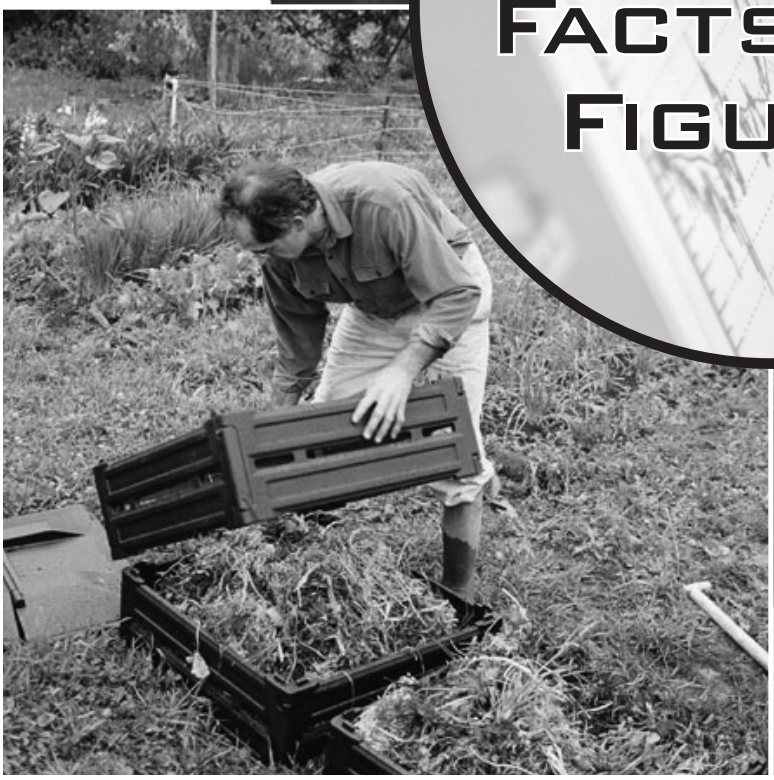
Municipal Solid Waste in The United States

2009 Facts and Figures



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MUNICIPAL SOLID WASTE IN THE UNITED STATES: 2009 FACTS AND FIGURES

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MUNICIPAL SOLID WASTE IN THE UNITED STATES: 2009 FACTS AND FIGURES

EXECUTIVE SUMMARY

OVERVIEW

This report describes the national municipal solid waste (MSW) stream based on data collected for 1960 through 2009. 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 243 million tons of MSW in 2009—eight million tons less than generated in 2008. Excluding composting, 61.3 million tons of MSW were recycled, a slight decrease of 0.5 million tons from 2008. The tons of food scrap and yard trimmings recovered for composting were 20.8 million tons in 2008. The recovery rate for recycling (including composting) was 33.8 percent in 2009, up from 33.4 percent in 2008. Although the tons recycled and composted decreased in 2009, the tons generated also decreased resulting in an increase in the recycling rate (see Tables ES-1 and ES-2 and Figures ES-1 and ES-2).

MSW generation in 2009 declined to 4.34 pounds per person per day. This is a decrease of 4 percent from 2008 to 2009. The recycling rate in 2009 was 1.46 pounds per person per day. Discards sent for combustion with energy recovery was 0.52 pounds per person per day. Discards sent to landfills after recycling and combustion with energy recovery declined to 2.36 pounds per person per day in 2009. This is a decrease of 3.3 percent from 2008 to 2009 (see Table ES-3).

Table ES-1. Generation, Materials Recovery, Composting, Combustion with Energy Recovery, and Discards of Municipal Solid Waste, 1960 – 2009 (In millions of tons)

Activity	1960	1970	1980	1990	2000	2005	2007	2008	2009
Generation	88.1	121.1	151.6	208.3	242.5	252.4	255.0	251.0	243.0
Recovery for recycling	5.6	8.0	14.5	29.0	53.0	59.3	63.1	61.8	61.3
Recovery for composting*	Neg.	Neg.	Neg.	4.2	16.5	20.6	21.7	22.1	20.8
Total materials recovery	5.6	8.0	14.5	33.2	69.5	79.9	84.8	83.9	82.0
Combustion with energy recovery†	0.0	0.4	2.7	29.7	33.7	31.6	32.0	31.6	29.0
Discards to landfill, other disposal‡	82.5	112.7	134.4	145.3	139.4	140.9	138.2	135.6	131.9

* 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 – 2009 (In percent of total generation)

