | | |
| Beer and Soft Drink Bottles | 7,710 | 2,660 | 34.5% | 5,050 |
| Wine and Liquor Bottles | 1,670 | 250 | 15.0% | 1,420 |
| Food and Other Bottles and Jars | 2,090 | 310 | 14.8% | 1,780 |
| Total Glass Containers | 11,470 | 3,220 | 28.1% | 8,250 |
| Total Glass | 13,580 | 3,220 | 23.7% | 10,360 |

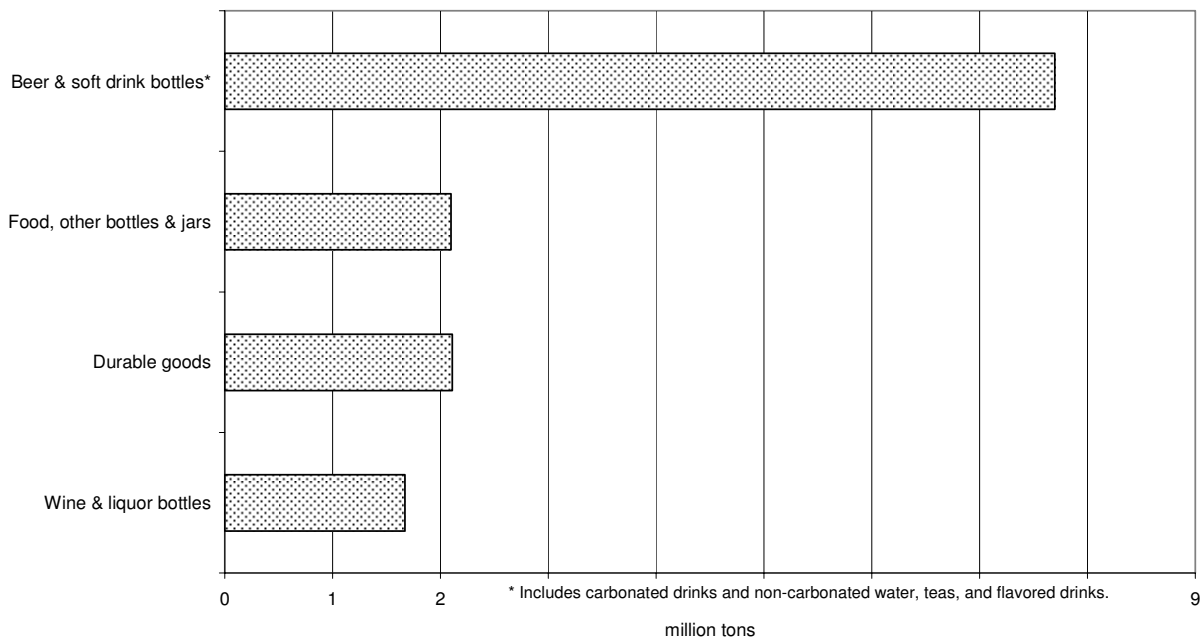
* Glass as a component of appliances, furniture, consumer electronics, etc.

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

Details may not add to totals due to rounding.

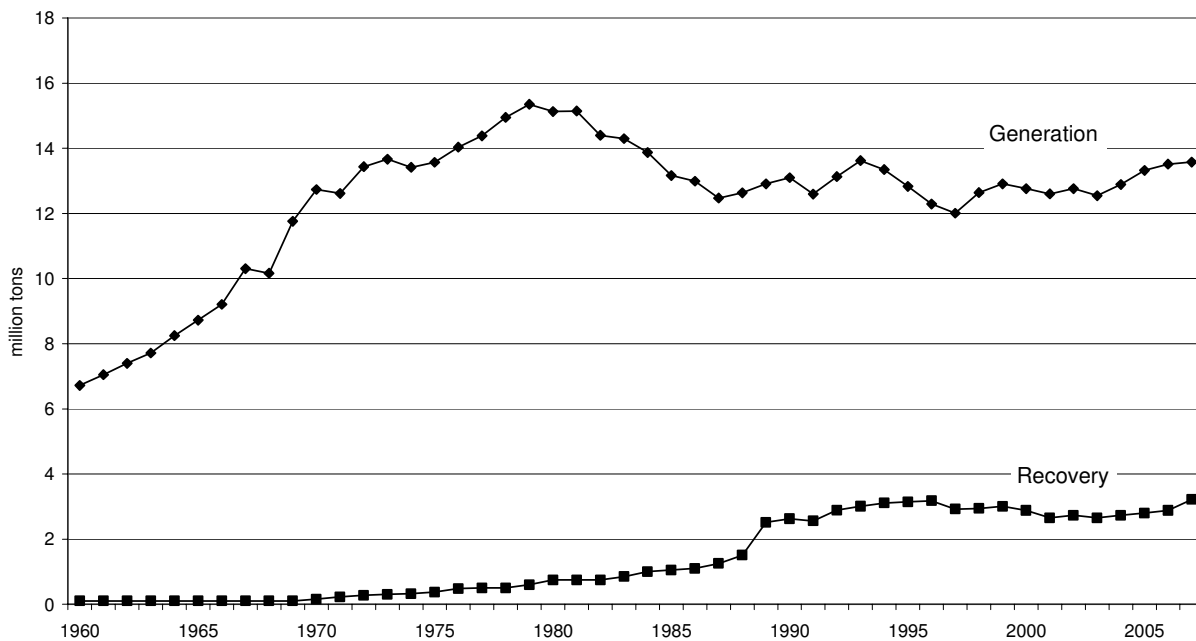
Source: Franklin Associates, A Division of ERG

Figure 4. Glass products generated in MSW, 2007



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). During the 1990s glass generation varied from 12.0 to 13.6 million tons per year. Between 2000 and 2007, glass generation trended upward to 13.6 million tons in 2007, about the same as 1993. Glass was 10 percent of MSW generation in 1980, declining to 5.3 percent in 2007.

Figure 5. Glass generation and recovery, 1960 to 2007



Recovery. Recovered glass containers (bottles) are used to make new glass containers and other uses such as fiberglass insulation, aggregate, and glassphalt for road construction. Until 1998, the Glass Packaging Institute published estimates of glass bottle recovery annually. Since this data source is no longer available, industry and state agency sources were contacted for recovery data. Recovery of glass containers was estimated at 3.2 million tons in 2007, up from an estimated 2.9 million tons in 2006.

Discards After Recovery. Recovery for recycling lowered discards of glass to 10.4 million tons in 2007 or 6.1 percent of total MSW discards (Table 3).

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 2007 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 15.6 million tons in 2007 (Table 1). The percentage of ferrous metals generation in total MSW has declined from 11.7 percent in 1960 to 6.2 percent in 2007.

Table 6
METAL PRODUCTS IN MSW, 2007
(In thousands of tons and percent of generation)

| Product Category | Generation | Recovery | | Discards |
|---|-----------------|-----------------|-------------------------|-----------------|
| | (Thousand tons) | (Thousand tons) | (Percent of generation) | (Thousand tons) |
| Durable Goods | | | | |
| Ferrous Metals* | 12,960 | 3,550 | 27.4% | 9,410 |
| Aluminum** | 1,260 | Neg. | Neg. | 1,260 |
| Lead† | 1,230 | 1,220 | 99.2% | 10 |
| Other Nonferrous Metals‡ | 530 | Neg. | Neg. | 530 |
| Total Metals in Durable Goods | 15,980 | 4,770 | 29.8% | 11,210 |
| Nondurable Goods | | | | |
| Aluminum | 220 | Neg. | Neg. | 220 |
| Containers and Packaging | | | | |
| Steel | | | | |
| Food and Other Cans | 2,440 | 1,570 | 64.3% | 870 |
| Other Steel Packaging | 240 | 160 | 66.7% | 80 |
| Total Steel Packaging | 2,680 | 1,730 | 64.6% | 950 |
| Aluminum | | | | |
| Beer and Soft Drink Cans | 1,420 | 690 | 48.6% | 730 |
| Food and Other Cans | 40 | Neg. | Neg. | 40 |
| Foil and Closures | 410 | 40 | 9.8% | 370 |
| Total Aluminum Packaging | 1,870 | 730 | 39.0% | 1,140 |
| Total Metals in Containers and Packaging | 4,550 | 2,460 | 54.1% | 2,090 |
| Total Metals | 20,750 | 7,230 | 34.8% | 13,520 |
| Ferrous | 15,640 | 5,280 | 33.8% | 10,360 |
| Aluminum | 3,350 | 730 | 21.8% | 2,620 |
| Other nonferrous | 1,760 | 1,220 | 69.3% | 540 |

* 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, 2007

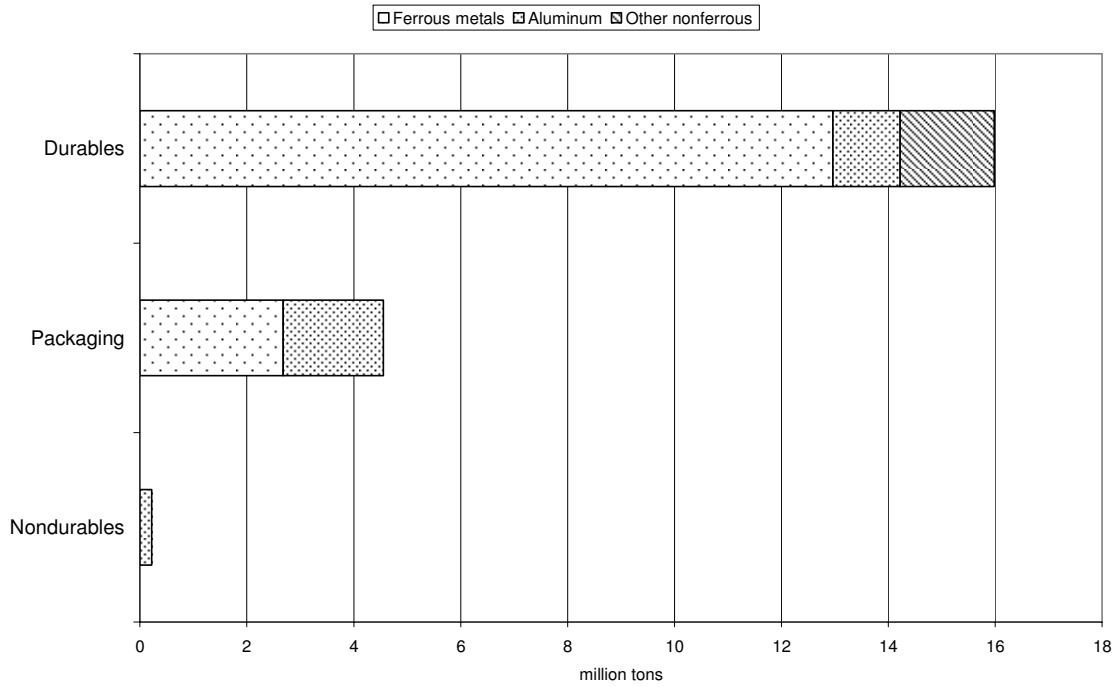
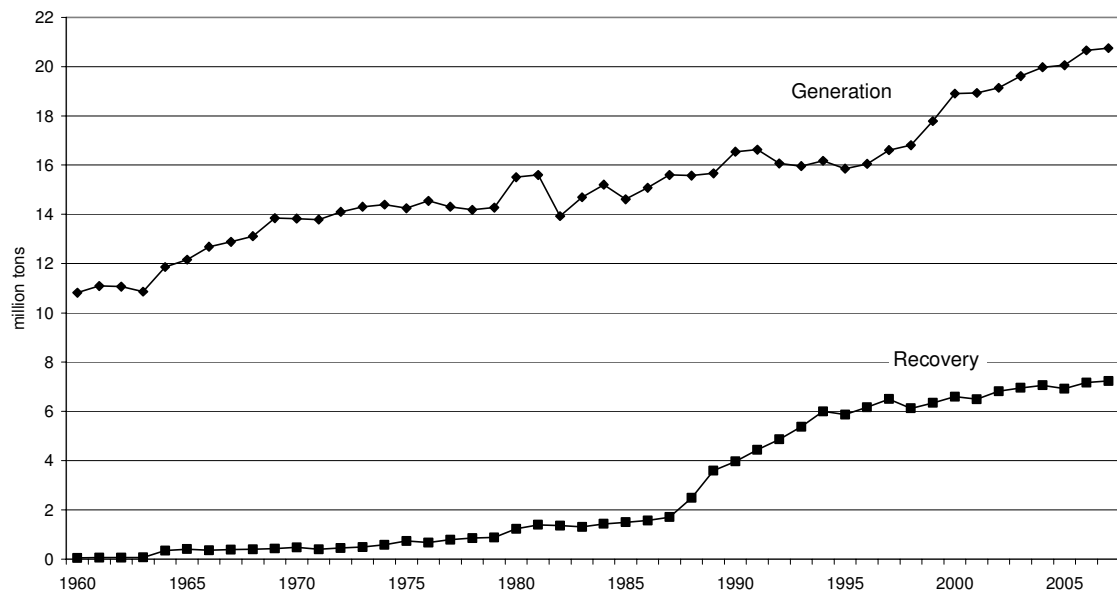


Figure 7. Metals generation and recovery, 1960 to 2007



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 2007. Recovery of all materials in appliances (including ferrous metals) was estimated at 67.1 percent (Table 13). Overall recovery of ferrous metals from durable goods (large and small appliances, furniture, and tires) was estimated to be 29.8 percent (4.8 million tons) in 2007 (Table 6).

Steel food cans and other cans were estimated to be recovered at a rate of 64.3 percent (1.6 million tons) in 2007. Approximately 160,000 tons of other steel packaging, mostly steel barrels and drums, were estimated to have been recovered for recycling in 2007. Recovery of ferrous metals includes material collected through recycling programs as well as metal recovered at combustion facilities.

Discards After Recovery. In 2007, discards of ferrous metals after recovery were 10.4 million tons, or 6.1 percent of total discards (Table 3).

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 2007, 1.9 million tons of aluminum were generated as containers and packaging, while approximately 1.5 million tons were found in durable and nondurable goods. The total—3.4 million tons—was 1.3 percent of total MSW generation in 2007 (Table 1). 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 48.6 percent of generation (0.7 million tons) in 2007, and 39.0 percent of all aluminum in containers and packaging (beverage containers, food containers, foil, and other aluminum packaging) was recovered for recycling in 2007.

Discards After Recovery. In 2007, about 2.6 million tons of aluminum were discarded in MSW after recovery, which was 1.5 percent of total MSW discards (Table 3).

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 1.8 million tons in 2007. Lead in batteries accounted for 1.2 million tons of this amount. Generation of these metals has increased slowly, up from 180,000 tons in 1960, 1.1 million tons in 1990, and 1.6 million tons in 2000. As a percentage of total generation, nonferrous metals have never exceeded one percent.

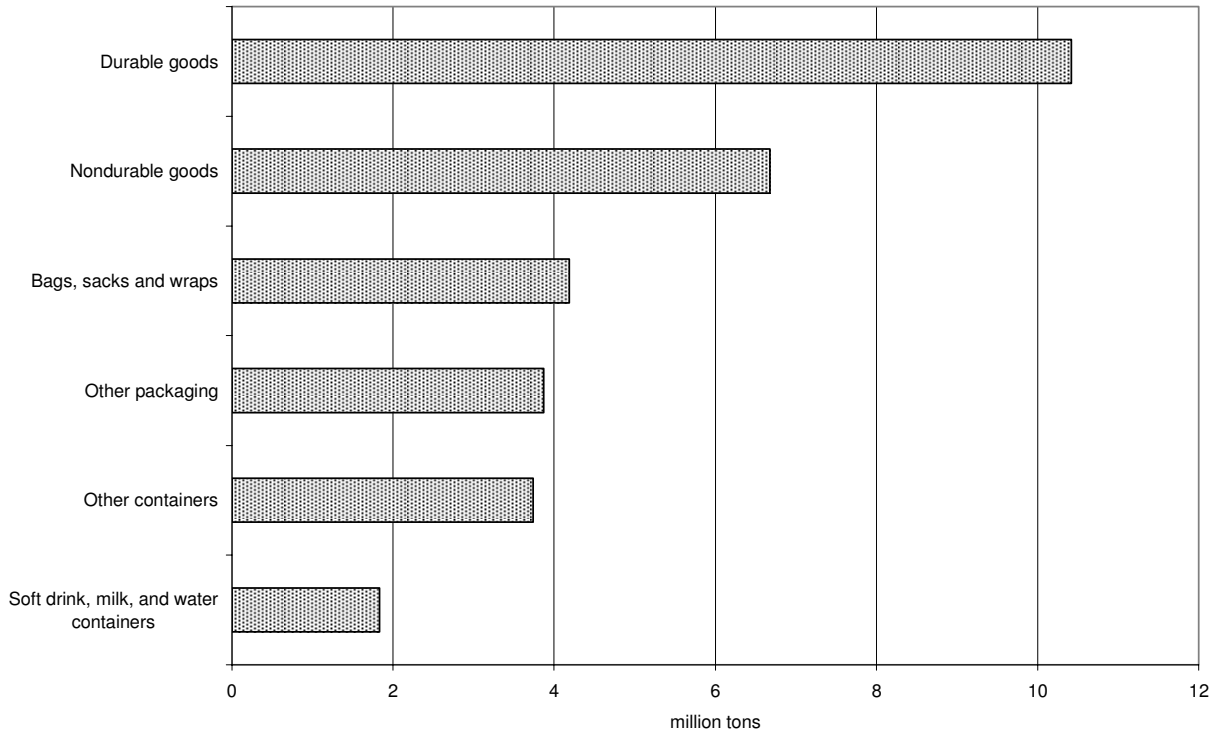
Recovery. Recovery of the other nonferrous metals was 1.2 million tons in 2007, with most of this being lead recovered from batteries. It was estimated that 99 percent of battery lead was recovered in 2007.

Discards After Recovery. In 2007, 540,000 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 (bags, sacks, and wraps, other packaging, other containers, and soft drink, milk, and water containers) has the most plastic tonnage (Figure 8 and Table 7).

Figure 8. Plastics products generated in MSW, 2007



In durable goods, plastics are found in appliances, furniture, casings of lead-acid batteries, and other products. (Note that plastics in transportation products other than lead-acid batteries 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, 2007
(In thousands of tons, and percent of generation by resin)

| Product Category | Generation (Thousand tons) | Recovery | | Discards (Thousand tons) |
|---|----------------------------------|--------------------|----------------------|--------------------------------|
| | | (Thousand tons) | (Percent of Gen.) | |
| Durable Goods | | | | |
| PET | 570 | | | |
| HDPE | 780 | | | |
| PVC | 620 | | | |
| LDPE/LLDPE | 920 | | | |
| PP | 1,630 | | | |
| PS | 890 | | | |
| Other resins | 5,010 | | | |
| Total Plastics in Durable Goods | 10,420 | 500 | 4.8% | 9,920 |
| Nondurable Goods | | | | |
| Plastic Plates and Cups | | | | |
| LDPE/LLDPE | 20 | | | 20 |
| PS | 840 | Neg. | | 840 |
| Subtotal Plastic Plates and Cups | 860 | | | 860 |
| Trash Bags | | | | |
| HDPE | 290 | | | 290 |
| LDPE/LLDPE | 780 | | | 780 |
| Subtotal Trash Bags | 1,070 | | | 1,070 |
| All other nondurables* | | | | |
| PET | 230 | | | 230 |
| HDPE | 430 | | | 430 |
| PVC | 630 | | | 630 |
| LDPE/LLDPE | 1,680 | | | 1,680 |
| PP | 900 | | | 900 |
| PS | 590 | | | 590 |
| Other resins | 290 | | | 290 |
| Subtotal All Other Nondurables | 4,750 | | | 4,750 |
| Total Plastics in Nondurable Goods, by resin | | | | |
| PET | 230 | | | 230 |
| HDPE | 720 | | | 720 |
| PVC | 630 | | | 630 |
| LDPE/LLDPE | 2,480 | | | 2,480 |
| PP | 900 | | | 900 |
| PS | 1,430 | | | 1,430 |
| Other resins | 290 | | | 290 |
| Total Plastics in Nondurable Goods | 6,680 | Neg. | Neg. | 6,680 |
| Plastic Containers & Packaging | | | | |
| Soft drink bottles | | | | |
| PET | 1,010 | 370 | 36.6% | 640 |
| Milk and water bottles | | | | |
| HDPE | 820 | 230 | 28.0% | 590 |

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.

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

Source: Franklin Associates, A Division of ERG

Table 7 (continued)
PLASTICS IN PRODUCTS IN MSW, 2007
(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 | 1,730 | 270 | 15.6% | 1,460 |
| HDPE | 1,410 | 240 | 17.0% | 1,170 |
| PVC | 60 | Neg. | | 60 |
| LDPE/LLDPE | 40 | Neg. | | 40 |
| PP | 420 | 10 | 2.4% | 410 |
| PS | 0 | | | 0 |
| Other resins | 80 | | | 80 |
| Subtotal Other Containers | 3,740 | 520 | 13.9% | 3,220 |
| Bags, sacks, & wraps | | | | |
| HDPE | 590 | 70 | 11.9% | 520 |
| PVC | 80 | | | 80 |
| LDPE/LLDPE | 2,490 | 310 | 12.4% | 2,180 |
| PP | 800 | | | 800 |
| PS | 0 | | | 0 |
| Other resins | 230 | | | 230 |
| Subtotal Bags, Sacks, & Wraps | 4,190 | 380 | 9.1% | 3,810 |
| Other Plastics Packaging** | | | | |
| PET | 220 | 40 | 18.2% | 180 |
| HDPE | 1,330 | 30 | 2.3% | 1,300 |
| PVC | 270 | Neg. | | 270 |
| LDPE/LLDPE | 470 | Neg. | | 470 |
| PP | 820 | Neg. | | 820 |
| PS | 300 | 20 | 6.7% | 280 |
| Other resins | 460 | | | 460 |
| Subtotal Other Packaging | 3,870 | 90 | 2.3% | 3,780 |
| Total Plastics in Containers & Packaging, by resin | | | | |
| PET | 2,960 | 680 | 23.0% | 2,280 |
| HDPE | 4,150 | 570 | 13.7% | 3,580 |
| PVC | 410 | | | 410 |
| LDPE/LLDPE | 3,000 | 310 | 10.3% | 2,690 |
| PP | 2,040 | 10 | 0.5% | 2,030 |
| PS | 300 | 20 | 6.7% | 280 |
| Other resins | 770 | | | 770 |
| Total Plastics in Cont. & Packaging | 13,630 | 1,590 | 11.7% | 12,040 |
| Total Plastics in MSW, by resin | | | | |
| PET | 3,760 | 680 | 18.1% | 3,080 |
| HDPE | 5,650 | 570 | 10.1% | 5,080 |
| PVC | 1,660 | | | 1,660 |
| LDPE/LLDPE | 6,400 | 310 | 4.8% | 6,090 |
| PP | 4,570 | 10 | 0.2% | 4,560 |
| PS | 2,620 | 20 | 0.8% | 2,600 |
| Other resins | 6,070 | 500 | 8.2% | 5,570 |
| Total Plastics in MSW | 30,730 | 2,090 | 6.8% | 28,640 |
| 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.

Some detail of recovery by resin omitted due to lack of data. Neg. = less than 5,000 tons or 0.05 percent

Source: Franklin Associates, A Division of ERG

Plastics are found in such nondurable products as disposable diapers, trash bags, cups, eating utensils, 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.

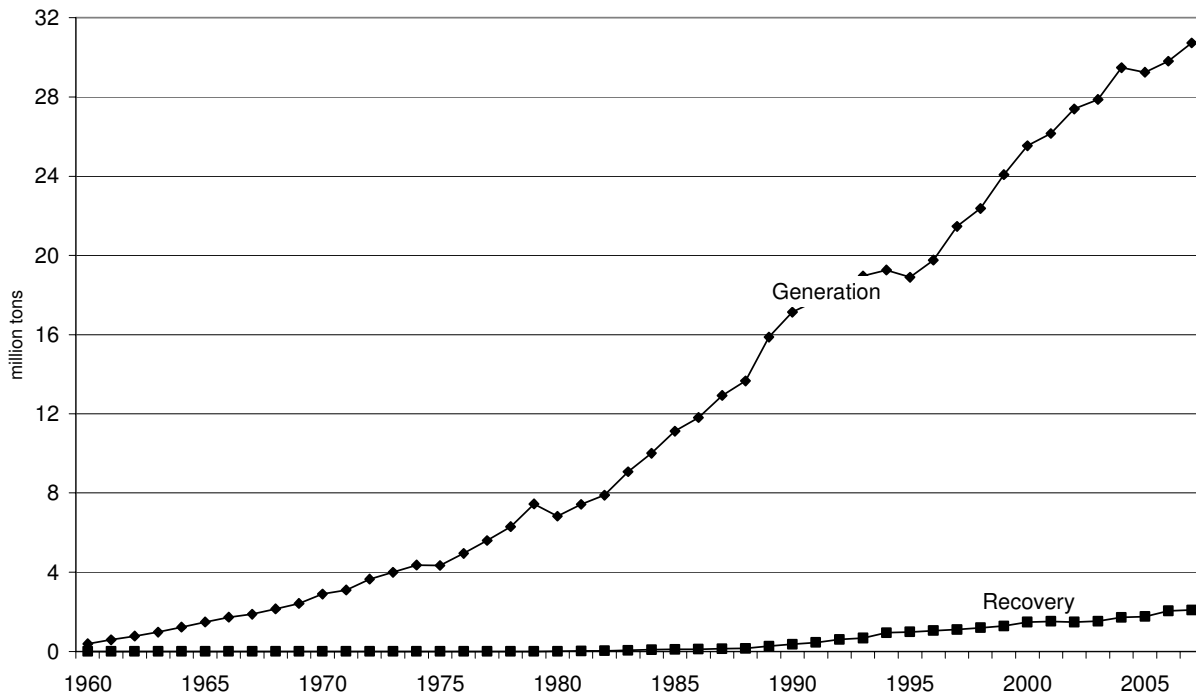
Generation. Production data on plastics resin use in products are taken from the American Chemistry Council's annual resin reports. The basic data are adjusted for product service life, fabrication losses, and net imports of plastic products to derive generation of plastics in the various products in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

Plastics made up an estimated 390,000 tons of MSW generation in 1960. The quantity has increased relatively steadily to 30.7 million tons in 2007 (Figure 9). As a percentage of MSW generation, plastics were less than one percent in 1960, increasing to 12.1 percent in 2007.

Recovery for Recycling. While overall recovery of plastics for recycling is relatively small – 2.1 million tons, or 6.8 percent of plastics generation in 2007 (Table 7) – recovery of some plastic containers is more significant. PET soft drink bottles (including water bottles) were recovered at a rate of 36.6 percent in 2007. Recovery of high-density polyethylene milk and water bottles was estimated at about 28.0 percent in 2007. Significant recovery of plastics from lead-acid battery casings and from some other containers was also reported. The primary sources of data on plastics recovery are annual product recovery surveys conducted for the American Chemistry Council and the National Association for PET Container Resources (NAPCOR).

Discards After Recovery. Discards of plastics in MSW after recovery were 28.6 million tons, or 16.9 percent of total MSW discards in 2007 (Table 3).

Figure 9. Plastics generation and recovery, 1960 to 2007



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 7.5 million tons in 2007. 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 1.1 million tons in 2007. This is 34.8 percent of rubber in tires in 2007. (Table 8). (This recovery estimate does not include tires retreaded or energy recovery from tires.) Overall, 14.7 percent of rubber and leather in MSW was recovered in 2007.

Table 8
RUBBER AND LEATHER PRODUCTS IN MSW, 2007
(In thousands of tons and percent of generation)

| Product Category | Generation | Recovery | | Discards |
|--|-----------------|-----------------|-------------------------|-----------------|
| | (Thousand tons) | (Thousand tons) | (Percent of generation) | (Thousand tons) |
| Durable Goods | | | | |
| Rubber in Tires* | 3,160 | 1,100 | 34.8% | 2,060 |
| Other Durables** | <u>3,320</u> | <u>Neg.</u> | <u>Neg.</u> | <u>3,320</u> |
| Total Rubber & Leather Durable Goods | 6,480 | 1,100 | 17.0% | 5,380 |
| Nondurable Goods | | | | |
| Clothing and Footwear | 690 | Neg. | Neg. | 690 |
| Other Nondurables | <u>280</u> | <u>Neg.</u> | <u>Neg.</u> | <u>280</u> |
| Total Rubber & Leather Nondurable Goods | 970 | Neg. | Neg. | 970 |
| Containers and Packaging | 30 | Neg. | Neg. | 30 |
| Total Rubber & Leather | <u>7,480</u> | <u>1,100</u> | <u>14.7%</u> | <u>6,380</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 6.4 million tons in 2007 (3.8 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 11.9 million tons of textiles were generated in 2007 or 4.7 percent of total MSW generation (Table 1). Significant amounts of textiles enter the reuse market. However, the reused garments and wiper rags re-enter the waste stream eventually becoming part of MSW generation. Since reuse occurs prior to generation, the amount of reused textiles is not included in the generation estimates (or estimated separately).

Recovery for Recycling and Discards. It was estimated that 17.3 percent of textiles in clothing and items such as sheets and pillowcases was recovered for export or reprocessing in 2007 (1.4 million tons). The recovery rate for all textiles is 15.9 percent in 2007 (1.9 million tons) (Table 2).

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 methodologies for wood pallets are based on data from the Center for Forest Products Marketing and Management (Virginia Polytechnic Institute).

Generation. Generation of wood in MSW was 14.2 million tons in 2007 (5.6 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 2007.

Accounting for recovery for recycling, wood discards were 12.9 million tons in 2007, or 7.6 percent of total MSW discards (Table 3).

Other materials. Generation of “other materials” 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. Preconsumer 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, students, and patients in institutions. Generation of food scraps was estimated to be 31.7 million tons in 2007 (12.5 percent of total generation) (Table 1).

Significant amounts of food products are donated by residents and commercial establishments (such as grocery stores) to local food banks and charities. A good portion of these food donations (in particular, the commercial establishment donations) represents waste

diversion by removing food scraps that would otherwise need to be managed either through composting or disposal. This diversion takes place prior to generation and therefore is not included in the generation estimates presented in this report.

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) improved, it became apparent that some other composted materials (e.g., industrial food processing wastes) had been included with food scraps classified as MSW in the past. Beginning in 2004, *BioCycle* staff conducted more targeted data gathering of MSW food waste composting from primary sources including state solid waste officials, large-scale municipal and commercial composting facilities, and large generators (e.g., supermarkets and restaurants).

The targeted data gathering of MSW food scrap composting operations resulted in an estimate of 410,000 tons food scraps composted in 2007. A separate *BioCycle* publication estimated 400,000 tons of MSW composted in 2007. MSW composting includes the composting of food scraps as well as other organic materials found in MSW. The total – 810,000 tons of food scraps and other organic materials composted in 2007 – is shown in the recovery tables.

Yard Trimmings

Yard trimmings² 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

² 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.

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.

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 32.6 million tons of yard trimmings were generated in MSW in 2007.

Recovery for Composting and Discards. Recovery for composting of yard trimmings was estimated using information from state composting programs that estimated tonnages composted or mulched in 2007. Analysis of this information resulted in an estimate of 20.9 million tons of yard trimmings removed for composting or mulching in 2007 – a significant increase over the 2000 estimate of 15.8 million tons.

It should be noted that the estimated 20.9 million tons recovered for composting in 2007 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 3.8 million tons of MSW in 2007. No recovery of these products was identified; discards are the same as generation.

Summary of Materials in Municipal Solid Waste

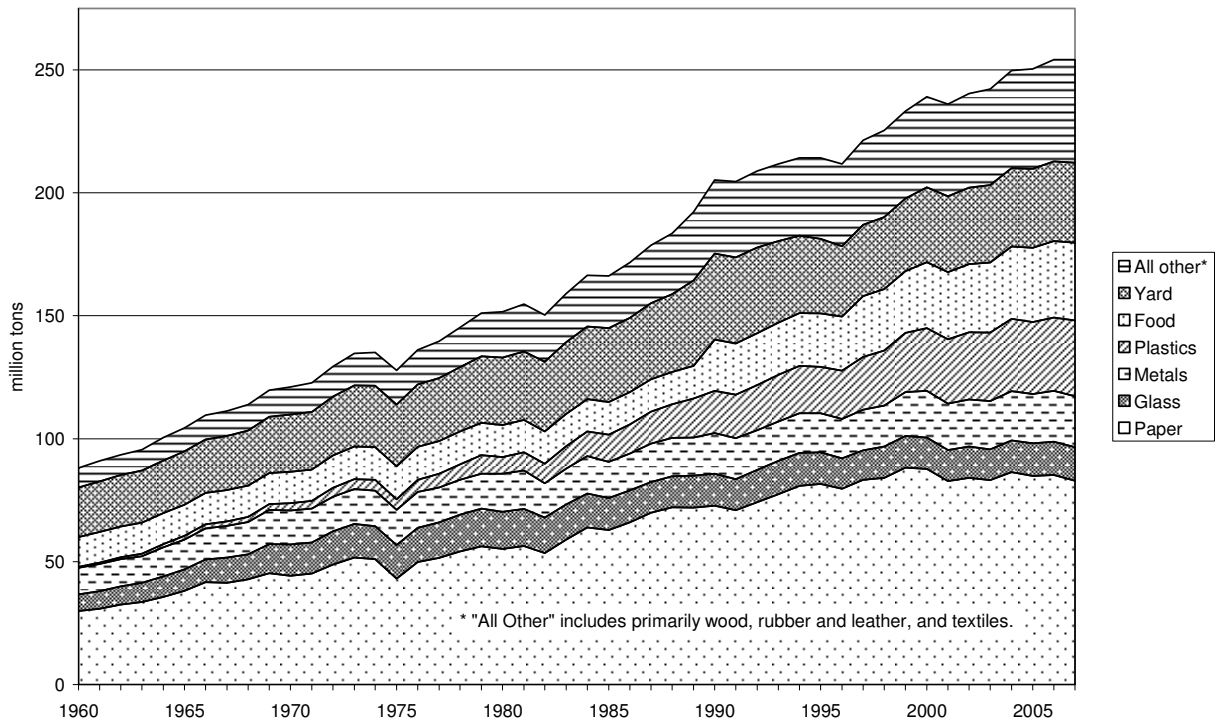
Generation. Changing quantities and composition of municipal solid waste generation are illustrated in Figure 10. Generation of MSW has grown relatively steadily, from 88.1 million tons in 1960 to 254.1 million tons in 2007.

Over the years paper and paperboard has been the dominant material category generated in MSW, accounting for 83 million tons (32.7 percent of generation) in 2007. Yard trimmings, the second largest material component of MSW at 32.6 million tons (12.8 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.

Metals account for 20.8 million tons (8.2 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 13.6 million tons in 2007, 5.3 percent of generation. Food scraps have increased in terms of MSW tonnage and percentage of total MSW (31.7 million tons and 12.5 percent of generation in 2007). Plastics have increasingly been used in a variety of products and thus have been a rapidly growing component of MSW. In terms of

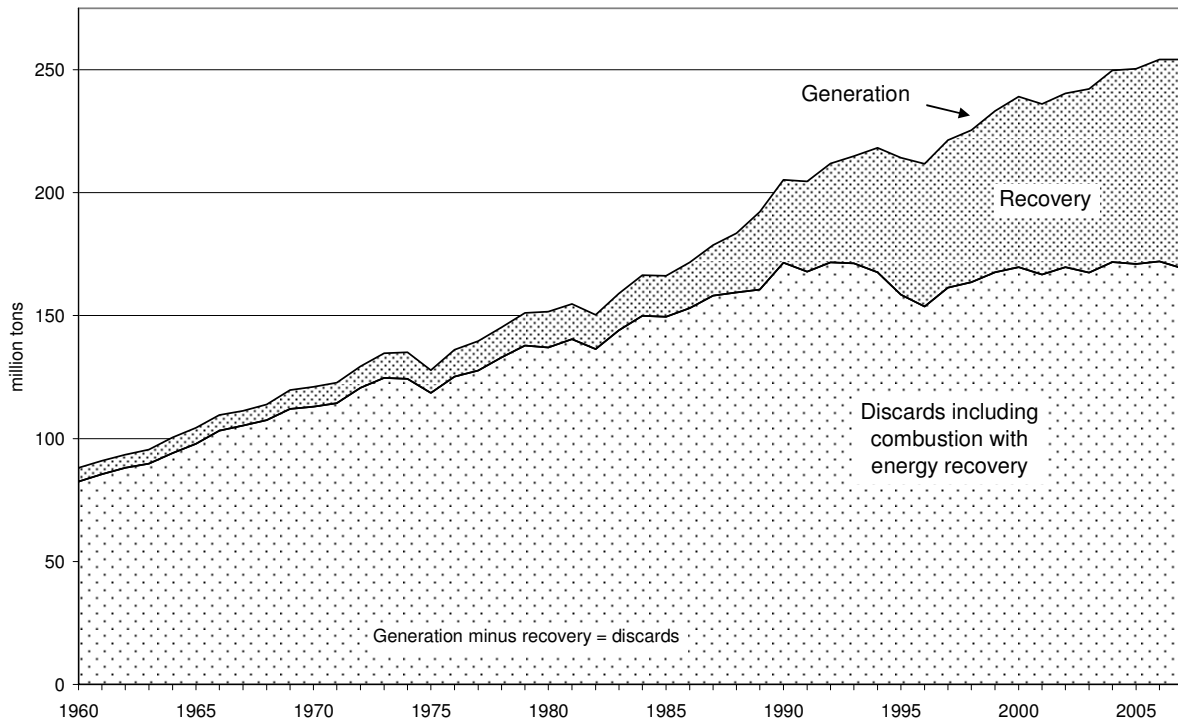
tonnage contributed they ranked fourth in 2007 (behind paper, yard trimmings, and food scraps) at 30.7 million tons, and account for 12.1 percent of MSW generation.

Figure 10. Generation of materials in MSW, 1960 to 2007



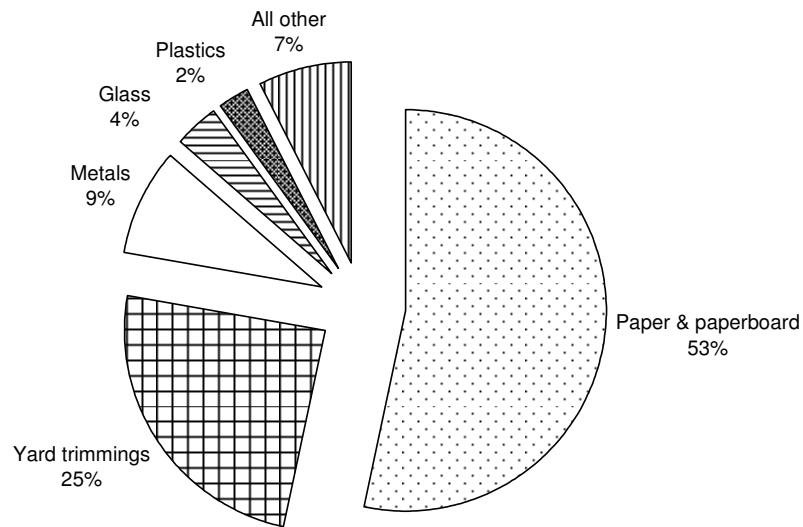
Recovery and Discards. The effect of recovery on MSW discards is illustrated in Figure 11. Recovery of materials for recycling and composting grew at a rather slow pace from 1960 to the 1980s, increasing only from 5.6 million tons (6.4 percent of generation) in 1960 to 14.5 million tons (9.6 percent) 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 (33.2 million tons), increasing to 69.3 million tons (29.0 percent) in 2000, and 85 million tons (33.4 percent of generation) in 2007.

Figure 11. Recovery and discards of materials in MSW, 1960 to 2007



Estimated recovery of materials (including composting) is shown in Figure 12. In 2007, recovery of paper and paperboard dominated materials recovery at 53 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.

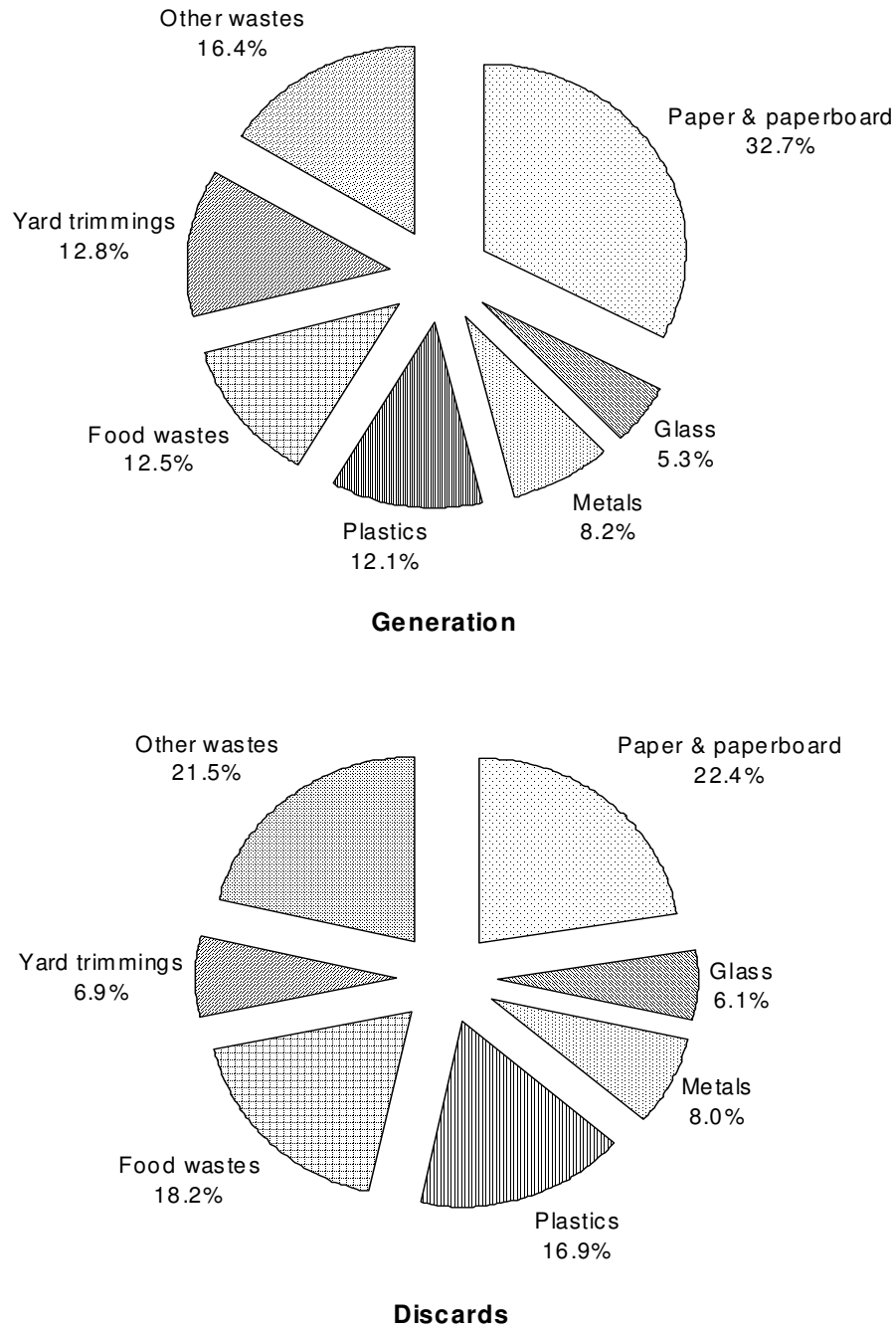
Figure 12. Materials recovery,* 2007



* 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 32.7 percent of MSW generated in 2007, but after recovery, paper and paperboard products were 22.4 percent of discards. Materials that have little or no recovery exhibit a larger percentage of MSW discards compared to generation. For example, plastic products were 12.1 percent of MSW generated in 2007 and, after recovery, were 16.9 percent of discards.

**Figure 13. Materials generated and discarded*
in municipal solid waste, 2007
(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 254.1 million tons of MSW were generated, recycled (including composted) and disposed of. The following section breaks out the same 254.1 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” – 254.14 million tons in 2007 – 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 recovered – 84.97 million tons; and for Table 11 and related tables, the “bottom line” is MSW discarded – 169.17 million tons. The “bottom line” for each of the quantity tables is calculated by adding the major category subtotal lines.

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 2007, 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 45.4 million tons in 2007 (17.9 percent of total MSW generation). After recovery for recycling, 37.4 million tons of durable goods remained as discards in 2007.