Activity	1960	1970	1980	1990	2000	2005	2007	2008	2009
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%	14.0%	21.9%	23.5%	24.8%	24.6%	25.2%
Recovery for composting*	Neg.	Neg.	Neg.	2.0%	6.7%	8.1%	8.5%	8.8%	8.6%
Total materials recovery	6.4%	6.6%	9.6%	16.0%	28.6%	31.6%	33.3%	33.4%	33.8%
Combustion with energy recovery†	0.0%	0.3%	1.8%	14.2%	13.9%	12.5%	12.5%	12.6%	11.9%
Discards to landfill, other disposal‡	93.6%	93.1%	88.6%	69.8%	57.5%	55.9%	54.2%	54.0%	54.3%

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

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets and tire-derived fuel). 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 – 2009 (In pounds per person per day)

Activity	1960	1970	1980	1990	2000	2005	2007	2008	2009
Generation	2.68	3.25	3.66	4.57	4.72	4.67	4.63	4.52	4.34
Recovery for recycling	0.17	0.22	0.35	0.64	1.03	1.10	1.15	1.11	1.09
Recovery for composting*	Neg.	Neg.	Neg.	0.09	0.32	0.38	0.39	0.40	0.37
Total materials recovery	0.17	0.22	0.35	0.73	1.35	1.48	1.54	1.51	1.46
Combustion with energy recovery†	0.00	0.01	0.07	0.65	0.66	0.58	0.58	0.57	0.52
Discards to landfill, other disposal‡	2.51	3.02	3.24	3.19	2.71	2.61	2.51	2.44	2.36
Population (millions)	179.979	203.984	227.255	249.907	281.422	296.410	301.621	304.060	307.007

* 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 2009

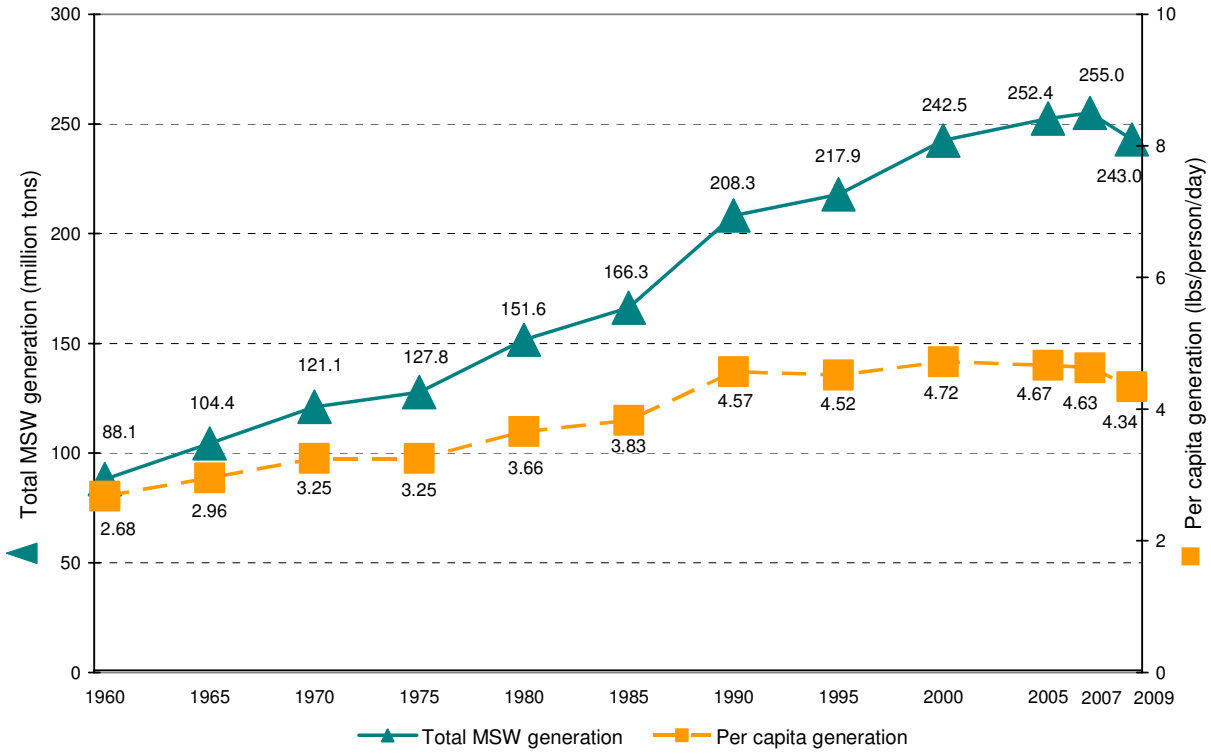
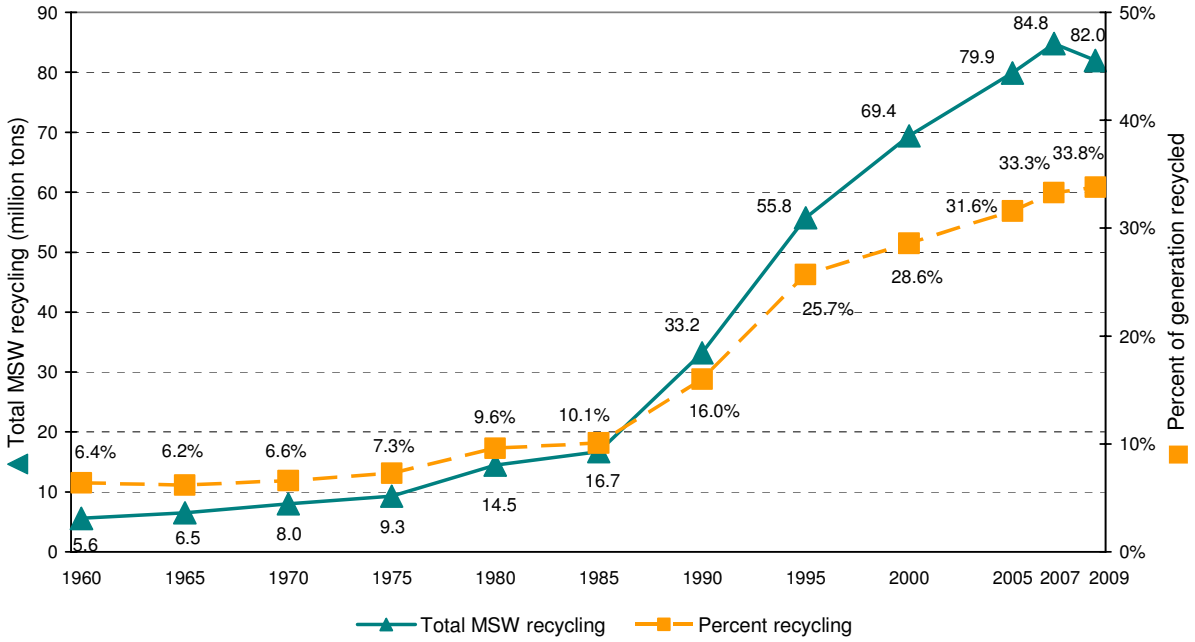