Table 9
CATEGORIES OF PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2007
(In thousands of tons and percent of total generation)

| Products | Thousands of Tons | | | | | | | | |
|--|-----------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 12)</i> | 9,920 | 14,660 | 21,800 | 29,810 | 38,850 | 43,280 | 44,400 | 44,890 | 45,420 |
| Nondurable Goods <i>(Detail in Table 15)</i> | 17,330 | 25,060 | 34,420 | 52,170 | 64,010 | 64,380 | 63,650 | 64,310 | 62,240 |
| Containers and Packaging <i>(Detail in Table 18)</i> | 27,370 | 43,560 | 52,670 | 64,530 | 75,350 | 77,290 | 76,400 | 77,820 | 78,450 |
| Total Product** Wastes | 54,620 | 83,280 | 108,890 | 146,510 | 178,210 | 184,950 | 184,450 | 187,020 | 186,110 |
| Other Wastes | | | | | | | | | |
| Food Scraps | 12,200 | 12,800 | 13,000 | 20,800 | 26,810 | 29,410 | 30,220 | 31,040 | 31,650 |
| Yard Trimmings | 20,000 | 23,200 | 27,500 | 35,000 | 30,530 | 31,770 | 32,070 | 32,400 | 32,630 |
| Miscellaneous Inorganic Wastes | 1,300 | 1,780 | 2,250 | 2,900 | 3,500 | 3,650 | 3,690 | 3,720 | 3,750 |
| Total Other Wastes | 33,500 | 37,780 | 42,750 | 58,700 | 60,840 | 64,830 | 65,980 | 67,160 | 68,030 |
| Total MSW Generated - Weight | 88,120 | 121,060 | 151,640 | 205,210 | 239,050 | 249,780 | 250,430 | 254,180 | 254,140 |
| Products | Percent of Total Generation | | | | | | | | |
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 12)</i> | 11.3% | 12.1% | 14.4% | 14.5% | 16.3% | 17.3% | 17.7% | 17.7% | 17.9% |
| Nondurable Goods <i>(Detail in Table 15)</i> | 19.7% | 20.7% | 22.7% | 25.4% | 26.8% | 25.8% | 25.4% | 25.3% | 24.5% |
| Containers and Packaging <i>(Detail in Table 19)</i> | 31.1% | 36.0% | 34.7% | 31.4% | 31.5% | 30.9% | 30.5% | 30.6% | 30.9% |
| Total Product** Wastes | 62.0% | 68.8% | 71.8% | 71.4% | 74.5% | 74.0% | 73.7% | 73.6% | 73.2% |
| Other Wastes | | | | | | | | | |
| Food Scraps | 13.8% | 10.6% | 8.6% | 10.1% | 11.2% | 11.8% | 12.1% | 12.2% | 12.5% |
| Yard Trimmings | 22.7% | 19.2% | 18.1% | 17.1% | 12.8% | 12.7% | 12.8% | 12.7% | 12.8% |
| Miscellaneous Inorganic Wastes | 1.5% | 1.5% | 1.5% | 1.4% | 1.5% | 1.5% | 1.5% | 1.5% | 1.5% |
| Total Other Wastes | 38.0% | 31.2% | 28.2% | 28.6% | 25.5% | 26.0% | 26.3% | 26.4% | 26.8% |
| Total MSW Generated - % | 100.0% | 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 2007
(In thousands of tons and percent of generation of each category)

| | Thousands of Tons | | | | | | | | |
|--|--|-------|--------|--------|--------|--------|--------|--------|--------|
| Products | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 13)</i> | 350 | 940 | 1,360 | 3,460 | 6,580 | 7,750 | 7,880 | 7,990 | 7,990 |
| Nondurable Goods <i>(Detail in Table 16)</i> | 2,390 | 3,730 | 4,670 | 8,800 | 17,560 | 19,420 | 19,770 | 21,050 | 21,760 |
| Containers and Packaging <i>(Detail in Table 20)</i> | 2,870 | 3,350 | 8,490 | 16,780 | 28,740 | 30,350 | 31,190 | 32,340 | 33,510 |
| Total Product** Wastes | 5,610 | 8,020 | 14,520 | 29,040 | 52,880 | 57,520 | 58,840 | 61,380 | 63,260 |
| Other Wastes | | | | | | | | | |
| Food, Other^ | Neg. | Neg. | Neg. | Neg. | 680 | 660 | 690 | 680 | 810 |
| Yard Trimmings | Neg. | Neg. | Neg. | 4,200 | 15,770 | 19,810 | 19,860 | 20,100 | 20,900 |
| Miscellaneous Inorganic Wastes | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Other Wastes | Neg. | Neg. | Neg. | 4,200 | 16,450 | 20,470 | 20,550 | 20,780 | 21,710 |
| Total MSW Recovered - Weight | 5,610 | 8,020 | 14,520 | 33,240 | 69,330 | 77,990 | 79,390 | 82,160 | 84,970 |
| | Percent of Generation of Each Category | | | | | | | | |
| Products | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 13)</i> | 3.5% | 6.4% | 6.2% | 11.6% | 16.9% | 17.9% | 17.7% | 17.8% | 17.6% |
| Nondurable Goods <i>(Detail in Table 16)</i> | 13.8% | 14.9% | 13.6% | 16.9% | 27.4% | 30.2% | 31.1% | 32.7% | 35.0% |
| Containers and Packaging <i>(Detail in Table 21)</i> | 10.5% | 7.7% | 16.1% | 26.0% | 38.1% | 39.3% | 40.8% | 41.6% | 42.7% |
| Total Product** Wastes | 10.3% | 9.6% | 13.3% | 19.8% | 29.7% | 31.1% | 31.9% | 32.8% | 34.0% |
| Other Wastes | | | | | | | | | |
| Food, Other^ | Neg. | Neg. | Neg. | Neg. | 2.5% | 2.2% | 2.3% | 2.2% | 2.6% |
| Yard Trimmings | Neg. | Neg. | Neg. | 12.0% | 51.7% | 62.4% | 61.9% | 62.0% | 64.1% |
| Miscellaneous Inorganic Wastes | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Other Wastes | Neg. | Neg. | Neg. | 7.2% | 27.0% | 31.6% | 31.1% | 30.9% | 31.9% |
| Total MSW Recovered - % | 6.4% | 6.6% | 9.6% | 16.2% | 29.0% | 31.2% | 31.7% | 32.3% | 33.4% |

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

** Other than food products.

^ Includes recovery of paper for composting.

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 11
CATEGORIES OF PRODUCTS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2007
(In thousands of tons and percent of total discards)

| Products | Thousands of Tons | | | | | | | | |
|--|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 14)</i> | 9,570 | 13,720 | 20,440 | 26,350 | 32,270 | 35,530 | 36,520 | 36,900 | 37,430 |
| Nondurable Goods <i>(Detail in Table 17)</i> | 14,940 | 21,330 | 29,750 | 43,370 | 46,450 | 44,960 | 43,880 | 43,260 | 40,480 |
| Containers and Packaging <i>(Detail in Table 22)</i> | 24,500 | 40,210 | 44,180 | 47,750 | 46,610 | 46,940 | 45,210 | 45,480 | 44,940 |
| Total Product** Wastes | 49,010 | 75,260 | 94,370 | 117,470 | 125,330 | 127,430 | 125,610 | 125,640 | 122,850 |
| Other Wastes | | | | | | | | | |
| Food Wastes | 12,200 | 12,800 | 13,000 | 20,800 | 26,130 | 28,750 | 29,530 | 30,360 | 30,840 |
| Yard Trimmings | 20,000 | 23,200 | 27,500 | 30,800 | 14,760 | 11,960 | 12,210 | 12,300 | 11,730 |
| Miscellaneous Inorganic Wastes | 1,300 | 1,780 | 2,250 | 2,900 | 3,500 | 3,650 | 3,690 | 3,720 | 3,750 |
| Total Other Wastes | 33,500 | 37,780 | 42,750 | 54,500 | 44,390 | 44,360 | 45,430 | 46,380 | 46,320 |
| Total MSW Discarded - Weight | 82,510 | 113,040 | 137,120 | 171,970 | 169,720 | 171,790 | 171,040 | 172,020 | 169,170 |
| Products | Percent of Total Discards | | | | | | | | |
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 14)</i> | 11.6% | 12.1% | 14.9% | 15.3% | 19.0% | 20.7% | 21.4% | 21.5% | 22.1% |
| Nondurable Goods <i>(Detail in Table 17)</i> | 18.1% | 18.9% | 21.7% | 25.2% | 27.4% | 26.2% | 25.7% | 25.1% | 23.9% |
| Containers and Packaging <i>(Detail in Table 23)</i> | 29.7% | 35.6% | 32.2% | 27.8% | 27.5% | 27.3% | 26.4% | 26.4% | 26.6% |
| Total Product** Wastes | 59.4% | 66.6% | 68.8% | 68.3% | 73.8% | 74.2% | 73.4% | 73.0% | 72.6% |
| Other Wastes | | | | | | | | | |
| Food Scraps | 14.8% | 11.3% | 9.5% | 12.1% | 15.4% | 16.7% | 17.3% | 17.6% | 18.2% |
| Yard Trimmings | 24.2% | 20.5% | 20.1% | 17.9% | 8.7% | 7.0% | 7.1% | 7.2% | 6.9% |
| Miscellaneous Inorganic Wastes | 1.6% | 1.6% | 1.6% | 1.7% | 2.1% | 2.1% | 2.2% | 2.2% | 2.2% |
| Total Other Wastes | 40.6% | 33.4% | 31.2% | 31.7% | 26.2% | 25.8% | 26.6% | 27.0% | 27.4% |
| Total MSW Discarded - % | 100.0% | 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*, *Appliance Manufacturer Shipments Forecasts*, and *Appliance Statistical Review*. 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 7 years. In 2007, generation was 3.6 million tons, or 1.4 percent of total MSW generation. In general, the number of units of appliances has increased but average weight per unit has decreased 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 2007, 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 and *Appliance Statistical Review*. Information on weights and materials composition of discarded small appliances was obtained through manufacturer specifications and interviews. It was estimated that 1.4 million tons of small appliances were generated in 2007. A small amount of ferrous metals in small appliances is recovered through magnetic separation.

Table 12
PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2007
(WITH DETAIL ON DURABLE GOODS)
 (In thousands of tons and percent of total generation)

| Products | Thousands of Tons | | | | | | | | |
|-------------------------------------|------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods | | | | | | | | | |
| Major Appliances | 1,630 | 2,170 | 2,950 | 3,310 | 3,640 | 3,570 | 3,610 | 3,580 | 3,620 |
| Small Appliances** | | | | 460 | 1,040 | 1,100 | 1,180 | 1,280 | 1,390 |
| Furniture and Furnishings | 2,150 | 2,830 | 4,760 | 6,790 | 7,990 | 8,640 | 8,870 | 9,100 | 9,340 |
| Carpets and Rugs** | | | | 1,660 | 2,570 | 2,930 | 2,980 | 3,070 | 3,140 |
| Rubber Tires | 1,120 | 1,890 | 2,720 | 3,610 | 4,930 | 4,770 | 4,960 | 4,900 | 4,910 |
| Batteries, Lead-Acid | Neg. | 820 | 1,490 | 1,510 | 2,280 | 2,450 | 2,490 | 2,560 | 2,540 |
| Miscellaneous Durables | | | | | | | | | |
| Selected Consumer Electronics*** | | | | | 1,900 | 2,420 | 2,630 | 2,840 | 3,010 |
| Other Miscellaneous Durables | | | | | 14,500 | 17,400 | 17,680 | 17,560 | 17,470 |
| <i>Total Miscellaneous Durables</i> | 5,020 | 6,950 | 9,880 | 12,470 | 16,400 | 19,820 | 20,310 | 20,400 | 20,480 |
| Total Durable Goods | 9,920 | 14,660 | 21,800 | 29,810 | 38,850 | 43,280 | 44,400 | 44,890 | 45,420 |
| Nondurable Goods | 17,330 | 25,060 | 34,420 | 52,170 | 64,010 | 64,380 | 63,650 | 64,310 | 62,240 |
| <i>(Detail in Table 15)</i> | | | | | | | | | |
| Containers and Packaging | 27,370 | 43,560 | 52,670 | 64,530 | 75,350 | 77,290 | 76,400 | 77,820 | 78,450 |
| <i>(Detail in Table 18)</i> | | | | | | | | | |
| Total Product Wastes† | 54,620 | 83,280 | 108,890 | 146,510 | 178,210 | 184,950 | 184,450 | 187,020 | 186,110 |
| Other Wastes | | | | | | | | | |
| Food Scraps | 12,200 | 12,800 | 13,000 | 20,800 | 26,810 | 29,410 | 30,220 | 31,040 | 31,650 |
| Yard Trimmings | 20,000 | 23,200 | 27,500 | 35,000 | 30,530 | 31,770 | 32,070 | 32,400 | 32,630 |
| Miscellaneous Inorganic Wastes | 1,300 | 1,780 | 2,250 | 2,900 | 3,500 | 3,650 | 3,690 | 3,720 | 3,750 |
| Total Other Wastes | 33,500 | 37,780 | 42,750 | 58,700 | 60,840 | 64,830 | 65,980 | 67,160 | 68,030 |
| Total MSW Generated - Weight | 88,120 | 121,060 | 151,640 | 205,210 | 239,050 | 249,780 | 250,430 | 254,180 | 254,140 |
| | Percent of Total Generation | | | | | | | | |
| Products | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods | | | | | | | | | |
| Major Appliances | 1.8% | 1.8% | 1.9% | 1.6% | 1.5% | 1.4% | 1.4% | 1.4% | 1.4% |
| Small Appliances** | | | | 0.2% | 0.4% | 0.4% | 0.5% | 0.5% | 0.5% |
| Furniture and Furnishings | 2.4% | 2.3% | 3.1% | 3.3% | 3.3% | 3.5% | 3.5% | 3.6% | 3.7% |
| Carpets and Rugs** | | | | 0.8% | 1.1% | 1.2% | 1.2% | 1.2% | 1.2% |
| Rubber Tires | 1.3% | 1.6% | 1.8% | 1.8% | 2.1% | 1.9% | 2.0% | 1.9% | 1.9% |
| Batteries, Lead-Acid | Neg. | 0.7% | 1.0% | 0.7% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% |
| Miscellaneous Durables | | | | | | | | | |
| Selected Consumer Electronics*** | | | | | 0.8% | 1.0% | 1.1% | 1.1% | 1.2% |
| Other Miscellaneous Durables | | | | | 6.1% | 7.0% | 7.1% | 6.9% | 6.9% |
| <i>Total Miscellaneous Durables</i> | 5.7% | 5.7% | 6.5% | 6.1% | 6.9% | 7.9% | 8.1% | 8.0% | 8.1% |
| Total Durable Goods | 11.3% | 12.1% | 14.4% | 14.5% | 16.3% | 17.3% | 17.7% | 17.7% | 17.9% |
| Nondurable Goods | 19.7% | 20.7% | 22.7% | 25.4% | 26.8% | 25.8% | 25.4% | 25.3% | 24.5% |
| <i>(Detail in Table 15)</i> | | | | | | | | | |
| Containers and Packaging | 31.1% | 36.0% | 34.7% | 31.4% | 31.5% | 30.9% | 30.5% | 30.6% | 30.9% |
| <i>(Detail in Table 19)</i> | | | | | | | | | |
| Total Product Wastes† | 62.0% | 68.8% | 71.8% | 71.4% | 74.5% | 74.0% | 73.7% | 73.6% | 73.2% |
| Other Wastes | | | | | | | | | |
| Food Scraps | 13.8% | 10.6% | 8.6% | 10.1% | 11.2% | 11.8% | 12.1% | 12.2% | 12.5% |
| Yard Trimmings | 22.7% | 19.2% | 18.1% | 17.1% | 12.8% | 12.7% | 12.8% | 12.7% | 12.8% |
| Miscellaneous Inorganic Wastes | 1.5% | 1.5% | 1.5% | 1.4% | 1.5% | 1.5% | 1.5% | 1.5% | 1.5% |
| Total Other Wastes | 38.0% | 31.2% | 28.2% | 28.6% | 25.5% | 26.0% | 26.3% | 26.4% | 26.8% |
| Total MSW Generated - % | 100.0% | 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.

*** Not estimated separately prior to 1999.

† Other than food products.

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

Source: Franklin Associates, A Division of ERG

Table 13
RECOVERY* OF PRODUCTS IN MUNICIPAL SOLID WASTE, 1960 TO 2007
(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 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods | | | | | | | | | |
| Major Appliances | 10 | 50 | 130 | 1,070 | 2,000 | 2,390 | 2,420 | 2,410 | 2,430 |
| Small Appliances** | | | | 10 | 20 | 20 | 20 | 20 | 20 |
| Furniture and Furnishings | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Carpets and Rugs** | | | | Neg. | 190 | 210 | 250 | 250 | 280 |
| Rubber Tires | 330 | 250 | 150 | 440 | 1,290 | 1,700 | 1,720 | 1,710 | 1,710 |
| Batteries, Lead-Acid | Neg. | 620 | 1,040 | 1,470 | 2,130 | 2,430 | 2,470 | 2,540 | 2,520 |
| Miscellaneous Durables | | | | | | | | | |
| Selected Consumer Electronics*** | | | | | 190 | 340 | 360 | 380 | 410 |
| Other Miscellaneous Durables | | | | | 760 | 660 | 640 | 680 | 620 |
| <i>Total Miscellaneous Durables</i> | 10 | 20 | 40 | 470 | 950 | 1,000 | 1,000 | 1,060 | 1,030 |
| Total Durable Goods | 350 | 940 | 1,360 | 3,460 | 6,580 | 7,750 | 7,880 | 7,990 | 7,990 |
| Nondurable Goods <i>(Detail in Table 16)</i> | 2,390 | 3,730 | 4,670 | 8,800 | 17,560 | 19,420 | 19,770 | 21,050 | 21,760 |
| Containers and Packaging <i>(Detail in Table 20)</i> | 2,870 | 3,350 | 8,490 | 16,780 | 28,740 | 30,350 | 31,190 | 32,340 | 33,510 |
| Total Product Wastes† | 5,610 | 8,020 | 14,520 | 29,040 | 52,880 | 57,520 | 58,840 | 61,380 | 63,260 |
| Other Wastes | | | | | | | | | |
| Food Scraps | Neg. | Neg. | Neg. | Neg. | 680 | 660 | 690 | 680 | 810 |
| Yard Trimmings | Neg. | Neg. | Neg. | 4,200 | 15,770 | 19,810 | 19,860 | 20,100 | 20,900 |
| Miscellaneous Inorganic Wastes | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Other Wastes | Neg. | Neg. | Neg. | 4,200 | 16,450 | 20,470 | 20,550 | 20,780 | 21,710 |
| Total MSW Recovered - Weight | 5,610 | 8,020 | 14,520 | 33,240 | 69,330 | 77,990 | 79,390 | 82,160 | 84,970 |
| | Percent of Generation of Each Product | | | | | | | | |
| Products | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods | | | | | | | | | |
| Major Appliances | 0.6% | 2.3% | 4.4% | 32.3% | 54.9% | 66.9% | 67.0% | 67.3% | 67.1% |
| Small Appliances** | | | | 2.2% | 1.9% | 1.8% | 1.7% | 1.6% | 1.4% |
| Furniture and Furnishings | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Carpets and Rugs** | | | | Neg. | 7.4% | 7.2% | 8.4% | 8.1% | 8.9% |
| Rubber Tires | 29.5% | 13.2% | 5.5% | 12.2% | 26.2% | 35.6% | 34.7% | 34.9% | 34.8% |
| Batteries, Lead-Acid | Neg. | 75.6% | 69.8% | 97.4% | 93.4% | 99.2% | 99.2% | 99.2% | 99.2% |
| Miscellaneous Durables | | | | | | | | | |
| Selected Consumer Electronics*** | | | | | 10.0% | 14.0% | 13.7% | 13.4% | 13.6% |
| Other Miscellaneous Durables | | | | | 5.2% | 3.8% | 3.6% | 3.9% | 3.5% |
| <i>Total Miscellaneous Durables</i> | 0.2% | 0.3% | 0.4% | 3.8% | 5.8% | 5.0% | 4.9% | 5.2% | 5.0% |
| Total Durable Goods | 3.5% | 6.4% | 6.2% | 11.6% | 16.9% | 17.9% | 17.7% | 17.8% | 17.6% |
| Nondurable Goods <i>(Detail in Table 16)</i> | 13.8% | 14.9% | 13.6% | 16.9% | 27.4% | 30.2% | 31.1% | 32.7% | 35.0% |
| Containers and Packaging <i>(Detail in Table 21)</i> | 10.5% | 7.7% | 16.1% | 26.0% | 38.1% | 39.3% | 40.8% | 41.6% | 42.7% |
| Total Product Wastes† | 10.3% | 9.6% | 13.3% | 19.8% | 29.7% | 31.1% | 31.9% | 32.8% | 34.0% |
| Other Wastes | | | | | | | | | |
| Food Scraps | Neg. | Neg. | Neg. | Neg. | 2.5% | 2.2% | 2.3% | 2.2% | 2.6% |
| Yard Trimmings | Neg. | Neg. | Neg. | 12.0% | 51.7% | 62.4% | 61.9% | 62.0% | 64.1% |
| Miscellaneous Inorganic Wastes | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Other Wastes | Neg. | Neg. | Neg. | 7.2% | 27.0% | 31.6% | 31.1% | 30.9% | 31.9% |
| Total MSW Recovered - % | 6.4% | 6.6% | 9.6% | 16.2% | 29.0% | 31.2% | 31.7% | 32.3% | 33.4% |

* 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 2007
 (WITH DETAIL ON DURABLE GOODS)
 (In thousands of tons and percent of total discards)

| Products | Thousands of Tons | | | | | | | | |
|---|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods | | | | | | | | | |
| Major Appliances | 1,620 | 2,120 | 2,820 | 2,240 | 1,640 | 1,180 | 1,190 | 1,170 | 1,190 |
| Small Appliances** | | | | 450 | 1,020 | 1,080 | 1,160 | 1,260 | 1,370 |
| Furniture and Furnishings | 2,150 | 2,830 | 4,760 | 6,790 | 7,990 | 8,640 | 8,870 | 9,100 | 9,340 |
| Carpets and Rugs** | | | | 1,660 | 2,380 | 2,720 | 2,730 | 2,820 | 2,860 |
| Rubber Tires | 790 | 1,640 | 2,570 | 3,170 | 3,640 | 3,070 | 3,240 | 3,190 | 3,200 |
| Batteries, Lead-Acid | Neg. | 200 | 450 | 40 | 150 | 20 | 20 | 20 | 20 |
| Miscellaneous Durables | | | | | | | | | |
| Selected Consumer Electronics*** | | | | | 1,710 | 2,080 | 2,270 | 2,460 | 2,600 |
| Other Miscellaneous Durables | | | | | 13,740 | 16,740 | 17,040 | 16,880 | 16,850 |
| <i>Total Miscellaneous Durables</i> | 5,010 | 6,930 | 9,840 | 12,000 | 15,450 | 18,820 | 19,310 | 19,340 | 19,450 |
| Total Durable Goods | 9,570 | 13,720 | 20,440 | 26,350 | 32,270 | 35,530 | 36,520 | 36,900 | 37,430 |
| Nondurable Goods (Detail in Table 17) | 14,940 | 21,330 | 29,750 | 43,370 | 46,450 | 44,960 | 43,880 | 43,260 | 40,480 |
| Containers and Packaging (Detail in Table 22) | 24,500 | 40,210 | 44,180 | 47,750 | 46,610 | 46,940 | 45,210 | 45,480 | 44,940 |
| Total Product Wastes† | 49,010 | 75,260 | 94,370 | 117,470 | 125,330 | 127,430 | 125,610 | 125,640 | 122,850 |
| Other Wastes | | | | | | | | | |
| Food Scraps | 12,200 | 12,800 | 13,000 | 20,800 | 26,130 | 28,750 | 29,530 | 30,360 | 30,840 |
| Yard Trimmings | 20,000 | 23,200 | 27,500 | 30,800 | 14,760 | 11,960 | 12,210 | 12,300 | 11,730 |
| Miscellaneous Inorganic Wastes | 1,300 | 1,780 | 2,250 | 2,900 | 3,500 | 3,650 | 3,690 | 3,720 | 3,750 |
| Total Other Wastes | 33,500 | 37,780 | 42,750 | 54,500 | 44,390 | 44,360 | 45,430 | 46,380 | 46,320 |
| Total MSW Discarded - Weight | 82,510 | 113,040 | 137,120 | 171,970 | 169,720 | 171,790 | 171,040 | 172,020 | 169,170 |
| | | | | | | | | | |
| | Percent of Total Discards | | | | | | | | |
| Products | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods | | | | | | | | | |
| Major Appliances | 2.0% | 1.9% | 2.1% | 1.3% | 1.0% | 0.7% | 0.7% | 0.7% | 0.7% |
| Small Appliances** | | | | 0.3% | 0.6% | 0.6% | 0.7% | 0.7% | 0.8% |
| Furniture and Furnishings | 2.6% | 2.5% | 3.5% | 3.9% | 4.7% | 5.0% | 5.2% | 5.3% | 5.5% |
| Carpets and Rugs** | | | | 1.0% | 1.4% | 1.6% | 1.6% | 1.6% | 1.7% |
| Rubber Tires | 1.0% | 1.5% | 1.9% | 1.8% | 2.1% | 1.8% | 1.9% | 1.9% | 1.9% |
| Batteries, Lead-Acid | Neg. | 0.2% | 0.3% | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| Miscellaneous Durables | | | | | | | | | |
| Selected Consumer Electronics*** | | | | | 1.0% | 1.2% | 1.3% | 1.4% | 1.5% |
| Other Miscellaneous Durables | | | | | 8.1% | 9.7% | 10.0% | 9.8% | 10.0% |
| <i>Total Miscellaneous Durables</i> | 6.1% | 6.1% | 7.2% | 7.0% | 9.1% | 11.0% | 11.3% | 11.2% | 11.5% |
| Total Durable Goods | 11.6% | 12.1% | 14.9% | 15.3% | 19.0% | 20.7% | 21.4% | 21.5% | 22.1% |
| Nondurable Goods (Detail in Table 17) | 18.1% | 18.9% | 21.7% | 25.2% | 27.4% | 26.2% | 25.7% | 25.1% | 23.9% |
| Containers and Packaging (Detail in Table 23) | 29.7% | 35.6% | 32.2% | 27.8% | 27.5% | 27.3% | 26.4% | 26.4% | 26.6% |
| Total Product Wastes† | 59.4% | 66.6% | 68.8% | 68.3% | 73.8% | 74.2% | 73.4% | 73.0% | 72.6% |
| Other Wastes | | | | | | | | | |
| Food Scraps | 14.8% | 11.3% | 9.5% | 12.1% | 15.4% | 16.7% | 17.3% | 17.6% | 18.2% |
| Yard Trimmings | 24.2% | 20.5% | 20.1% | 17.9% | 8.7% | 7.0% | 7.1% | 7.2% | 6.9% |
| Miscellaneous Inorganic Wastes | 1.6% | 1.6% | 1.6% | 1.7% | 2.1% | 2.1% | 2.2% | 2.2% | 2.2% |
| Total Other Wastes | 40.6% | 33.4% | 31.2% | 31.7% | 26.2% | 25.8% | 26.6% | 27.0% | 27.4% |
| Total MSW Discarded - % | 100.0% | 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

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. For example, factors are developed by applying sales growth statistics (expressed as constant dollars) in household and office furniture, curtains, and mattresses to textile consumption (in tons) in household and office furniture, curtains, and mattresses manufacturing for those years where consumption data are available. These factors are then applied to those years where sales statistics are available but consumption data are not available. 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 9.3 million tons in 2007 (3.7 percent of total MSW). No significant recovery of materials from furniture was identified. Some mattress recovery is occurring but, according to an industry representative, recovery data are not currently available. Wood is the largest material category in furniture, with ferrous metals second. Plastics, glass, and other materials are also found in furniture.

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 pounds per square yard 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 3.1 million tons of carpets and rugs were generated in MSW in 2007, which was 1.2 percent of total generation.

Recovery of carpet fiber, backing, and padding – estimated from industry data – was 280,000 tons in 2007 (8.9 percent of carpet generation).

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 4.9 million tons in 2007 (1.9 percent of total MSW). Since 2000, the generation of rubber tires has remained fairly constant.

Data on recovery of tires are based on data from the Scrap Tire Management Council. The tire recovery rate increased from 26.2 percent in 2000 to 34.8 percent in 2007. In recent years, the quantity of tires generated and recovered through recycling has remained relatively steady. After recovery, 3.2 million tons of tires were discarded in 2007. (Tires going to combustion facilities as fuel are included in the combustion estimates in Chapter 3.)

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 2.5 million tons of lead-acid batteries from automobiles, trucks, and motorcycles were generated in MSW in 2007 (one percent of total generation).

The Battery Council International provided the most recent data on recovery of batteries. Recovery of batteries for recycling has fluctuated between 70 percent and 99 percent; recovery has increased since 1980 as a growing number of communities have restricted batteries from disposal at landfills or combustion facilities. In 2007, 99.2 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 20,000 tons in 2007. (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 20.5 million tons of these goods were generated in 2007, amounting to 8.1 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 2007, an estimated 3.0 million tons of these goods were generated. Of this, approximately 410,000 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. EPA has addressed television, computer products, and cell phone management separately in the recently released *Electronics Waste Management in the United States Approach 1*, EPA530-R-08-009, July 2008 (<http://www.epa.gov/waste/conservation/materials/recycling/docs/app-1.pdf>).

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 2007, bringing total recovery from this category to 1.0 million tons. Discards of miscellaneous durable goods were 19.5 million tons in 2007.

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 62.2 million tons in 2007 (24.5 percent of total generation). Recovery of paper products in this category is quite significant, resulting in 21.8 million tons of nondurable goods recovered in 2007 (35.0 percent of nondurables generation). This means that 40.5 million tons of nondurable goods were discarded in 2007 (23.9 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 2007 was shown earlier in Table 4. Generation of paper and paperboard nondurable products declined from 47.8 million tons in 2000 to 43.1 million tons in 2007. 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 11.0 million tons generated in 2007 (4.3 percent of total MSW). In 2007, an estimated 8.5 million tons of newspapers generated were recovered for recycling. Estimates of newspaper generation are broken down into newsprint (the majority of the weight of the newspapers) and groundwood³ 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 1.3 million tons, or 0.5 percent of total MSW generation, in 2007. Recovery of books is not well documented, but it was estimated that approximately 350,000 tons of books were recovered in 2007. Books are made of both groundwood and chemical pulp.
- Magazines accounted for an estimated 2.6 million tons, or 1.0 percent of total MSW generation, in 2007. Like books, recovery of magazines is not well documented. It was estimated that 1.0 million tons of magazines were recovered

³ 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.

in 2007. Magazines are predominantly 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 6.0 million tons, or 2.4 percent of total MSW generation in 2007. 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 4.3 million tons of office-type papers were recovered in 2007.
- Directories were estimated to generate 700,000 tons (0.3 percent of total MSW) in 2007. These directories are made of groundwood. It was estimated that 140,000 tons of directories were recovered in 2007.
- Standard mail includes catalogs and other direct bulk mailings; these amounted to an estimated 5.9 million tons, or 2.3 percent of MSW generation, in 2007. Both groundwood and chemical pulps are used in these mailings. It was estimated that 2.4 million tons were recovered in 2007. 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 6.3 million tons, or 2.5 percent of MSW generation, in 2007, with recovery estimated at 3.6 million tons.

Table 15
PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2007
(WITH DETAIL ON NONDURABLE GOODS)
(In thousands of tons and percent of total generation)

| Products | Thousands of Tons | | | | | | | | |
|---|-----------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods (Detail in Table 12) | 9,920 | 14,660 | 21,800 | 29,810 | 38,850 | 43,280 | 44,400 | 44,890 | 45,420 |
| Nondurable Goods | | | | | | | | | |
| Newspapers | 7,110 | 9,510 | 11,050 | 13,430 | 14,790 | 13,520 | 12,790 | 12,360 | 10,980 |
| Books and Magazines | 1,920 | 2,470 | 3,390 | | | | | | |
| Books** | | | | 970 | 1,240 | 1,270 | 1,100 | 1,130 | 1,340 |
| Magazines** | | | | 2,830 | 2,230 | 2,460 | 2,580 | 2,670 | 2,550 |
| Office-Type Papers | 1,520 | 2,650 | 4,000 | 6,410 | 7,420 | 7,040 | 6,620 | 5,890 | 6,000 |
| Directories** | | | | 610 | 680 | 640 | 660 | 680 | 700 |
| Standard Mail*** | | | | 3,820 | 5,570 | 5,570 | 5,830 | 5,890 | 5,910 |
| Other Commercial Printing | 1,260 | 2,130 | 3,120 | 4,460 | 7,380 | 6,640 | 6,440 | 7,250 | 6,260 |
| Tissue Paper and Towels | 1,090 | 2,080 | 2,300 | 2,960 | 3,220 | 3,220 | 3,460 | 3,590 | 3,500 |
| Paper Plates and Cups | 270 | 420 | 630 | 650 | 960 | 1,200 | 1,160 | 1,270 | 1,310 |
| Plastic Plates and Cupst | | | 190 | 650 | 870 | 970 | 930 | 890 | 860 |
| Trash Bags** | | | | 780 | 850 | 1,090 | 1,060 | 1,080 | 1,070 |
| Disposable Diapers | Neg. | 350 | 1,930 | 2,700 | 3,230 | 3,370 | 3,410 | 3,560 | 3,730 |
| Other Nonpackaging Paper | 2,700 | 3,630 | 4,230 | 3,840 | 4,250 | 4,540 | 4,490 | 4,540 | 4,450 |
| Clothing and Footwear | 1,360 | 1,620 | 2,170 | 4,010 | 6,470 | 7,570 | 7,890 | 8,350 | 8,320 |
| Towels, Sheets and Pillowcases** | | | | 710 | 820 | 940 | 980 | 1,030 | 1,100 |
| Other Miscellaneous Nondurables | 100 | 200 | 1,410 | 3,340 | 4,030 | 4,340 | 4,250 | 4,130 | 4,160 |
| Total Nondurable Goods | 17,330 | 25,060 | 34,420 | 52,170 | 64,010 | 64,380 | 63,650 | 64,310 | 62,240 |
| Containers and Packaging (Detail in Table 18) | 27,370 | 43,560 | 52,670 | 64,530 | 75,350 | 77,290 | 76,400 | 77,820 | 78,450 |
| Total Product Wastes† | 54,620 | 83,280 | 108,890 | 146,510 | 178,210 | 184,950 | 184,450 | 187,020 | 186,110 |
| Other Wastes | 33,500 | 37,780 | 42,750 | 58,700 | 60,840 | 64,830 | 65,980 | 67,160 | 68,030 |
| Total MSW Generated - Weight | 88,120 | 121,060 | 151,640 | 205,210 | 239,050 | 249,780 | 250,430 | 254,180 | 254,140 |
| Products | Percent of Total Generation | | | | | | | | |
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods (Detail in Table 12) | 11.3% | 12.1% | 14.4% | 14.5% | 16.3% | 17.3% | 17.7% | 17.7% | 17.9% |
| Nondurable Goods | | | | | | | | | |
| Newspapers | 8.1% | 7.9% | 7.3% | 6.5% | 6.2% | 5.4% | 5.1% | 4.9% | 4.3% |
| Books and Magazines | 2.2% | 2.0% | 2.2% | | | | | | |
| Books** | | | | 0.5% | 0.5% | 0.5% | 0.4% | 0.4% | 0.5% |
| Magazines** | | | | 1.4% | 0.9% | 1.0% | 1.0% | 1.1% | 1.0% |
| Office-Type Papers*** | 1.7% | 2.2% | 2.6% | 3.1% | 3.1% | 2.8% | 2.6% | 2.3% | 2.4% |
| Directories** | | | | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Standard Mail§ | | | | 1.9% | 2.3% | 2.2% | 2.3% | 2.3% | 2.3% |
| Other Commercial Printing | 1.4% | 1.8% | 2.1% | 2.2% | 3.1% | 2.7% | 2.6% | 2.9% | 2.5% |
| Tissue Paper and Towels | 1.2% | 1.7% | 1.5% | 1.4% | 1.3% | 1.3% | 1.4% | 1.4% | 1.4% |
| Paper Plates and Cups | 0.3% | 0.3% | 0.4% | 0.3% | 0.4% | 0.5% | 0.5% | 0.5% | 0.5% |
| Plastic Plates and Cupst | | | 0.1% | 0.3% | 0.4% | 0.4% | 0.4% | 0.4% | 0.3% |
| Trash Bags** | | | | 0.4% | 0.4% | 0.4% | 0.4% | 0.4% | 0.4% |
| Disposable Diapers | Neg. | 0.3% | 1.3% | 1.3% | 1.4% | 1.3% | 1.4% | 1.4% | 1.5% |
| Other Nonpackaging Paper | 3.1% | 3.0% | 2.8% | 1.9% | 1.8% | 1.8% | 1.8% | 1.8% | 1.8% |
| Clothing and Footwear | 1.5% | 1.3% | 1.4% | 2.0% | 2.7% | 3.0% | 3.2% | 3.3% | 3.3% |
| Towels, Sheets and Pillowcases** | | | | 0.3% | 0.3% | 0.4% | 0.4% | 0.4% | 0.4% |
| Other Miscellaneous Nondurables | 0.1% | 0.2% | 0.9% | 1.6% | 1.7% | 1.7% | 1.7% | 1.6% | 1.6% |
| Total Nondurables | 19.7% | 20.7% | 22.7% | 25.4% | 26.8% | 25.8% | 25.4% | 25.3% | 24.5% |
| Containers and Packaging (Detail in Table 19) | 31.1% | 36.0% | 34.7% | 31.4% | 31.5% | 30.9% | 30.5% | 30.6% | 30.9% |
| Total Product Wastes† | 62.0% | 68.8% | 71.8% | 71.4% | 74.5% | 74.0% | 73.7% | 73.6% | 73.2% |
| Other Wastes | 38.0% | 31.2% | 28.2% | 28.6% | 25.5% | 26.0% | 26.3% | 26.4% | 26.8% |
| Total MSW Generated - % | 100.0% | 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 2007
(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 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods (Detail in Table 13) | 350 | 940 | 1,360 | 3,460 | 6,580 | 7,750 | 7,880 | 7,990 | 7,990 |
| Nondurable Goods | | | | | | | | | |
| Newspapers | 1,820 | 2,250 | 3,020 | 5,110 | 8,720 | 9,150 | 9,360 | 9,310 | 8,540 |
| Books and Magazines | 100 | 260 | 280 | | | | | | |
| Books** | | | | 100 | 240 | 250 | 270 | 290 | 350 |
| Magazines** | | | | 300 | 710 | 890 | 960 | 1,030 | 1,010 |
| Office-Type Papers | 250 | 710 | 870 | 1,700 | 4,090 | 4,240 | 4,110 | 4,210 | 4,310 |
| Directories** | | | | 50 | 120 | 100 | 120 | 130 | 140 |
| Standard Mail*** | | | | 200 | 1,830 | 1,930 | 2,090 | 2,280 | 2,380 |
| Other Commercial Printing | 130 | 340 | 350 | 700 | 810 | 1,450 | 1,440 | 2,370 | 3,590 |
| Tissue Paper and Towels | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Paper Plates and Cups | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Plastic Plates and Cups† | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Trash Bags** | | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Disposable Diapers | | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Other Nonpackaging Paper | 40 | 110 | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Clothing and Footwear | 50 | 60 | 150 | 520 | 900 | 1,250 | 1,250 | 1,250 | 1,250 |
| Towels, Sheets and Pillowcases** | | | | 120 | 140 | 160 | 170 | 180 | 190 |
| Other Miscellaneous Nondurables | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Nondurable Goods | 2,390 | 3,730 | 4,670 | 8,800 | 17,560 | 19,420 | 19,770 | 21,050 | 21,760 |
| Containers and Packaging (Detail in Table 20) | 2,870 | 3,350 | 8,490 | 16,780 | 28,740 | 30,350 | 31,190 | 32,340 | 33,510 |
| Total Product Wastes‡ | 5,610 | 8,020 | 14,520 | 29,040 | 52,880 | 57,520 | 58,840 | 61,380 | 63,260 |
| Other Wastes | Neg. | Neg. | Neg. | 4,200 | 16,450 | 20,470 | 20,550 | 20,780 | 21,710 |
| Total MSW Recovered - Weight | 5,610 | 8,020 | 14,520 | 33,240 | 69,330 | 77,990 | 79,390 | 82,160 | 84,970 |
| Products | Percent of Generation of Each Product | | | | | | | | |
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods (Detail in Table 13) | 3.5% | 6.4% | 6.2% | 11.6% | 16.9% | 17.9% | 17.7% | 17.8% | 17.6% |
| Nondurable Goods | | | | | | | | | |
| Newspapers | 25.6% | 23.7% | 27.3% | 38.0% | 59.0% | 67.7% | 73.2% | 75.3% | 77.8% |
| Books and Magazines | 5.2% | 10.5% | 8.3% | | | | | | |
| Books** | | | | 10.3% | 19.4% | 19.7% | 24.5% | 25.7% | 26.1% |
| Magazines** | | | | 10.6% | 31.8% | 36.2% | 37.2% | 38.6% | 39.6% |
| Office-Type Papers*** | 16.4% | 26.8% | 21.8% | 26.5% | 55.1% | 60.2% | 62.1% | 71.5% | 71.8% |
| Directories** | | | | 8.2% | 17.6% | 15.6% | 18.2% | 19.1% | 20.0% |
| Standard Mail§ | | | | 5.2% | 32.9% | 34.6% | 35.8% | 38.7% | 40.3% |
| Other Commercial Printing | 10.3% | 16.0% | 11.2% | 15.7% | 11.0% | 21.8% | 22.4% | 32.7% | 57.3% |
| Tissue Paper and Towels | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Paper Plates and Cups | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Plastic Plates and Cups† | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Trash Bags** | | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Disposable Diapers | | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Other Nonpackaging Paper | 1.5% | 3.0% | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Clothing and Footwear | Neg. | Neg. | Neg. | 13.0% | 13.9% | 16.5% | 15.8% | 15.0% | 15.0% |
| Towels, Sheets and Pillowcases** | | | | 16.9% | 17.1% | 17.0% | 17.3% | 17.5% | 17.3% |
| Other Miscellaneous Nondurables | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Nondurables | 13.8% | 14.9% | 13.6% | 16.9% | 27.4% | 30.2% | 31.1% | 32.7% | 35.0% |
| Containers and Packaging (Detail in Table 21) | 10.5% | 7.7% | 16.1% | 26.0% | 38.1% | 39.3% | 40.8% | 41.6% | 42.7% |
| Total Product Wastes‡ | 10.3% | 9.6% | 13.3% | 19.8% | 29.7% | 31.1% | 31.9% | 32.8% | 34.0% |
| Other Wastes | Neg. | Neg. | Neg. | 7.2% | 27.0% | 31.6% | 31.1% | 30.9% | 31.9% |
| Total MSW Recovered - % | 6.4% | 6.6% | 9.6% | 16.2% | 29.0% | 31.2% | 31.7% | 32.3% | 33.4% |

* 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 2007
(WITH DETAIL ON NONDURABLE GOODS)
(In thousands of tons and percent of total discards)

| Products | Thousands of Tons | | | | | | | | |
|---|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods (Detail in Table 14) | 9,570 | 13,720 | 20,440 | 26,350 | 32,270 | 35,530 | 36,520 | 36,900 | 37,430 |
| Nondurable Goods | | | | | | | | | |
| Newspapers | 5,290 | 7,260 | 8,030 | 8,320 | 6,070 | 4,370 | 3,430 | 3,050 | 2,440 |
| Books and Magazines | 1,820 | 2,210 | 3,110 | | | | | | |
| Books** | | | | 870 | 1,000 | 1,020 | 830 | 840 | 990 |
| Magazines** | | | | 2,530 | 1,520 | 1,570 | 1,620 | 1,640 | 1,540 |
| Office-Type Papers | 1,270 | 1,940 | 3,130 | 4,710 | 3,330 | 2,800 | 2,510 | 1,680 | 1,690 |
| Directories** | | | | 560 | 560 | 540 | 540 | 550 | 560 |
| Standard Mail*** | | | | 3,620 | 3,740 | 3,640 | 3,740 | 3,610 | 3,530 |
| Other Commercial Printing | 1,130 | 1,790 | 2,770 | 3,760 | 6,570 | 5,190 | 5,000 | 4,880 | 2,670 |
| Tissue Paper and Towels | 1,090 | 2,080 | 2,300 | 2,960 | 3,220 | 3,220 | 3,460 | 3,590 | 3,500 |
| Paper Plates and Cups | 270 | 420 | 630 | 650 | 960 | 1,200 | 1,160 | 1,270 | 1,310 |
| Plastic Plates and Cups† | | | 190 | 650 | 870 | 970 | 930 | 890 | 860 |
| Trash Bags** | | | | 780 | 850 | 1,090 | 1,060 | 1,080 | 1,070 |
| Disposable Diapers | Neg. | 350 | 1,930 | 2,700 | 3,230 | 3,370 | 3,410 | 3,560 | 3,730 |
| Other Nonpackaging Paper | 2,660 | 3,520 | 4,230 | 3,840 | 4,250 | 4,540 | 4,490 | 4,540 | 4,450 |
| Clothing and Footwear | 1,310 | 1,560 | 2,020 | 3,490 | 5,570 | 6,320 | 6,640 | 7,100 | 7,070 |
| Towels, Sheets and Pillowcases** | | | | 590 | 680 | 780 | 810 | 850 | 910 |
| Other Miscellaneous Nondurables | 100 | 200 | 1,410 | 3,340 | 4,030 | 4,340 | 4,250 | 4,130 | 4,160 |
| Total Nondurable Goods | 14,940 | 21,330 | 29,750 | 43,370 | 46,450 | 44,960 | 43,880 | 43,260 | 40,480 |
| Containers and Packaging (Detail in Table 22) | 24,500 | 40,210 | 44,180 | 47,750 | 46,610 | 46,940 | 45,210 | 45,480 | 44,940 |
| Total Product Wastes‡ | 49,010 | 75,260 | 94,370 | 117,470 | 125,330 | 127,430 | 125,610 | 125,640 | 122,850 |
| Other Wastes | 33,500 | 37,780 | 42,750 | 54,500 | 44,390 | 44,360 | 45,430 | 46,380 | 46,320 |
| Total MSW Discarded - Weight | 82,510 | 113,040 | 137,120 | 171,970 | 169,720 | 171,790 | 171,040 | 172,020 | 169,170 |
| Products | Percent of Total Discards | | | | | | | | |
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods (Detail in Table 14) | 11.6% | 12.1% | 14.9% | 15.3% | 19.0% | 20.7% | 21.4% | 21.5% | 22.1% |
| Nondurable Goods | | | | | | | | | |
| Newspapers | 6.4% | 6.4% | 5.9% | 4.8% | 3.6% | 2.5% | 2.0% | 1.8% | 1.4% |
| Books and Magazines | 2.2% | 2.0% | 2.3% | | | | | | |
| Books** | | | | 0.5% | 0.6% | 0.6% | 0.5% | 0.5% | 0.6% |
| Magazines** | | | | 1.5% | 0.9% | 0.9% | 0.9% | 1.0% | 0.9% |
| Office-Type Papers*** | 1.5% | 1.7% | 2.3% | 2.7% | 2.0% | 1.6% | 1.5% | 1.0% | 1.0% |
| Directories** | | | | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Standard Mail§ | | | | 2.1% | 2.2% | 2.1% | 2.2% | 2.1% | 2.1% |
| Other Commercial Printing | 1.4% | 1.6% | 2.0% | 2.2% | 3.9% | 3.0% | 2.9% | 2.8% | 1.6% |
| Tissue Paper and Towels | 1.3% | 1.8% | 1.7% | 1.7% | 1.9% | 1.9% | 2.0% | 2.1% | 2.1% |
| Paper Plates and Cups | 0.3% | 0.4% | 0.5% | 0.4% | 0.6% | 0.7% | 0.7% | 0.7% | 0.8% |
| Plastic Plates and Cups† | | | 0.1% | 0.4% | 0.5% | 0.6% | 0.5% | 0.5% | 0.5% |
| Trash Bags** | | | | 0.5% | 0.5% | 0.6% | 0.6% | 0.6% | 0.6% |
| Disposable Diapers | Neg. | 0.3% | 1.4% | 1.6% | 1.9% | 2.0% | 2.0% | 2.1% | 2.2% |
| Other Nonpackaging Paper | 3.2% | 3.1% | 3.1% | 2.2% | 2.5% | 2.6% | 2.6% | 2.6% | 2.6% |
| Clothing and Footwear | 1.6% | 1.4% | 1.5% | 2.0% | 3.3% | 3.7% | 3.9% | 4.1% | 4.2% |
| Towels, Sheets and Pillowcases** | | | | 0.3% | 0.4% | 0.5% | 0.5% | 0.5% | 0.5% |
| Other Miscellaneous Nondurables | 0.1% | 0.2% | 1.7% | 1.9% | 2.4% | 2.5% | 2.5% | 2.4% | 2.5% |
| Total Nondurables | 18.1% | 18.9% | 21.7% | 25.2% | 27.4% | 26.2% | 25.7% | 25.1% | 23.9% |
| Containers and Packaging (Detail in Table 23) | 29.7% | 35.6% | 32.2% | 27.8% | 27.5% | 27.3% | 26.4% | 26.4% | 26.6% |
| Total Product Wastes‡ | 59.4% | 66.6% | 68.8% | 68.3% | 73.8% | 74.2% | 73.4% | 73.0% | 72.6% |
| Other Wastes | 40.6% | 33.4% | 31.2% | 31.7% | 26.2% | 25.8% | 26.6% | 27.0% | 27.4% |
| Total MSW Discarded - % | 100.0% | 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

- 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 3.5 million tons (1.4 percent of total MSW generation) in 2007. 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 1.3 million tons (0.5 percent of total MSW generation) in 2007. No significant recovery for recycling of these products was identified.
- Other nonpackaging papers—including posters, photographic papers, cards, and games – accounted for 4.5 million tons (1.8 percent of total MSW generation) in 2007. No significant recovery for recycling of these papers was identified.

Overall, generation of paper and paperboard products in nondurable goods was 43.1 million tons in 2007 (Table 4). While newspapers were recovered at the highest rate, other paper products, such as books, magazines, office papers, directories, standard mail, and other commercial printing also were recovered for recycling, and the overall recovery rate for paper in nondurables was 47.2 percent in 2007. Thus 22.7 million tons of paper in nondurables were discarded in 2007.

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 860,000 tons of these products were generated in 2007, or 0.3 percent of total MSW (Table 15). No significant recovery for recycling was identified in 2007.

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 2007 (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 3.7 million tons of disposable diapers were generated in 2007, 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 2007.

Clothing and Footwear. Generation of clothing and footwear was estimated to be 8.3 million tons in 2007 (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 recycling in 2007. (Reuse occurs before generation and is not included in the generation or recycling estimates.)

Towels, Sheets, and Pillowcases. An estimated 1.1 million tons of towels, sheets, and pillowcases were generated in 2007. Generation was estimated using a methodology similar to

that for clothing. An estimated 190,000 tons of these textiles were recovered for export or recycling in 2007.

Other Miscellaneous Nondurables. Generation of other miscellaneous nondurables was estimated to be 4.2 million tons in 2007 (1.6 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 Chemistry 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 78.5 million tons of generation in 2007 (30.9 percent of total generation). Generation in this category has recently trended upward; Table 18 shows a 1 percent decrease between 2004 and 2005 followed by a 2 percent increase in 2006 (to 77.8 million tons) and a 1 percent increase between 2006 and 2007 (to 78.5 million tons).

Paper and paperboard packaging generation remained fairly consistent in recent years. Glass packaging generation declined after 1980 until 2004 when a small increase was observed in 2005 through 2007. There were small declines in generation of steel packaging with an up turn in 2006 and 2007, while aluminum packaging and wood packaging (mostly pallets) held steady. Plastics packaging generation decreased in 2005 and increased in 2006 and 2007. 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 2007, 42.7 percent of containers and packaging generated was

recovered for recycling. Because of this recovery, containers and packaging comprised 26.6 percent of total MSW discards in 2007.

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 11.5 million tons in 2007, or 4.5 percent of MSW generation (Tables 18 and 19). This is higher tonnage than was generated in 2000 but lower than the amount generated in 1990 and earlier years.

An estimated 3.2 million tons of glass containers were recovered for recycling, or 28.1 percent of generation, in 2007. Glass container discards were 8.3 million tons in 2007, 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 2.7 million tons in 2007 (1.1 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 1.7 million tons of steel packaging were recovered in 2007, or 64.6 percent of generation. The 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 the Aluminum Association and can weight data from the Aluminum Association, while estimates of the net import of unfilled aluminum cans is based on Department of Commerce data. Other aluminum packaging is also based on Department of Commerce data.

Prior to 2000, the Can Manufacturers Institute published data on consumption of beverages in aluminum cans. After 2000, the Aluminum Association provided consumption data. 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 2007 was 1.9 million tons, or 0.7 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 2007 was 0.7 million tons, or 48.6 percent of generation. Recovery of all aluminum packaging was estimated to be 39.0 percent of total generation in 2007. After recovery for recycling, 1.1 million tons of aluminum packaging were discarded in 2007.

Table 18
PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2007
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In thousands of tons)

| Products | Thousands of Tons | | | | | | | | |
|--|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 12)</i> | 9,920 | 14,660 | 21,800 | 29,810 | 38,850 | 43,280 | 44,400 | 44,890 | 45,420 |
| Nondurable Goods <i>(Detail in Table 15)</i> | 17,330 | 25,060 | 34,420 | 52,170 | 64,010 | 64,380 | 63,650 | 64,310 | 62,240 |
| Containers and Packaging | | | | | | | | | |
| Glass Packaging | | | | | | | | | |
| Beer and Soft Drink Bottles | 1,400 | 5,580 | 6,740 | 5,640 | 5,710 | 7,010 | 7,180 | 7,500 | 7,710 |
| Wine and Liquor Bottles | 1,080 | 1,900 | 2,450 | 2,030 | 1,910 | 1,570 | 1,700 | 1,680 | 1,670 |
| Food and Other Bottles & Jars | 3,710 | 4,440 | 4,780 | 4,160 | 3,420 | 2,280 | 2,360 | 2,240 | 2,090 |
| Total Glass Packaging | 6,190 | 11,920 | 13,970 | 11,830 | 11,040 | 10,860 | 11,240 | 11,420 | 11,470 |
| Steel Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | 640 | 1,570 | 520 | 150 | Neg. | Neg. | Neg. | Neg. | Neg. |
| Food and Other Cans | 3,760 | 3,540 | 2,850 | 2,540 | 2,630 | 2,450 | 2,130 | 2,510 | 2,440 |
| Other Steel Packaging | 260 | 270 | 240 | 200 | 240 | 240 | 240 | 240 | 240 |
| Total Steel Packaging | 4,660 | 5,380 | 3,610 | 2,890 | 2,870 | 2,690 | 2,370 | 2,750 | 2,680 |
| Aluminum Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | Neg. | 100 | 850 | 1,550 | 1,520 | 1,480 | 1,450 | 1,440 | 1,420 |
| Other Cans | Neg. | 60 | 40 | 20 | 50 | 50 | 80 | 110 | 40 |
| Foil and Closures | 170 | 410 | 380 | 330 | 380 | 390 | 400 | 420 | 410 |
| Total Aluminum Packaging | 170 | 570 | 1,270 | 1,900 | 1,950 | 1,920 | 1,930 | 1,970 | 1,870 |
| Paper & Paperboard Pkg | | | | | | | | | |
| Corrugated Boxes | 7,330 | 12,760 | 17,080 | 24,010 | 30,210 | 31,490 | 30,930 | 31,430 | 31,230 |
| Milk Cartons | | | 790 | 510 | 550 | 460 | 500 | 490 | 500 |
| Folding Cartons | | | 3,820 | 4,300 | 5,820 | 5,410 | 5,530 | 5,450 | 5,530 |
| Other Paperboard Packaging | 3,840 | 4,830 | 230 | 290 | 200 | 170 | 160 | 160 | 150 |
| Bags and Sacks | | | 3,380 | 2,440 | 1,490 | 1,270 | 1,120 | 1,080 | 1,140 |
| Wrapping Papers | | | 200 | 110 | Neg. | Neg. | Neg. | Neg. | Neg. |
| Other Paper Packaging | 2,940 | 3,810 | 850 | 1,020 | 1,670 | 1,480 | 1,400 | 1,400 | 1,390 |
| Total Paper & Board Pkg | 14,110 | 21,400 | 26,350 | 32,680 | 39,940 | 40,280 | 39,640 | 40,010 | 39,940 |
| Plastics Packaging | | | | | | | | | |
| Soft Drink Bottles | | | 260 | 430 | 830 | 850 | 850 | 940 | 1,010 |
| Milk Bottles | | | 230 | 530 | 690 | 800 | 800 | 710 | 820 |
| Other Containers | 60 | 910 | 890 | 1,430 | 2,630 | 3,150 | 3,110 | 3,430 | 3,740 |
| Bags and Sacks | | | 390 | 940 | 1,650 | 1,810 | 1,640 | 1,830 | 1,010 |
| Wraps | | | 840 | 1,530 | 2,550 | 2,940 | 2,810 | 2,800 | 3,180 |
| Subtotal Bags, Sacks, and Wraps | | | 1,230 | 2,470 | 4,200 | 4,750 | 4,450 | 4,630 | 4,190 |
| Other Plastics Packaging | 60 | 1,180 | 790 | 2,040 | 2,840 | 3,270 | 3,210 | 3,200 | 3,870 |
| Total Plastics Packaging | 120 | 2,090 | 3,400 | 6,900 | 11,190 | 12,820 | 12,420 | 12,910 | 13,630 |
| Wood Packaging | 2,000 | 2,070 | 3,940 | 8,180 | 8,120 | 8,430 | 8,520 | 8,480 | 8,540 |
| Other Misc. Packaging | 120 | 130 | 130 | 150 | 240 | 290 | 280 | 280 | 320 |
| Total Containers & Pkg | 27,370 | 43,560 | 52,670 | 64,530 | 75,350 | 77,290 | 76,400 | 77,820 | 78,450 |
| Total Product Wastes† | 54,620 | 83,280 | 108,890 | 146,510 | 178,210 | 184,950 | 184,450 | 187,020 | 186,110 |
| Other Wastes | | | | | | | | | |
| Food Scraps | 12,200 | 12,800 | 13,000 | 20,800 | 26,810 | 29,410 | 30,220 | 31,040 | 31,650 |
| Yard Trimmings | 20,000 | 23,200 | 27,500 | 35,000 | 30,530 | 31,770 | 32,070 | 32,400 | 32,630 |
| Miscellaneous Inorganic Wastes | 1,300 | 1,780 | 2,250 | 2,900 | 3,500 | 3,650 | 3,690 | 3,720 | 3,750 |
| Total Other Wastes | 33,500 | 37,780 | 42,750 | 58,700 | 60,840 | 64,830 | 65,980 | 67,160 | 68,030 |
| Total MSW Generated - Weight | 88,120 | 121,060 | 151,640 | 205,210 | 239,050 | 249,780 | 250,430 | 254,180 | 254,140 |

* Generation before materials recovery or combustion.
Details may not add to totals due to rounding.

† 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 2007
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of total generation)

| Products | Percent of Total Generation | | | | | | | | |
|--|-----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 12)</i> | 11.3% | 12.1% | 14.4% | 14.5% | 16.3% | 17.3% | 17.7% | 17.7% | 17.9% |
| Nondurable Goods <i>(Detail in Table 15)</i> | 19.7% | 20.7% | 22.7% | 25.4% | 26.8% | 25.8% | 25.4% | 25.3% | 24.5% |
| Containers and Packaging | | | | | | | | | |
| Glass Packaging | | | | | | | | | |
| Beer and Soft Drink Bottles | 1.6% | 4.6% | 4.4% | 2.7% | 2.4% | 2.8% | 2.9% | 3.0% | 3.0% |
| Wine and Liquor Bottles | 1.2% | 1.6% | 1.6% | 1.0% | 0.8% | 0.6% | 0.7% | 0.7% | 0.7% |
| Food and Other Bottles & Jars | 4.2% | 3.7% | 3.2% | 2.0% | 1.4% | 0.9% | 0.9% | 0.9% | 0.8% |
| Total Glass Packaging | 7.0% | 9.8% | 9.2% | 5.8% | 4.6% | 4.3% | 4.5% | 4.5% | 4.5% |
| Steel Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | 0.7% | 1.3% | 0.3% | 0.1% | Neg. | Neg. | Neg. | Neg. | Neg. |
| Food and Other Cans | 4.3% | 2.9% | 1.9% | 1.2% | 1.1% | 1.0% | 0.9% | 1.0% | 1.0% |
| Other Steel Packaging | 0.3% | 0.2% | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Total Steel Packaging | 5.3% | 4.4% | 2.4% | 1.4% | 1.2% | 1.1% | 0.9% | 1.1% | 1.1% |
| Aluminum Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | Neg. | 0.1% | 0.6% | 0.8% | 0.6% | 0.6% | 0.6% | 0.6% | 0.6% |
| Other Cans | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | 0.04% | 0.02% |
| Foil and Closures | 0.2% | 0.3% | 0.3% | 0.2% | 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% | 0.7% |
| Paper & Paperboard Pkg | | | | | | | | | |
| Corrugated Boxes | 8.3% | 10.5% | 11.3% | 11.7% | 12.6% | 12.6% | 12.4% | 12.4% | 12.3% |
| Milk Cartons | | | 0.5% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% | 0.2% |
| Folding Cartons | | | 2.5% | 2.1% | 2.4% | 2.2% | 2.2% | 2.1% | 2.2% |
| Other Paperboard Packaging | 4.4% | 4.0% | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Bags and Sacks | | | 2.2% | 1.2% | 0.6% | 0.5% | 0.4% | 0.4% | 0.4% |
| Wrapping Papers | | | 0.1% | 0.1% | Neg. | Neg. | Neg. | Neg. | Neg. |
| Other Paper Packaging | 3.3% | 3.1% | 0.6% | 0.5% | 0.7% | 0.6% | 0.6% | 0.6% | 0.5% |
| Total Paper & Board Pkg | 16.0% | 17.7% | 17.4% | 15.9% | 16.7% | 16.1% | 15.8% | 15.7% | 15.7% |
| Plastics Packaging | | | | | | | | | |
| Soft Drink Bottles | | | 0.2% | 0.2% | 0.3% | 0.3% | 0.3% | 0.4% | 0.4% |
| Milk Bottles | | | 0.2% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Other Containers | 0.1% | 0.8% | 0.6% | 0.7% | 1.1% | 1.3% | 1.2% | 1.3% | 1.5% |
| Bags and Sacks | | | 0.3% | 0.5% | 0.7% | 0.7% | 0.7% | 0.7% | 0.4% |
| Wraps | | | 0.6% | 0.7% | 1.1% | 1.2% | 1.1% | 1.1% | 1.3% |
| <i>Subtotal Bags, Sacks, and Wraps</i> | | | 0.8% | 1.2% | 1.8% | 1.9% | 1.8% | 1.8% | 1.6% |
| Other Plastics Packaging | 0.1% | 1.0% | 0.5% | 1.0% | 1.2% | 1.3% | 1.3% | 1.3% | 1.5% |
| Total Plastics Packaging | 0.1% | 1.7% | 2.2% | 3.4% | 4.7% | 5.1% | 5.0% | 5.1% | 5.4% |
| Wood Packaging | 2.3% | 1.7% | 2.6% | 4.0% | 3.4% | 3.4% | 3.4% | 3.3% | 3.4% |
| Other Misc. Packaging | 0.1% | 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% | 31.5% | 30.9% | 30.5% | 30.6% | 30.9% |
| Total Product Wastes† | 62.0% | 68.8% | 71.8% | 71.4% | 74.5% | 74.0% | 73.7% | 73.6% | 73.2% |
| Other Wastes | | | | | | | | | |
| Food Scraps | 13.8% | 10.6% | 8.6% | 10.1% | 11.2% | 11.8% | 12.1% | 12.2% | 12.5% |
| Yard Trimmings | 22.7% | 19.2% | 18.1% | 17.1% | 12.8% | 12.7% | 12.8% | 12.7% | 12.8% |
| Miscellaneous Inorganic Wastes | 1.5% | 1.5% | 1.5% | 1.4% | 1.5% | 1.5% | 1.5% | 1.5% | 1.5% |
| Total Other Wastes | 38.0% | 31.2% | 28.2% | 28.6% | 25.5% | 26.0% | 26.3% | 26.4% | 26.8% |
| Total MSW Generated - % | 100.0% | 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.

† 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 2007
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In thousands of tons)

| Products | Thousands of Tons | | | | | | | | |
|--|-------------------|-------|--------|--------|--------|--------|--------|--------|--------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 13)</i> | 350 | 940 | 1,360 | 3,460 | 6,580 | 7,750 | 7,880 | 7,990 | 7,990 |
| Nondurable Goods <i>(Detail in Table 16)</i> | 2,390 | 3,730 | 4,670 | 8,800 | 17,560 | 19,420 | 19,770 | 21,050 | 21,760 |
| Containers and Packaging | | | | | | | | | |
| Glass Packaging | | | | | | | | | |
| Beer and Soft Drink Bottles | 90 | 140 | 730 | 1,890 | 1,530 | 2,150 | 2,200 | 2,300 | 2,660 |
| Wine and Liquor Bottles | 10 | 10 | 20 | 210 | 430 | 240 | 250 | 250 | 250 |
| Food and Other Bottles & Jars | Neg. | Neg. | Neg. | 520 | 920 | 340 | 350 | 330 | 310 |
| Total Glass Packaging | 100 | 150 | 750 | 2,620 | 2,880 | 2,730 | 2,800 | 2,880 | 3,220 |
| Steel Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | 10 | 20 | 50 | 40 | Neg. | Neg. | Neg. | Neg. | Neg. |
| Food and Other Cans | 20 | 60 | 150 | 590 | 1,530 | 1,500 | 1,340 | 1,580 | 1,570 |
| Other Steel Packaging | Neg. | Neg. | Neg. | 60 | 160 | 160 | 160 | 160 | 160 |
| Total Steel Packaging | 30 | 80 | 200 | 690 | 1,690 | 1,660 | 1,500 | 1,740 | 1,730 |
| Aluminum Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | Neg. | 10 | 320 | 990 | 830 | 670 | 650 | 650 | 690 |
| Other Cans | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Foil and Closures | Neg. | Neg. | Neg. | 20 | 30 | 40 | 40 | 40 | 40 |
| Total Aluminum Pkg | Neg. | 10 | 320 | 1,010 | 860 | 710 | 690 | 690 | 730 |
| Paper & Paperboard Pkg | | | | | | | | | |
| Corrugated Boxes | 2,520 | 2,760 | 6,390 | 11,530 | 20,330 | 21,440 | 22,100 | 22,630 | 22,990 |
| Milk Cartons | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Folding Cartons | | | 520 | 340 | 410 | 960 | 1,190 | 1,220 | 1,510 |
| Other Paperboard Packaging | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Bags and Sacks | | | Neg. | 200 | 300 | 320 | 320 | 360 | 420 |
| Wrapping Papers | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Other Paper Packaging | 220 | 350 | 300 | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Paper & Board Pkg | 2,740 | 3,110 | 7,210 | 12,070 | 21,040 | 22,720 | 23,610 | 24,210 | 24,920 |
| Plastics Packaging | | | | | | | | | |
| Soft Drink Bottles | | | 10 | 140 | 290 | 290 | 290 | 290 | 370 |
| Milk Bottles | | | Neg. | 20 | 210 | 230 | 230 | 220 | 230 |
| Other Containers | Neg. | Neg. | Neg. | 20 | 260 | 440 | 440 | 460 | 520 |
| Bags and Sacks | | | | | | | | | |
| Wraps | | | | | | | | | |
| <i>Subtotal Bags, Sacks, and Wraps</i> | | | Neg. | 60 | 180 | 190 | 230 | 360 | 380 |
| Other Plastics Packaging | Neg. | Neg. | Neg. | 20 | 90 | 90 | 90 | 180 | 90 |
| Total Plastics Packaging | Neg. | Neg. | 10 | 260 | 1,030 | 1,240 | 1,280 | 1,510 | 1,590 |
| Wood Packaging | Neg. | Neg. | Neg. | 130 | 1,240 | 1,290 | 1,310 | 1,310 | 1,320 |
| Other Misc. Packaging | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Containers & Pkg | 2,870 | 3,350 | 8,490 | 16,780 | 28,740 | 30,350 | 31,190 | 32,340 | 33,510 |
| Total Product Wastes† | 5,610 | 8,020 | 14,520 | 29,040 | 52,880 | 57,520 | 58,840 | 61,380 | 63,260 |
| Other Wastes | | | | | | | | | |
| Food Scraps | Neg. | Neg. | Neg. | Neg. | 680 | 660 | 690 | 680 | 810 |
| Yard Trimmings | Neg. | Neg. | Neg. | 4,200 | 15,770 | 19,810 | 19,860 | 20,100 | 20,900 |
| Miscellaneous Inorganic Wastes | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Other Wastes | Neg. | Neg. | Neg. | 4,200 | 16,450 | 20,470 | 20,550 | 20,780 | 21,710 |
| Total MSW Recovered - Weight | 5,610 | 8,020 | 14,520 | 33,240 | 69,330 | 77,990 | 79,390 | 82,160 | 84,970 |

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

† 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 2007
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of generation of each product)

| Products | Percent of Generation of Each Product | | | | | | | | |
|--|---------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 13)</i> | 3.5% | 6.4% | 6.2% | 11.6% | 16.9% | 17.9% | 17.7% | 17.8% | 17.6% |
| Nondurable Goods <i>(Detail in Table 16)</i> | 13.8% | 14.9% | 13.6% | 16.9% | 27.4% | 30.2% | 31.1% | 32.7% | 35.0% |
| Containers and Packaging | | | | | | | | | |
| Glass Packaging | | | | | | | | | |
| Beer and Soft Drink Bottles | 6.4% | 2.5% | 10.8% | 33.5% | 26.8% | 30.7% | 30.6% | 30.7% | 34.5% |
| Wine and Liquor Bottles | Neg. | Neg. | Neg. | 10.3% | 22.5% | 15.3% | 14.7% | 14.9% | 15.0% |
| Food and Other Bottles & Jars | Neg. | Neg. | Neg. | 12.5% | 26.9% | 14.9% | 14.8% | 14.7% | 14.8% |
| Total Glass Packaging | 1.6% | 1.3% | 5.4% | 22.1% | 26.1% | 25.1% | 24.9% | 25.2% | 28.1% |
| Steel Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | 1.6% | 1.3% | 9.6% | 26.7% | Neg. | Neg. | Neg. | Neg. | Neg. |
| Food and Other Cans | Neg. | 1.7% | 5.3% | 23.2% | 58.2% | 61.2% | 62.9% | 62.9% | 64.3% |
| Other Steel Packaging | Neg. | Neg. | Neg. | 30.0% | 66.7% | 66.7% | 66.7% | 66.7% | 66.7% |
| Total Steel Packaging | Neg. | 1.5% | 5.5% | 23.9% | 58.9% | 61.7% | 63.3% | 63.3% | 64.6% |
| Aluminum Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | Neg. | 10.0% | 37.6% | 63.9% | 54.6% | 45.3% | 44.8% | 45.1% | 48.6% |
| Other Cans | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Foil and Closures | Neg. | Neg. | Neg. | 6.1% | 7.9% | 10.3% | 10.0% | 9.5% | 9.8% |
| Total Aluminum Pkg | Neg. | 1.8% | 25.2% | 53.2% | 44.1% | 37.0% | 35.8% | 35.0% | 39.0% |
| Paper & Paperboard Pkg | | | | | | | | | |
| Corrugated Boxes | 34.4% | 21.6% | 37.4% | 48.0% | 67.3% | 68.1% | 71.5% | 72.0% | 73.6% |
| Milk Cartons | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Folding Cartons | | | Neg. | Neg. | 7.0% | 17.7% | 21.5% | 22.4% | 27.3% |
| Other Paperboard Packaging | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Bags and Sacks | | | Neg. | Neg. | 20.1% | 25.2% | 28.6% | 33.3% | 36.8% |
| Wrapping Papers | | | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Other Paper Packaging | 7.5% | 9.2% | 35.3% | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Paper & Board Pkg | 19.4% | 14.5% | 27.4% | 36.9% | 52.7% | 56.4% | 59.6% | 60.5% | 62.4% |
| Plastics Packaging | | | | | | | | | |
| Soft Drink Bottles | | | 3.8% | 32.6% | 34.9% | 34.1% | 34.1% | 30.9% | 36.6% |
| Milk Bottles | | | Neg. | 3.8% | 30.4% | 28.8% | 28.8% | 31.0% | 28.0% |
| Other Containers | Neg. | Neg. | Neg. | 1.4% | 9.9% | 14.0% | 14.1% | 13.4% | 13.9% |
| Bags and Sacks | | | | | | | | | |
| Wraps | | | | | | | | | |
| Subtotal Bags, Sacks, and Wraps | | | Neg. | 2.4% | 4.3% | 4.0% | 5.2% | 7.8% | 9.1% |
| Other Plastics Packaging | Neg. | Neg. | Neg. | 1.0% | 3.2% | 2.8% | 2.8% | 5.6% | 2.3% |
| Total Plastics Packaging | Neg. | Neg. | Neg. | 3.8% | 9.2% | 9.7% | 10.3% | 11.7% | 11.7% |
| Wood Packaging | Neg. | Neg. | Neg. | 1.6% | 15.3% | 15.3% | 15.4% | 15.4% | 15.5% |
| Other Misc. Packaging | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Containers & Pkg | 10.5% | 7.7% | 16.1% | 26.0% | 38.1% | 39.3% | 40.8% | 41.6% | 42.7% |
| Total Product Wastes† | 10.3% | 9.6% | 13.3% | 19.8% | 29.7% | 31.1% | 31.9% | 32.8% | 34.0% |
| Other Wastes | | | | | | | | | |
| Food Scraps | Neg. | Neg. | Neg. | Neg. | 2.5% | 2.2% | 2.3% | 2.2% | 2.6% |
| Yard Trimmings | Neg. | Neg. | Neg. | 12.0% | 51.7% | 62.4% | 61.9% | 62.0% | 64.1% |
| Miscellaneous Inorganic Wastes | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. | Neg. |
| Total Other Wastes | Neg. | Neg. | Neg. | 7.2% | 27.0% | 31.6% | 31.1% | 30.9% | 31.9% |
| Total MSW Recovered - % | 6.4% | 6.6% | 9.6% | 16.2% | 29.0% | 31.2% | 31.7% | 32.3% | 33.4% |

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

† 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 2007
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In thousands of tons)

| Products | Thousands of Tons | | | | | | | | |
|--|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 14)</i> | 9,570 | 13,720 | 20,440 | 26,350 | 32,270 | 35,530 | 36,520 | 36,900 | 37,430 |
| Nondurable Goods <i>(Detail in Table 17)</i> | 14,940 | 21,330 | 29,750 | 43,370 | 46,450 | 44,960 | 43,880 | 43,260 | 40,480 |
| Containers and Packaging | | | | | | | | | |
| Glass Packaging | | | | | | | | | |
| Beer and Soft Drink Bottles | 1,310 | 5,440 | 6,010 | 3,750 | 4,180 | 4,860 | 4,980 | 5,200 | 5,050 |
| Wine and Liquor Bottles | 1,070 | 1,890 | 2,430 | 1,820 | 1,480 | 1,330 | 1,450 | 1,430 | 1,420 |
| Food and Other Bottles & Jars | 3,710 | 4,440 | 4,780 | 3,640 | 2,500 | 1,940 | 2,010 | 1,910 | 1,780 |
| Total Glass Packaging | 6,090 | 11,770 | 13,220 | 9,210 | 8,160 | 8,130 | 8,440 | 8,540 | 8,250 |
| Steel Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | 630 | 1,550 | 470 | 110 | Neg. | Neg. | Neg. | Neg. | Neg. |
| Food and Other Cans | 3,740 | 3,480 | 2,700 | 1,950 | 1,100 | 950 | 790 | 930 | 870 |
| Other Steel Packaging | 260 | 270 | 240 | 140 | 80 | 80 | 80 | 80 | 80 |
| Total Steel Packaging | 4,630 | 5,300 | 3,410 | 2,200 | 1,180 | 1,030 | 870 | 1,010 | 950 |
| Aluminum Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | Neg. | 90 | 530 | 560 | 690 | 810 | 800 | 790 | 730 |
| Other Cans | Neg. | 60 | 40 | 20 | 50 | 50 | 80 | 110 | 40 |
| Foil and Closures | 170 | 410 | 380 | 310 | 350 | 350 | 360 | 380 | 370 |
| Total Aluminum Pkg | 170 | 560 | 950 | 890 | 1,090 | 1,210 | 1,240 | 1,280 | 1,140 |
| Paper & Paperboard Pkg | | | | | | | | | |
| Corrugated Boxes | 4,810 | 10,000 | 10,690 | 12,480 | 9,880 | 10,050 | 8,830 | 8,800 | 8,240 |
| Milk Cartons | | | 790 | 510 | 550 | 460 | 500 | 490 | 500 |
| Folding Cartons | | | 3,300 | 3,960 | 5,410 | 4,450 | 4,340 | 4,230 | 4,020 |
| Other Paperboard Packaging | 3,840 | 4,830 | 230 | 290 | 200 | 170 | 160 | 160 | 150 |
| Bags and Sacks | | | 3,380 | 2,240 | 1,190 | 950 | 800 | 720 | 720 |
| Wrapping Papers | | | 200 | 110 | Neg. | Neg. | Neg. | Neg. | Neg. |
| Other Paper Packaging | 2,720 | 3,460 | 550 | 1,020 | 1,670 | 1,480 | 1,400 | 1,400 | 1,390 |
| Total Paper & Board Pkg | 11,370 | 18,290 | 19,140 | 20,610 | 18,900 | 17,560 | 16,030 | 15,800 | 15,020 |
| Plastics Packaging | | | | | | | | | |
| Soft Drink Bottles | | | 250 | 290 | 540 | 560 | 560 | 650 | 640 |
| Milk Bottles | | | 230 | 510 | 480 | 570 | 570 | 490 | 590 |
| Other Containers | 60 | 910 | 890 | 1,410 | 2,370 | 2,710 | 2,670 | 2,970 | 3,220 |
| Bags and Sacks | | | | | | | | | |
| Wraps | | | | | | | | | |
| <i>Subtotal Bags, Sacks, and Wraps</i> | | | 1,230 | 2,410 | 4,020 | 4,560 | 4,220 | 4,270 | 3,810 |
| Other Plastics Packaging | 60 | 1,180 | 790 | 2,020 | 2,750 | 3,180 | 3,120 | 3,020 | 3,780 |
| Total Plastics Packaging | 120 | 2,090 | 3,390 | 6,640 | 10,160 | 11,580 | 11,140 | 11,400 | 12,040 |
| Wood Packaging | 2,000 | 2,070 | 3,940 | 8,050 | 6,880 | 7,140 | 7,210 | 7,170 | 7,220 |
| Other Misc. Packaging | 120 | 130 | 130 | 150 | 240 | 290 | 280 | 280 | 320 |
| Total Containers & Pkg | 24,500 | 40,210 | 44,180 | 47,750 | 46,610 | 46,940 | 45,210 | 45,480 | 44,940 |
| Total Product Wastes† | 49,010 | 75,260 | 94,370 | 117,470 | 125,330 | 127,430 | 125,610 | 125,640 | 122,850 |
| Other Wastes | | | | | | | | | |
| Food Scraps | 12,200 | 12,800 | 13,000 | 20,800 | 26,130 | 28,750 | 29,530 | 30,360 | 30,840 |
| Yard Trimmings | 20,000 | 23,200 | 27,500 | 30,800 | 14,760 | 11,960 | 12,210 | 12,300 | 11,730 |
| Miscellaneous Inorganic Wastes | 1,300 | 1,780 | 2,250 | 2,900 | 3,500 | 3,650 | 3,690 | 3,720 | 3,750 |
| Total Other Wastes | 33,500 | 37,780 | 42,750 | 54,500 | 44,390 | 44,360 | 45,430 | 46,380 | 46,320 |
| Total MSW Discarded - Weight | 82,510 | 113,040 | 137,120 | 171,970 | 169,720 | 171,790 | 171,040 | 172,020 | 169,170 |

* 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.

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 2007
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of total discards)

| Products | Percent of Total Discards | | | | | | | | |
|--|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Durable Goods <i>(Detail in Table 14)</i> | 11.6% | 12.1% | 14.9% | 15.3% | 19.0% | 20.7% | 21.4% | 21.5% | 22.1% |
| Nondurable Goods <i>(Detail in Table 17)</i> | 18.1% | 18.9% | 21.7% | 25.2% | 27.4% | 26.2% | 25.7% | 25.1% | 23.9% |
| Containers and Packaging | | | | | | | | | |
| Glass Packaging | | | | | | | | | |
| Beer and Soft Drink Bottles | 1.6% | 4.8% | 4.4% | 2.2% | 2.5% | 2.8% | 2.9% | 3.0% | 3.0% |
| Wine and Liquor Bottles | 1.3% | 1.7% | 1.8% | 1.1% | 0.9% | 0.8% | 0.8% | 0.8% | 0.8% |
| Food and Other Bottles & Jars | 4.5% | 3.9% | 3.5% | 2.1% | 1.5% | 1.1% | 1.2% | 1.1% | 1.1% |
| Total Glass Packaging | 7.4% | 10.4% | 9.6% | 5.4% | 4.8% | 4.7% | 4.9% | 5.0% | 4.9% |
| Steel Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | 0.8% | 1.4% | 0.3% | 0.1% | Neg. | Neg. | Neg. | Neg. | Neg. |
| Food and Other Cans | 4.5% | 3.1% | 2.0% | 1.1% | 0.6% | 0.6% | 0.5% | 0.5% | 0.5% |
| Other Steel Packaging | 0.3% | 0.2% | 0.2% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Total Steel Packaging | 5.6% | 4.7% | 2.5% | 1.3% | 0.7% | 0.6% | 0.5% | 0.6% | 0.6% |
| Aluminum Packaging | | | | | | | | | |
| Beer and Soft Drink Cans | Neg. | 0.1% | 0.4% | 0.3% | 0.4% | 0.5% | 0.5% | 0.5% | 0.4% |
| Other Cans | Neg. | 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% | 0.2% |
| Total Aluminum Pkg | 0.2% | 0.5% | 0.7% | 0.5% | 0.6% | 0.7% | 0.7% | 0.7% | 0.7% |
| Paper & Paperboard Pkg | | | | | | | | | |
| Corrugated Boxes | 5.8% | 8.8% | 7.8% | 7.3% | 5.8% | 5.9% | 5.2% | 5.1% | 4.9% |
| Milk Cartons | | | 0.6% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% | 0.3% |
| Folding Cartons | | | 2.4% | 2.3% | 3.2% | 2.6% | 2.5% | 2.5% | 2.4% |
| Other Paperboard Packaging | 4.7% | 4.3% | 0.2% | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| Bags and Sacks | | | 2.5% | 1.3% | 0.7% | 0.6% | 0.5% | 0.4% | 0.4% |
| Wrapping Papers | | | 0.1% | 0.1% | Neg. | Neg. | Neg. | Neg. | Neg. |
| Other Paper Packaging | 3.3% | 3.1% | 0.4% | 0.6% | 1.0% | 0.9% | 0.8% | 0.8% | 0.8% |
| Total Paper & Board Pkg | 13.8% | 16.2% | 14.0% | 12.0% | 11.1% | 10.2% | 9.4% | 9.2% | 8.9% |
| Plastics Packaging | | | | | | | | | |
| Soft Drink Bottles | | | 0.2% | 0.2% | 0.3% | 0.3% | 0.3% | 0.4% | 0.4% |
| Milk Bottles | | | 0.2% | 0.3% | 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% | 1.7% | 1.9% |
| Bags and Sacks | | | | | | | | | |
| Wraps | | | | | | | | | |
| <i>Subtotal Bags, Sacks, and Wraps</i> | | | 0.9% | 1.4% | 2.4% | 2.7% | 2.5% | 2.5% | 2.3% |
| Other Plastics Packaging | 0.1% | 1.0% | 0.6% | 1.2% | 1.6% | 1.9% | 1.8% | 1.8% | 2.2% |
| Total Plastics Packaging | 0.1% | 1.8% | 2.5% | 3.9% | 6.0% | 6.7% | 6.5% | 6.6% | 7.1% |
| Wood Packaging | 2.4% | 1.8% | 2.9% | 4.7% | 4.1% | 4.2% | 4.2% | 4.2% | 4.3% |
| Other Misc. Packaging | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.2% | 0.2% | 0.2% | 0.2% |
| Total Containers & Pkg | 29.7% | 35.6% | 32.2% | 27.8% | 27.5% | 27.3% | 26.4% | 26.4% | 26.6% |
| Total Product Wastes† | 59.4% | 66.6% | 68.8% | 68.3% | 73.8% | 74.2% | 73.4% | 73.0% | 72.6% |
| Other Wastes | | | | | | | | | |
| Food Scraps | 14.8% | 11.3% | 9.5% | 12.1% | 15.4% | 16.7% | 17.3% | 17.6% | 18.2% |
| Yard Trimmings | 24.2% | 20.5% | 20.1% | 17.9% | 8.7% | 7.0% | 7.1% | 7.2% | 6.9% |
| Miscellaneous Inorganic Wastes | 1.6% | 1.6% | 1.6% | 1.7% | 2.1% | 2.1% | 2.2% | 2.2% | 2.2% |
| Total Other Wastes | 40.6% | 33.4% | 31.2% | 31.7% | 26.2% | 25.8% | 26.6% | 27.0% | 27.4% |
| Total MSW Discarded - % | 100.0% | 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.

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

Paper and Paperboard Containers and Packaging. Corrugated boxes are the largest single product category of MSW at 31.2 million tons generated, or 12.3 percent of total generation, in 2007. Corrugated boxes also represent the largest single category of product recovery; at 23.0 million tons of recovery in 2007, 73.6 percent of boxes generated were recovered. After recovery, 8.2 million tons of corrugated boxes were discarded, or 4.9 percent of MSW discards in 2007.

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 39.9 million tons of MSW generation in 2007, or 15.7 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 1.9 million tons in 2007). The overall recovery rate for paper and paperboard packaging in 2007 was 62.4 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 and water 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 Chemistry 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 13.6 million tons in 2007 (5.4 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 Chemistry Council supplemented with additional industry data. Plastic soft drink bottles were estimated to have been recovered at a 36.6 percent rate in 2007 (370,000 tons). Recovery of plastic milk and water bottles was estimated to have been 230,000 tons, or 28.0 percent of generation. Overall, recovery of plastic containers and packaging was estimated to be 1.6 million tons, or 11.7 percent in 2007. Discards of plastic packaging thus were 12.0 million tons in 2007, or 7.1 percent of total MSW generation.

Wood Packaging. Wood packaging includes wood crates and pallets (mostly pallets). Data on production of wood packaging are from the National Wood Pallet and Container Association, and more recently, the USDA Forest Service Southern Research Station and Virginia Polytechnic Institute. In 2007, 8.5 million tons of wood pallets and other wood packaging were estimated to have been generated, or 3.4 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 2007.

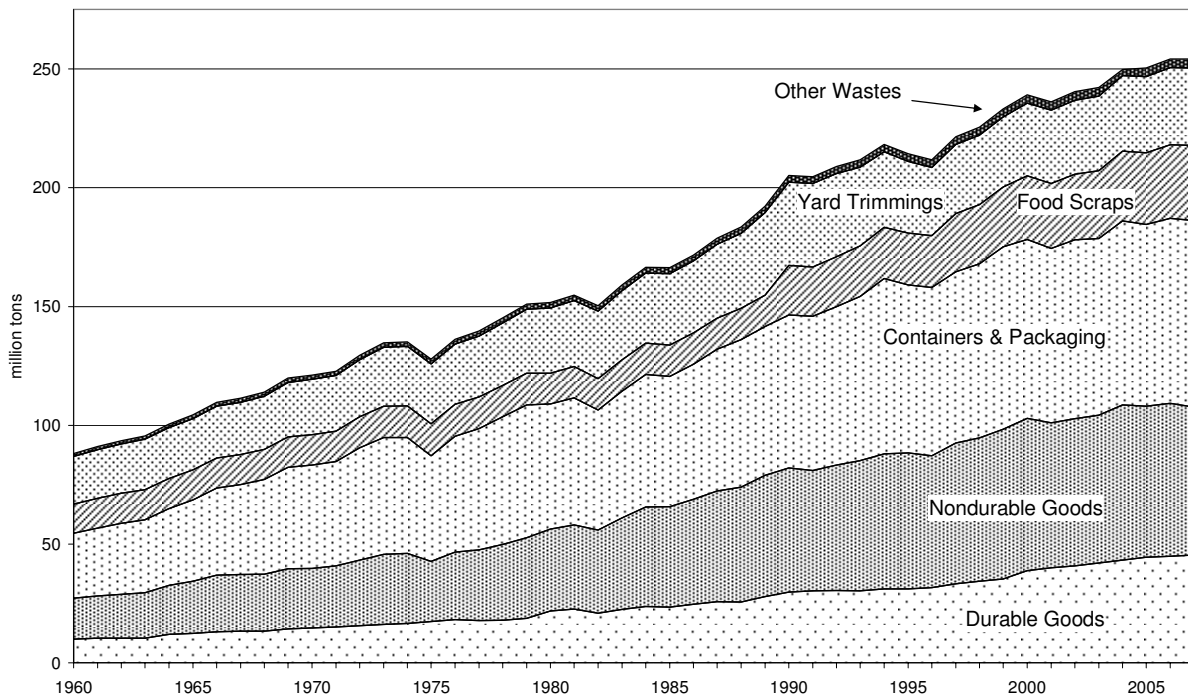
Accounting for pallet reuse and recovery for recycling, wood packaging discards were 7.2 million tons in 2007, or 4.3 percent of total MSW discards.

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 320,000 tons were generated in 2007.

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.

Figure 14. Generation of products in MSW, 1960 to 2007

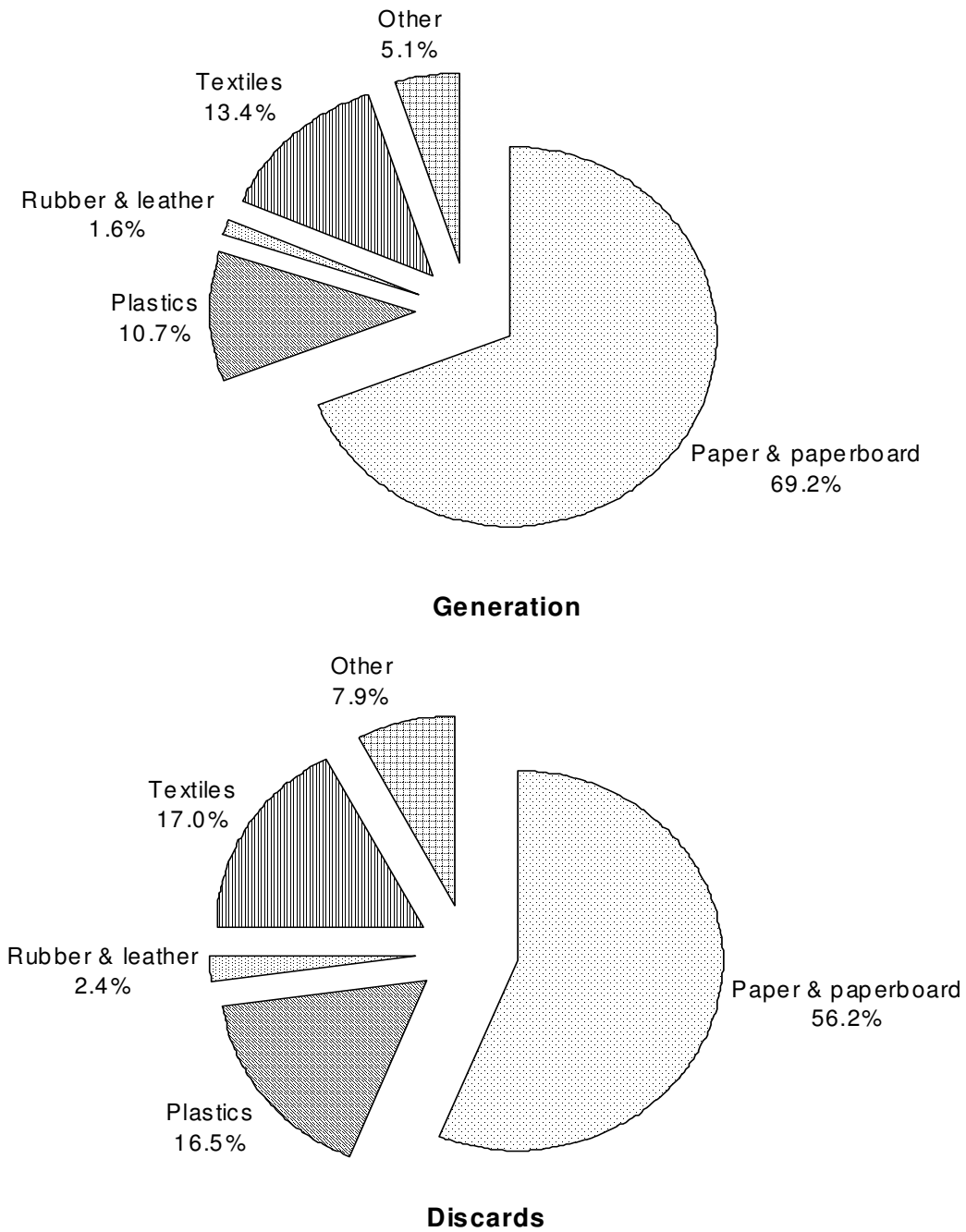


The materials composition of nondurable goods in 2007 is shown in Figure 15. Paper and paperboard made up 69.2 percent of nondurables in MSW generation, with plastics contributing 10.7 percent, and textiles 13.4 percent. Other materials contributed lesser percentages. After recovery for recycling, paper and paperboard were 56.2 percent of nondurable discards, with plastics being 16.5 percent, and textiles 17.0 percent.

The materials composition of containers and packaging in MSW in 2007 is shown in Figure 16. By weight, paper and paperboard products made up 50.9 percent of containers and packaging generation; plastics accounted for 17.4 percent. Glass was 14.6 percent, wood was 11.3 percent, and metals were 5.8 percent.

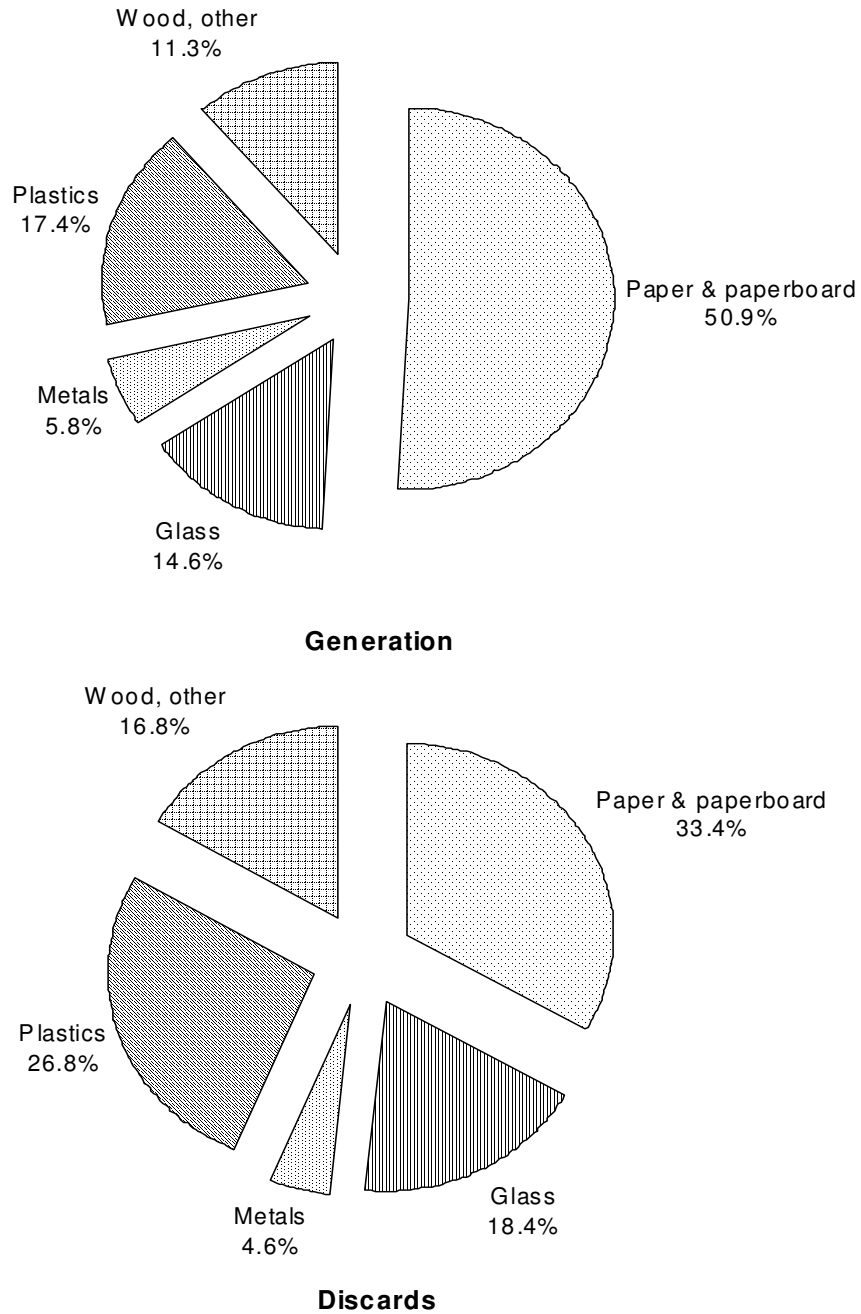
The percentage of materials discards from containers and packaging is affected by recovery for recycling. After recovery for recycling, paper and paperboard dropped to 33.4 percent of discards. Glass containers accounted for 18.4 percent of discards of containers and packaging, plastics were 26.8 percent, wood was 16.8 percent, and metals were 4.6 percent.

**Figure 15. Nondurable goods generated and discarded*
in municipal solid waste, 2007
(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, 2007**
(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 2007 was 254.1 million tons, which was similar to 2006 when 254.2 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 32.7 percent of total generation. Generation of paper and paperboard products declined from 87.7 million tons in 2000 to 83.0 million tons in 2007. Generation of newspapers has been declining since 2000, and this trend is expected to continue, partly due to decreased page size, 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 32 and 35 percent of generation since 2004.
- Yard trimmings comprised the second largest material category, estimated at 32.6 million tons, or 12.8 percent of total generation, in 2007. 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 2007 was 30.7 million tons, or 12.1 percent of generation. This was an increase of 920,000 tons from 2006 to 2007. This increase in plastics generation came mostly from the containers and packaging category. Plastics generation has grown from 8.3 percent of generation in 1990 to 12.1 percent in 2007.

MSW Recovery

- Recovery of materials in MSW increased from 69.3 million tons in 2000 (29.0 percent of total generation) to 85.0 million tons in 2007 (33.4 percent of generation).
- Recovery of products and other wastes (food scraps and yard trimmings) in MSW increased by 2.8 million tons from 2006 to 2007. Recovery of paper and paperboard products, the largest component of recovery, increased from 51.4 percent in 2006 to 54.5 percent in 2007.
- 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 2006 and 2007, the key categories showing increases in recovery rates were newspapers, mail, other commercial printing, and corrugated boxes.
- The newspaper recovery rate increased from 75.3 percent to 77.8 percent between 2006 and 2007. Newspaper generation decreased from 12.4 million tons in 2006 to 11.0 million tons in 2007. 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 32.3 million tons in 2006 to 33.5 million tons in 2007; percentage recovery increased from 41.6 percent to 42.7 percent. Nondurable goods recovery increased from 21.1 million tons in 2006 to 21.8 million tons in 2007; percentage recovery increased from 32.7 percent to 35.0 percent.
- Measured by tonnage, the most recovered products and materials in 2007 were corrugated boxes (23.0 million tons), yard trimmings (20.9 million tons), newspapers (8.5 million tons), high grade office papers (4.3 million tons), other commercial printing (3.6 million tons), glass containers (3.2 million tons), major appliances (2.4 million tons), standard mail (2.4 million tons), rubber tires (1.7 million tons), folding cartons (1.5 million tons), and wood packaging (1.3 million tons). Collectively, these products accounted for about 86 percent of total MSW recovery in 2007.
- Measured by percentage of generation, products with the highest recovery rates in 2007 were lead-acid batteries (99.2 percent), newspapers (77.8 percent), corrugated boxes (73.6 percent), office-type papers (71.8 percent), major appliances (67.1 percent), steel packaging (64.6 percent), yard trimmings (64.1 percent), other commercial printing (57.3 percent), aluminum cans (48.6 percent), standard mail (40.3 percent), magazines (39.6 percent), paper bags and sacks (36.8 percent), and PET soft drink bottles (36.6 percent).

Long Term Trends

- Generation of MSW has increased (except in recession years), from 88.1 million tons in 1960 to 254.1 million tons in 2007.

- 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 83.0 million tons in 2007. 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 since 2000, except 2007, which saw a minimal decline from 2006, primarily due to the decline in paper and paperboard generation between 2006 and 2007 – offsetting increases in other categories.
- 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 (33.4 percent) reflects a rapid increase in the infrastructure for recovery and expansion of domestic and foreign markets over the last decade.
- Recovery (as a percentage of generation) of most materials in MSW has increased dramatically over the last 37 years. Some examples:

| | 1970 | 1980 | 1990 | 2000 | 2007 |
|----------------------|-------------|-------------|-------------|-------------|-------------|
| Paper and paperboard | 15% | 21% | 28% | 43% | 55% |
| Glass | 1% | 5% | 20% | 23% | 24% |
| Metals | 4% | 8% | 24% | 35% | 35% |
| Plastics | Neg. | <1% | 2% | 6% | 7% |
| Yard trimmings | Neg. | Neg. | 12% | 52% | 64% |
| Rubber tires | 13% | 6% | 12% | 26% | 35% |
| Lead-acid batteries | 76% | 70% | 97% | 93% | 99% |

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

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CHAPTER 3

MANAGEMENT OF MUNICIPAL SOLID WASTE

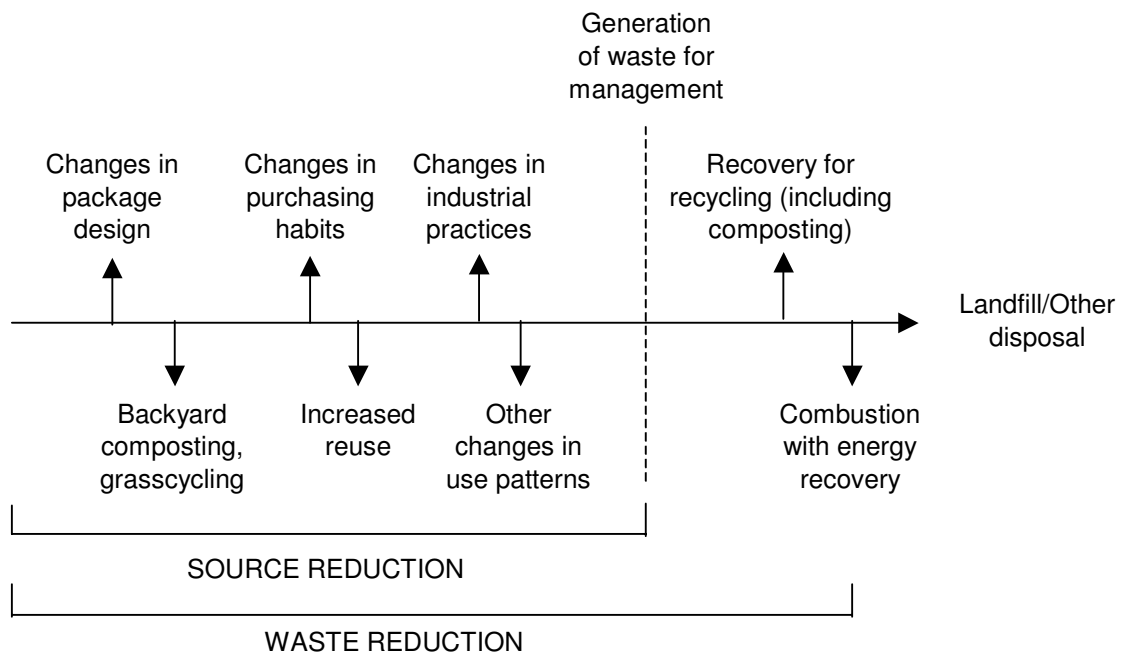
INTRODUCTION

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

- 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.

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 and composting and the amounts combusted with energy recovery from total MSW generation.

SOURCE REDUCTION

During the past 47 years, the amount of waste each person creates has increased from 2.7 to 4.62 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 | • Downgauge metals in appliances | • Paperless purchase orders | • Concentrates | • Xeriscaping |
| Materials substitution | • Use of composites in appliances and electronic circuitry | | • Cereal in bags • Coffee brick • Multi-use products | |
| Lengthen life | • High mileage tires • Electronic components reduce moving parts | • Regular servicing • Look at warranties • Extend warranties | • Design for secondary uses | |
| Consumer Practices | | | | |
| | • Purchase long lived products | • Repair • Duplexing • Sharing • Reduce unwanted mail | • Purchasing: products in bulk, concentrates • Reusable bags | |
| Reuse | | | | |
| By design | • Modular design | • Envelopes | • Reusable pallets • Returnable secondary packaging | |
| Secondary | • Borrow or rent for temporary use • Give to charity • Buy or sell at garage sales | • Clothing • Waste paper scratch pads | • Loosefill • Grocery sacks • Dairy containers • Glass and plastic jars | |
| Reduce/Eliminate Toxins | | | | |
| | • Eliminate PCBs | • Soy ink, waterbased • Waterbased solvents • Reduce mercury | • Replace lead foil on wine bottles | |
| Reduce Organics | | | | |
| Food scraps | | | | • Backyard composting • Vermi-composting |
| Yard trimmings | | | | • 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. The use of reusable shopping bags reduces the quantity of plastic and paper bags produced.

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 13 million tons of wood pallets were refurbished and returned to service in 2007. 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 2007, 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. By 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 2007, more than 8,600 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 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. The American Forest & Paper Association (AF&PA) estimated that 50 percent of curbside recyclables collection programs were single-stream in 2007.⁴ These programs require that the materials be taken to a materials recovery facility (MRF) for processing.

In 2007, nearly 60 percent of the U.S. population had access to curbside recyclables collection programs (based on data from states representing over 80 percent of the U.S. population). The Northeast region had the largest population served – 43 million persons. In the Northeast about 84 percent of the population had access to curbside recyclables collection, while in the West 76 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.

Table 25
NUMBER AND POPULATION SERVED BY
CURBSIDE RECYCLABLES COLLECTION PROGRAMS, 2007

| Region | Number of Programs | Population* (in thousands) | Population Served | |
|-----------------------|--------------------|----------------------------|-------------------|------------|
| | | | (in thousands) | Percent** |
| NORTHEAST | 3,299 | 50,557 | 42,592 | 84% |
| SOUTH | 797 | 84,524 | 25,386 | 30% |
| MIDWEST | 3,749 | 46,473 | 28,236 | 61% |
| WEST | 814 | 63,985 | 48,702 | 76% |
| Total | 8,659 | 245,539 | 144,916 | 59% |
| Total U.S. Population | | 301,621 | | |

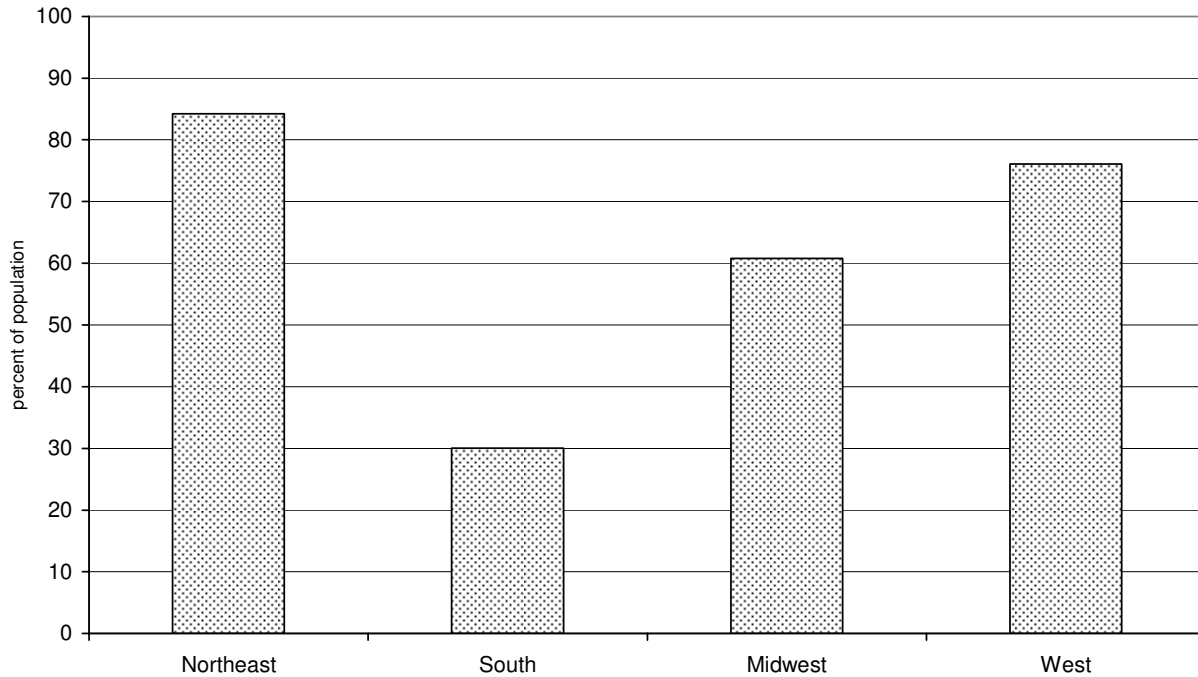
* Population in states reporting data

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

Source: U.S. Census Bureau 2007, *BioCycle* April 2006, California Integrated Waste Management Board, Illinois Recycling Association, www.coloradocurbside.com, Nebraska State Recycling Association, Pennsylvania Department of Environmental Protection

⁴ AF&PA. "2007 AF&PA Community Survey Executive Summary." June 2008. This report also estimated that 62 percent of the U.S. population is served by curbside recyclables collection.

Figure 18. Population served by curbside recycling, 2007



Source: U.S. Census Bureau 2007, BioCycle April 2006, California Integrated Waste Management Board, Illinois Recycling Association, www.coloradocurbside.com, Nebraska State Recycling Association, Pennsylvania Department of Environmental Protection

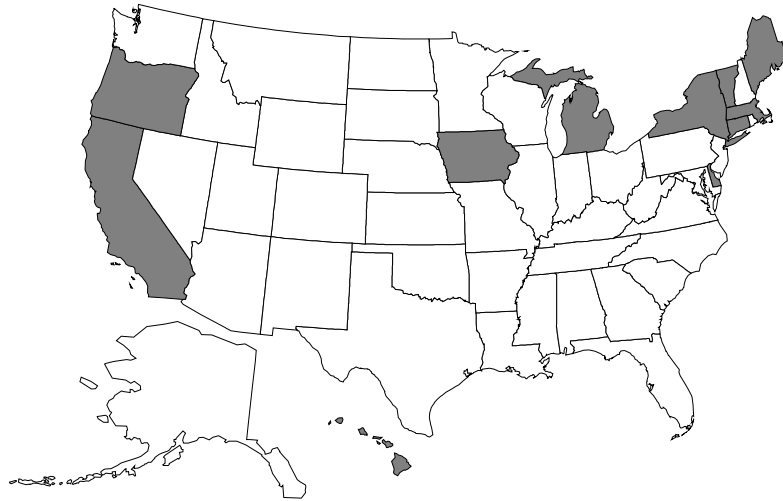
Drop-off Centers. Drop-off centers typically collect residential materials, although some accept materials from businesses. They are found in locations such as grocery stores, sheltered workshops, charitable organizations, city-sponsored sites, and apartment complexes. Types of materials collected vary 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 2007, the “2007 AF&PA Community Survey Executive Summary” estimated over 20,000 communities have drop-off centers (including some communities that also have curbside recyclables collection). 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 programs.

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. Eleven states have container deposit systems: California, 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 California, beverage distributors also pay a per container fee. In addition to these fees, handling fees are also assessed in most of the states listed.

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 ten of the eleven 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

Source: Container Recycling Institute, 2006.

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.

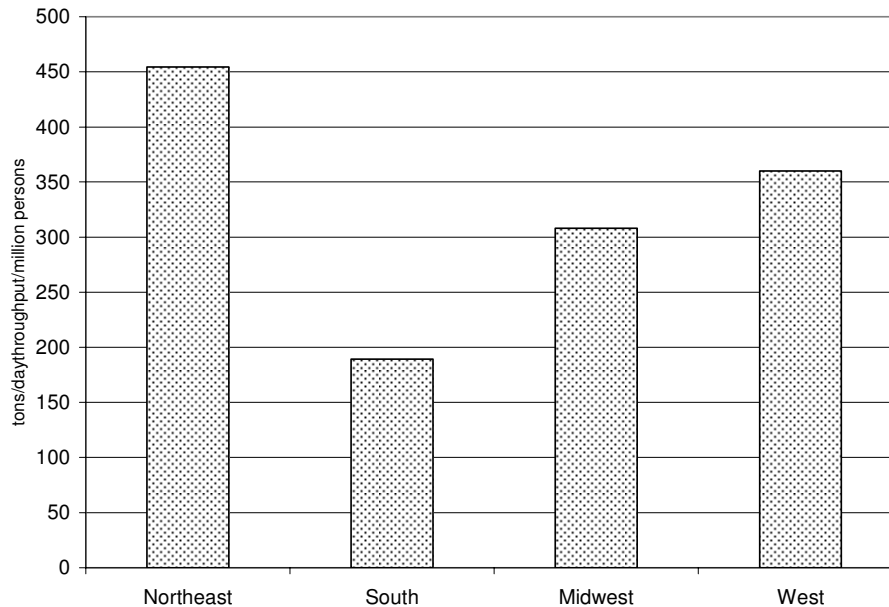
Materials Recovery Facilities. Materials recovery facilities vary widely across the United States, depending on the incoming materials and the technology and labor used to sort the materials. In 2007, 567 MRFs were operating in the United States, with an estimated total daily throughput of over 91,000 tons per day (Table 26). The most extensive recyclables processing throughput occurs in the Northeast and West (Figure 20).

Table 26
MATERIALS RECOVERY FACILITIES, 2007

| Region | Number | Estimated Throughput (tpd) |
|--------------------------|-------------------|---|
| NORTHEAST | 146 | 24,848 |
| SOUTH | 158 | 20,905 |
| MIDWEST | 138 | 20,455 |
| WEST | 125 | 25,242 |
| <i>U.S. Total</i> | <u>567</u> | <u>91,450</u> |

Source: Governmental Advisory Associates, Inc.

**Figure 20. Estimated MRF throughput, 2007
(tons per day per million persons)**

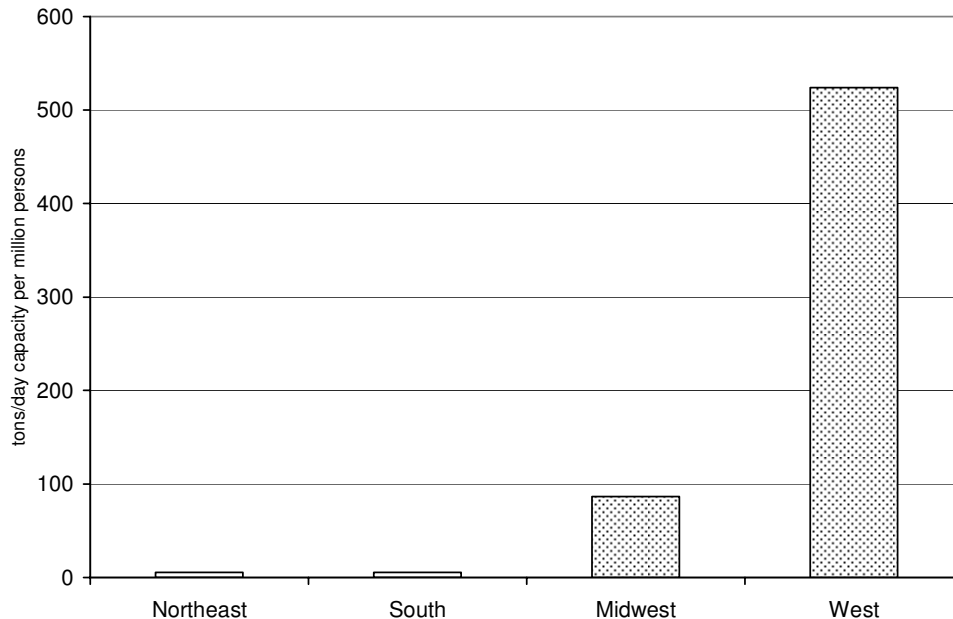


Source: U.S. Census Bureau; Governmental Advisory Associates, Inc.

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 illustrated in Figure 21. Mixed waste processing facilities receive mixed solid waste (including recyclable and non-recyclable materials), which is then loaded on conveyors. Using both mechanical and manual (high and low technology) sorting, recyclable materials are removed for further processing. In 2007, there were reported 34 mixed waste processing facilities in the U.S., handling about 43,000 tons of waste per day. The Western region has the largest concentration of these processing facilities (representing over 80 percent of the daily per capita throughput).

**Figure 21. Mixed waste processing estimated throughput 2007
(tons per day per million persons)**

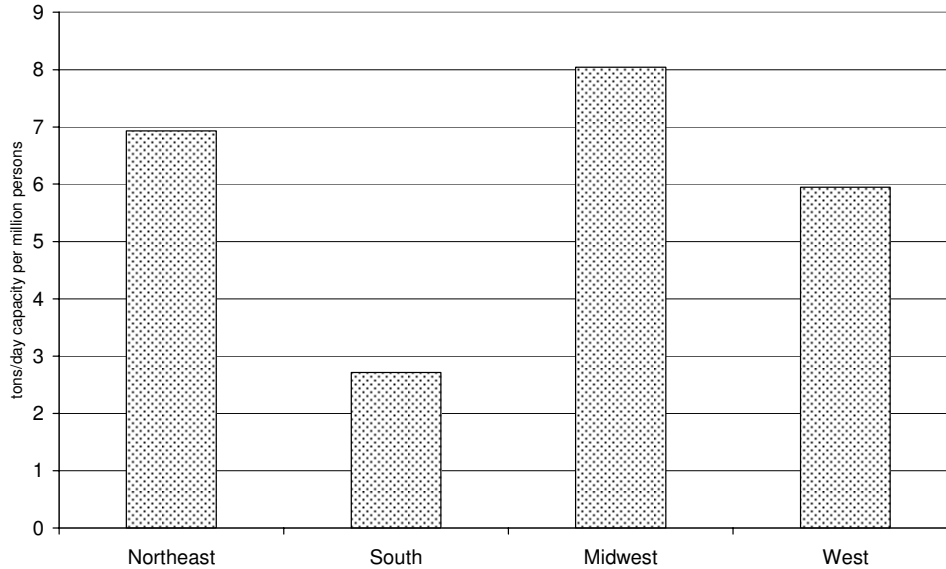


Source: U.S. Census Bureau; Governmental Advisory Associates, Inc.

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 2007, there were 16 mixed waste composting facilities, two more than was reported in 2006.

Nationally, mixed waste composting facilities handled about 1,500 tons per day in 2007, up from 1,200 tons per day in 2006. In 2007, the highest processing capacity per million persons was found in the Northeast and Midwest, as shown in Figure 22.

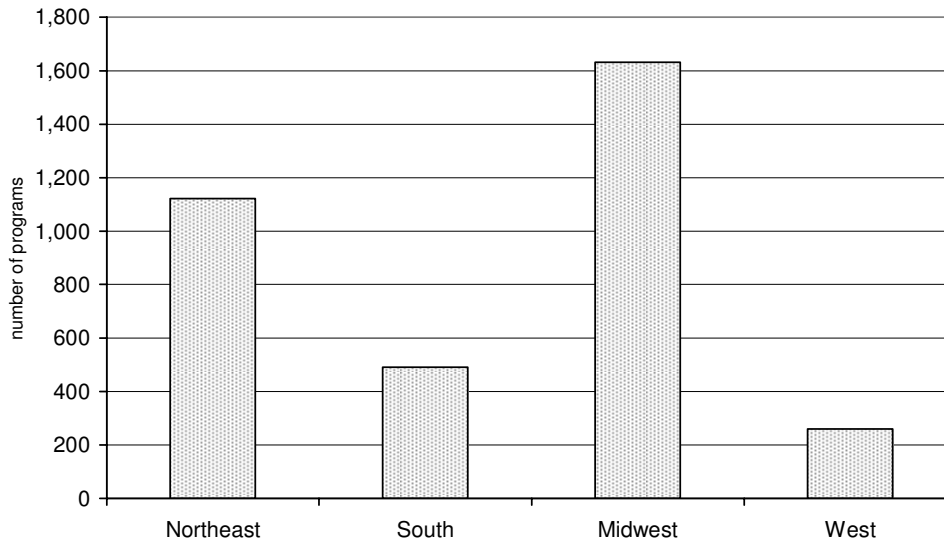
Figure 22. MSW composting capacity, 2007
(Capacity in tons per day per million persons)



Source: U.S. Census Bureau; *BioCycle*, November 2007.

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 earlier in this chapter, and is classified as source reduction, not recycling. In 2007, 3,505 yard trimmings composting programs were reported. In 2007, about 80 percent of these programs were in the Northeast and Midwest regions, as shown in Figure 23. Based on 20.9 million tons of yard trimmings recovered for composting in the United States (Table 2, Chapter 2), yard trimmings composting facilities handled approximately 57,300 tons per day in 2007.

**Figure 23. Yard trimmings composting programs, 2007
(In number of programs)**



Source: *BioCycle* April 2006.
Revised with data from Arkansas Department of Environmental Quality, California Integrated Waste Management Board, and Colorado Department of Public Health and Environment.

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 2007 design capacity of 94,721 tons per day. There were 87 WTE facilities in 2007 (Table 27), down from 102 in 2000. In tons of capacity per million persons, the Northeast region had the most MSW combustion capacity in 2007 (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 3.1 million tons of MSW were combusted in this manner in 2007, with tires contributing a majority of the total.

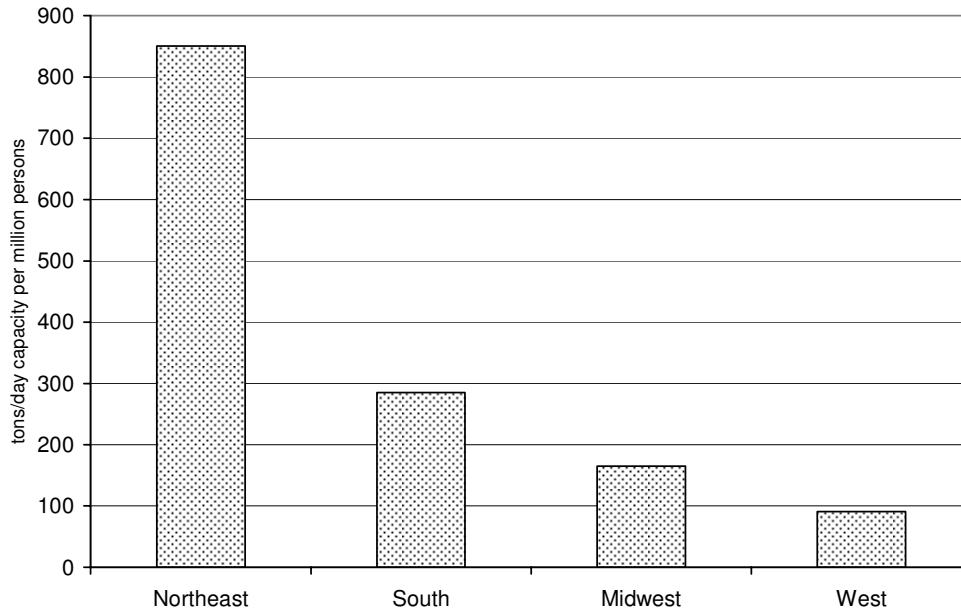
Table 27
MUNICIPAL WASTE-TO-ENERGY PROJECTS, 2007

| Region | Number Operational | Design Capacity (tpd) |
|---------------------------|-------------------------------|--------------------------------------|
| NORTHEAST | 40 | 46,537 |
| SOUTH | 23 | 31,131 |
| MIDWEST | 16 | 10,912 |
| WEST | 8 | 6,141 |
| <i>U.S. Total*</i> | 87 | 94,721 |

* Projects on hold or inactive were not included.
WTE includes mass burn, modular, and refuse-derived fuel-combustion facilities.

Source: "The IWSA Directory of Waste-To-Energy Plants."
Integrated Waste Services Association, 2007.

**Figure 24. Municipal waste-to-energy capacity, 2007
(Capacity in tons per million persons)**



Source: U.S. Census Bureau, Integrated Waste Services Association 2007.

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 separately⁵. (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 2007, there were 1,754 municipal solid waste landfills reported in the United States.

Table 28
LANDFILL FACILITIES, 2007

| Region | Number of Landfills |
|--------------------------|--------------------------------|
| NORTHEAST | 133 |
| SOUTH | 676 |
| MIDWEST | 425 |
| WEST | 520 |
| <i>U.S. Total</i> | 1,754 |

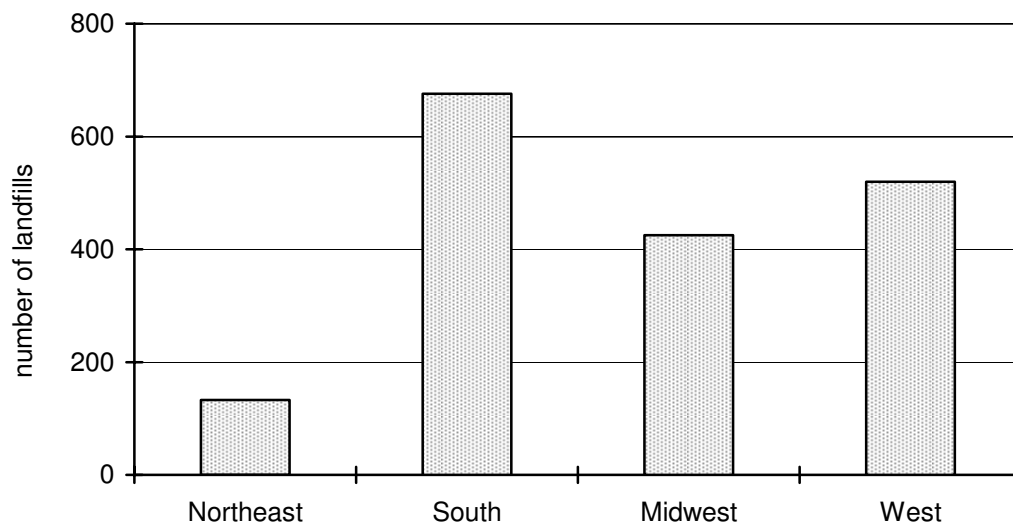
Source: BioCycle April 2006.

Revised with data from Alabama Department of Environmental Management, Arizona Department of Environmental Quality, Arkansas Department of Environmental Quality, California Integrated Waste Management Board, Colorado Department of Public Health and Environment, and Louisiana Department of Environmental Quality.

⁵ 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.

Table 28 and Figure 25 show the number of landfills in each region. The South and West had the largest number of landfills. Thirty-eight percent of the landfills are located in the South, 30 percent in the West, and 24 percent in the Midwest. Only 8 percent are located in the Northeast.

Figure 25. Number of landfills in the U.S., 2007



Source: *BioCycle* April 2006, Alabama Department of Environmental Management, Arizona Department of Environmental Quality, Arkansas Department of Environmental Quality, California Integrated Waste Management Board, Colorado Department of Public Health and Environment, and Louisiana Department of Environmental Quality.

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 2007
(In thousands of tons and percent of total generation)

| | Thousands of Tons | | | | | | | | |
|---------------------------------------|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Generation | 88,120 | 121,060 | 151,640 | 205,210 | 239,050 | 249,780 | 250,430 | 254,180 | 254,140 |
| Recovery for recycling | 5,610 | 8,020 | 14,520 | 29,040 | 52,880 | 57,520 | 58,840 | 61,380 | 63,260 |
| Recovery for composting* | Neg. | Neg. | Neg. | 4,200 | 16,450 | 20,470 | 20,550 | 20,780 | 21,710 |
| Total Materials Recovery | 5,610 | 8,020 | 14,520 | 33,240 | 69,330 | 77,990 | 79,390 | 82,160 | 84,970 |
| Discards after recovery | 82,510 | 113,040 | 137,120 | 171,970 | 169,720 | 171,790 | 171,040 | 172,020 | 169,170 |
| Combustion with energy recovery** | 0 | 400 | 2,700 | 29,700 | 33,730 | 31,510 | 31,620 | 31,950 | 31,970 |
| Discards to landfill, other disposal† | 82,510 | 112,640 | 134,420 | 142,270 | 135,990 | 140,280 | 139,420 | 140,070 | 137,200 |

| | Pounds per Person per Day | | | | | | | | |
|---------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Generation | 2.68 | 3.25 | 3.66 | 4.50 | 4.65 | 4.66 | 4.63 | 4.65 | 4.62 |
| Recovery for recycling | 0.17 | 0.22 | 0.35 | 0.64 | 1.03 | 1.07 | 1.09 | 1.12 | 1.15 |
| Recovery for composting* | Neg. | Neg. | Neg. | 0.09 | 0.32 | 0.38 | 0.38 | 0.38 | 0.39 |
| Total Materials Recovery | 0.17 | 0.22 | 0.35 | 0.73 | 1.35 | 1.45 | 1.47 | 1.50 | 1.54 |
| Discards after recovery | 2.51 | 3.03 | 3.31 | 3.77 | 3.30 | 3.21 | 3.16 | 3.15 | 3.08 |
| Combustion with energy recovery** | 0.00 | 0.01 | 0.07 | 0.65 | 0.66 | 0.59 | 0.58 | 0.58 | 0.58 |
| Discards to landfill, other disposal† | 2.51 | 3.02 | 3.24 | 3.12 | 2.64 | 2.62 | 2.58 | 2.57 | 2.50 |
| Population (thousands) | 179,979 | 203,984 | 227,255 | 249,907 | 281,422 | 293,660 | 296,410 | 299,398 | 301,621 |

| | Percent of Total Generation | | | | | | | | |
|---------------------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 1960 | 1970 | 1980 | 1990 | 2000 | 2004 | 2005 | 2006 | 2007 |
| Generation | 100.0% | 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% | 22.1% | 23.0% | 23.5% | 24.1% | 24.9% |
| Recovery for composting* | Neg. | Neg. | Neg. | 2.0% | 6.9% | 8.2% | 8.2% | 8.2% | 8.5% |
| Total Materials Recovery | 6.4% | 6.6% | 9.6% | 16.2% | 29.0% | 31.2% | 31.7% | 32.3% | 33.4% |
| Discards after recovery | 93.6% | 93.4% | 90.4% | 83.8% | 71.0% | 68.8% | 68.3% | 67.7% | 66.6% |
| Combustion with energy recovery** | 0.0% | 0.3% | 1.8% | 14.5% | 14.1% | 12.6% | 12.6% | 12.6% | 12.6% |
| Discards to landfill, other disposal† | 93.6% | 93.1% | 88.6% | 69.3% | 56.9% | 56.2% | 55.7% | 55.1% | 54.0% |

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

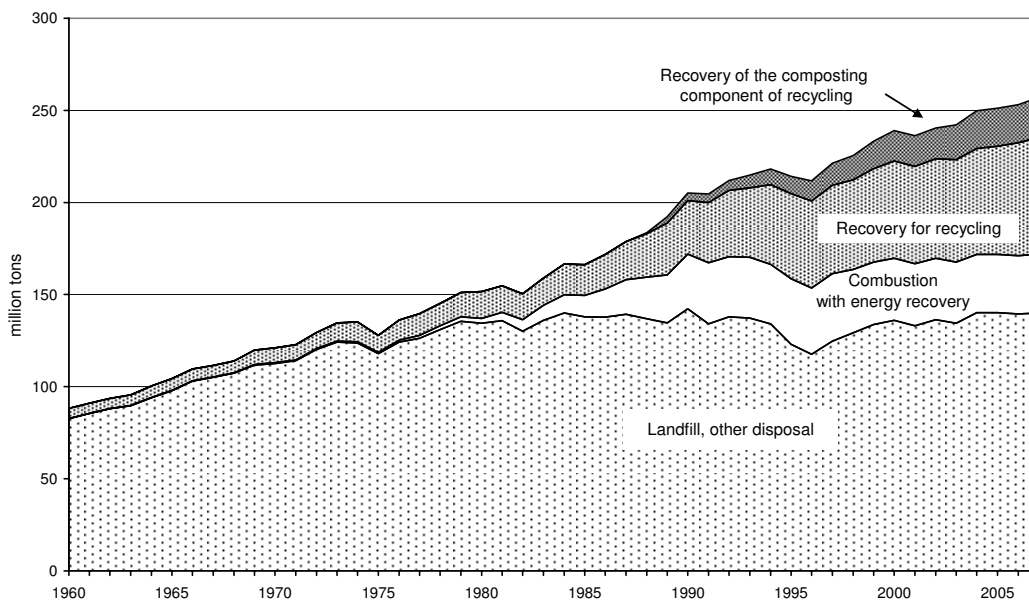
** Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets and tire-derived fuel). 2007 includes 28,860 MSW, 560 wood, and 2,550 tires (1,000 tons)

† 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

Historically, municipal solid waste generation has grown steadily (from 88 million tons in 1960 to 254 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 and then began to decline as materials recovery and combustion with energy recovery increased.

Figure 26. Municipal solid waste management, 1960 to 2007



Source: Franklin Associates, A Division of ERG

Recovery has increased steadily. Combustion with energy recovery, as a percentage of generation, has been declining (12.6 percent of generation in 2007). MSW discards to landfills rose to about 140 million tons in 2006, and then declined to 137 million tons in 2007. 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 percent in 2007.

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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 and processors of these materials.

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.

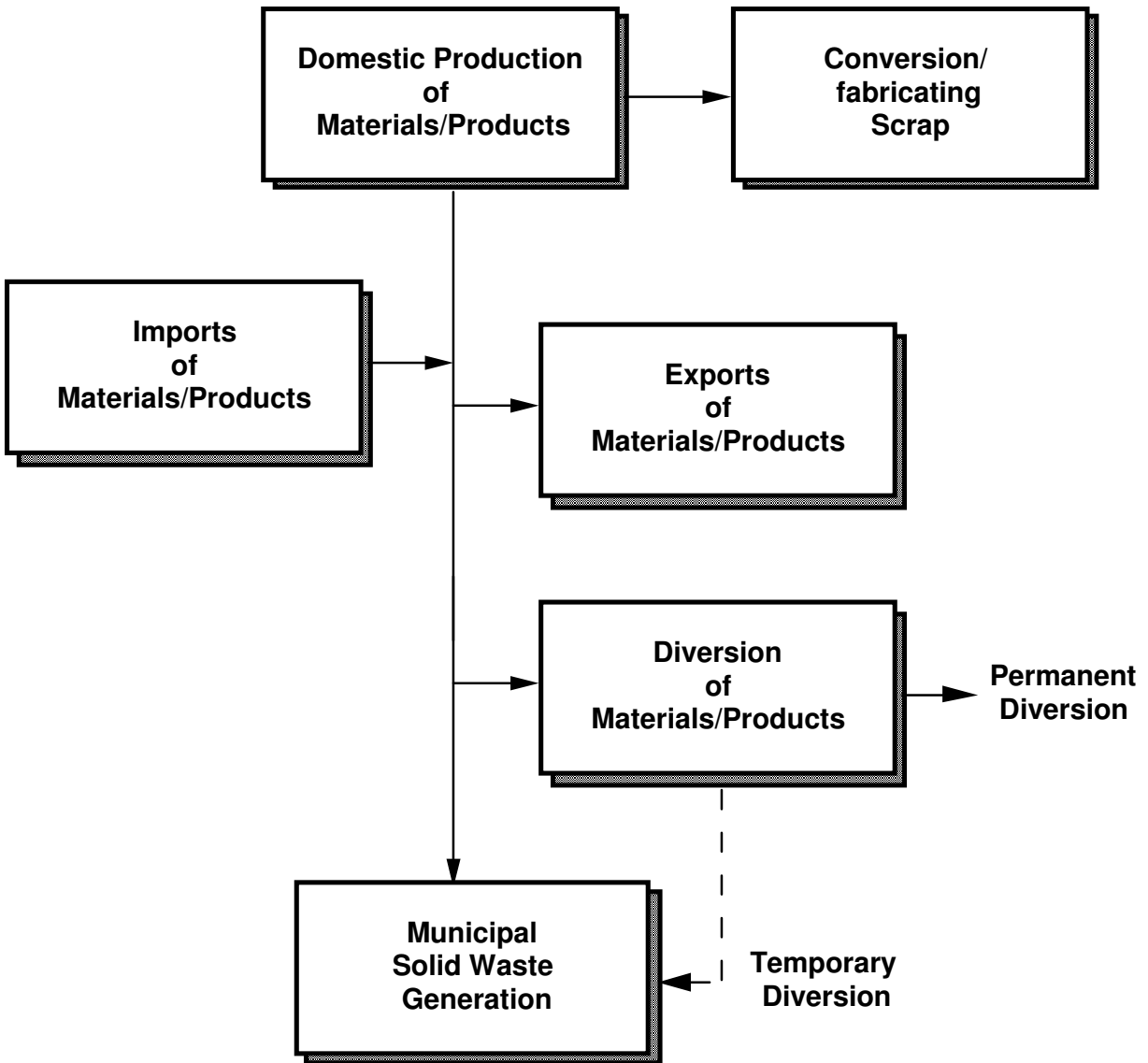


Figure A-1. Material flows methodology for estimating generation of products and materials in municipal solid waste.

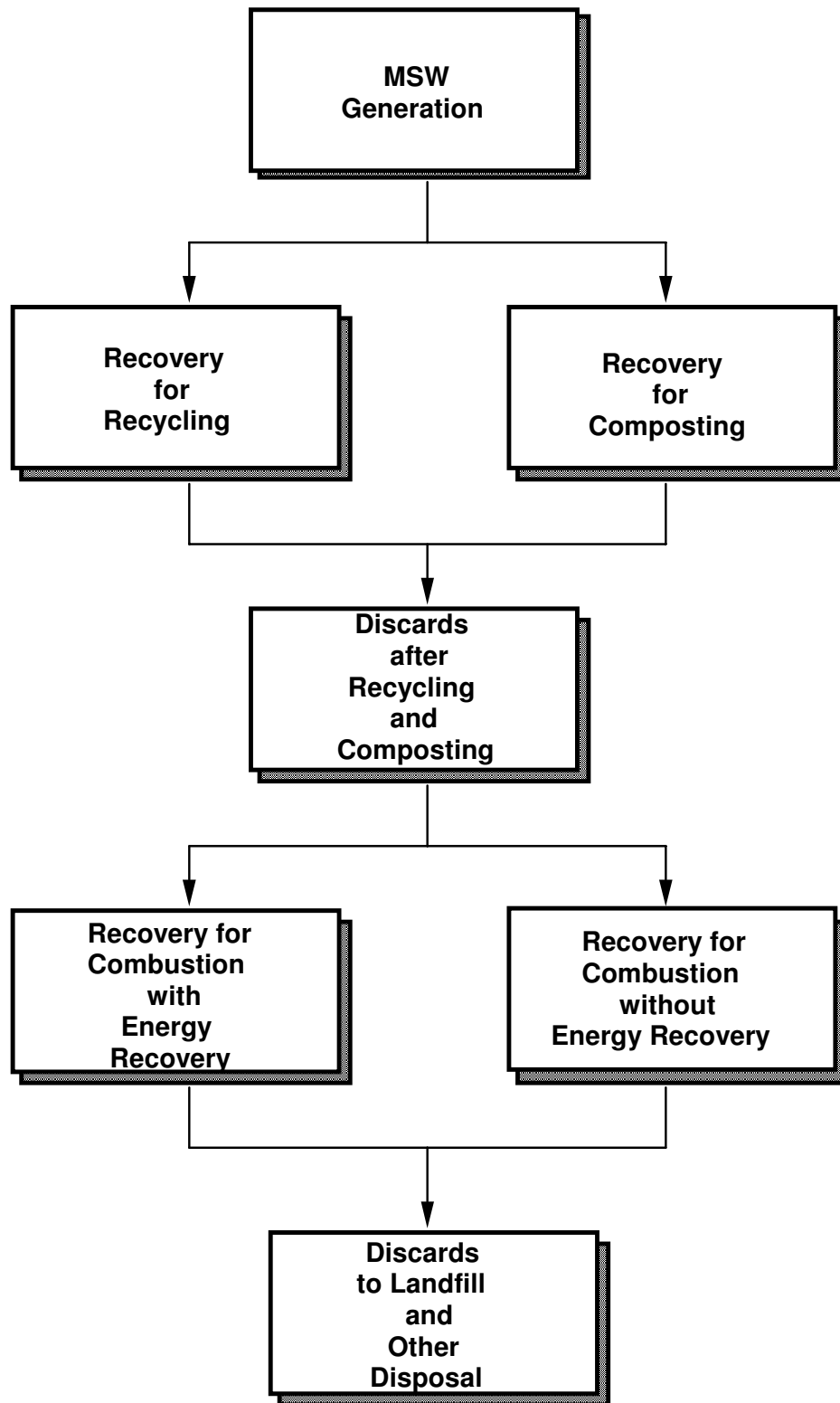


Figure A-2. Material flows methodology for estimating discards of products and materials in municipal solid waste.



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