Figure ES-2. MSW Recycling Rates, 1960 to 2009



Figures ES-1 and ES-2 show decreases in MSW generation and recycling from 2007 to 2009. 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 continued to increase from 1960, when it was 88 million tons, until 2007. After 2007, the tons of MSW generated started to decrease. 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 4.72 pounds per person per day in 2000, and decreased to 4.67 pounds per person per day in 2005. Since 2005, MSW generation per capita rate has continued to decrease. The generation rate was 4.34 pounds per person per day in 2009.

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 1990, to 29 percent in 2000, and to about 34 percent in 2009. Disposal of waste to landfills has decreased from 94 percent of the amount generated in 1960 to just over 54 percent of the amount generated in 2009.

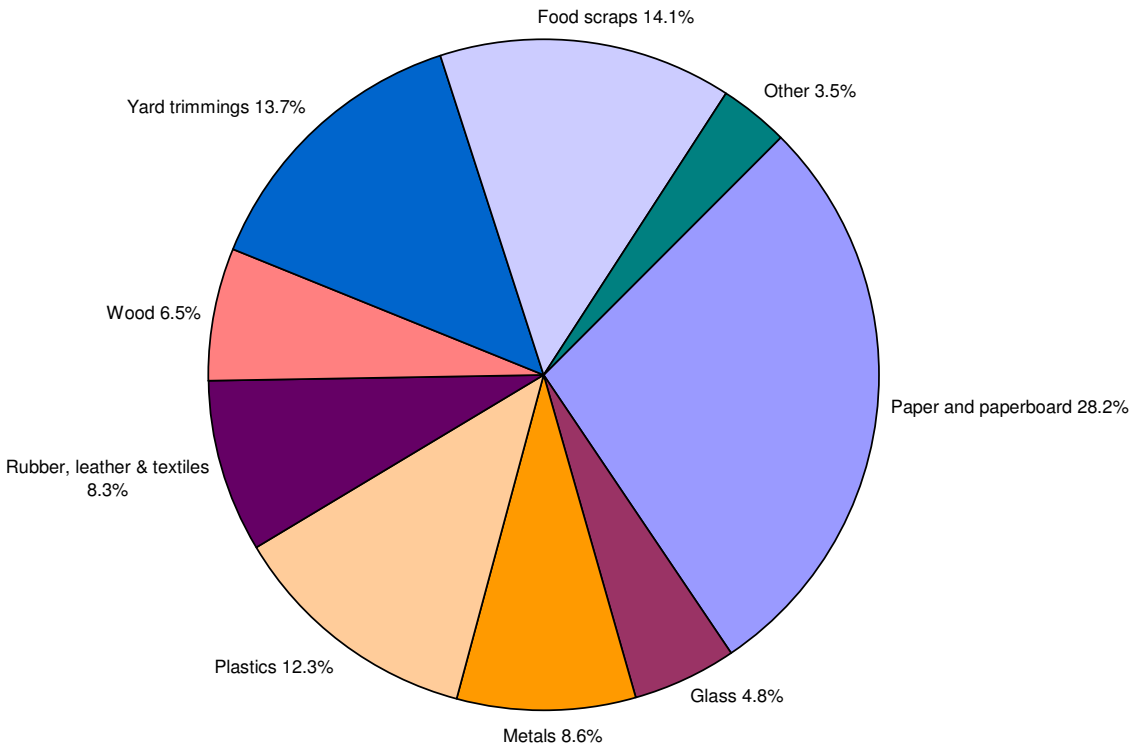
MUNICIPAL SOLID WASTE IN 2009

The U.S. Environmental Protection Agency (EPA) uses two methods to characterize the 243 million tons of MSW generated in 2009. 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 2009 is provided in Figure ES-3. Paper and paperboard made up the largest component of MSW generated (28.2 percent), food scraps were the second-largest component (14.1 percent) and yard trimmings were the third largest (13.7 percent). Metals, plastics, and wood each constituted between 6 and 13 percent of the total MSW generated. Glass made up 4.8 percent, rubber, leather, and textiles combined made up 8.3 percent of MSW, while other miscellaneous wastes made up 3.5 percent of the MSW generated in 2009.

Figure ES-3. Materials Generation in MSW, 2009
243 Million Tons (before recycling)



A portion of each material category in MSW was recycled or composted in 2009. The highest rates of recovery were achieved with paper and paperboard, yard trimmings, and metals. Over 62 percent (42.5 million tons) of paper and paperboard was recovered for recycling in 2009. About 60 percent (19.9 million tons) of yard trimmings was recovered for composting or mulching in 2009. This represents about a five-fold increase since 1990. Recycling paper and paperboard and yard trimmings alone diverted about 26 percent of municipal solid waste from landfills and combustion facilities. In addition, about 7.2 million tons, or 34.5 percent, of metals were recovered for recycling. Recycling rates for all materials categories in 2009 are listed in Table ES-4.

Table ES-4. Generation and Recovery of Materials in MSW, 2009
(In millions of tons and percent of generation of each material)

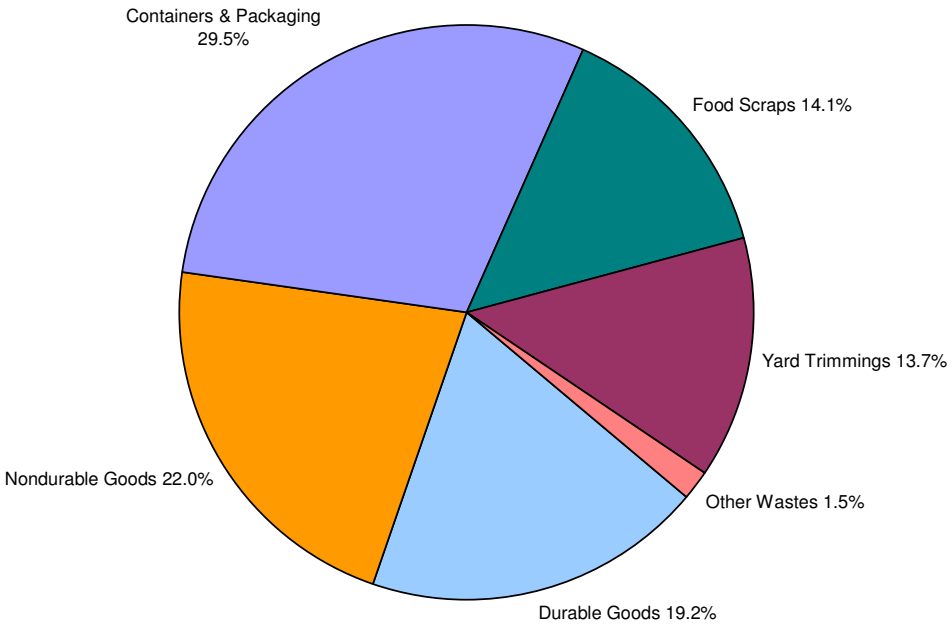
Material	Weight Generated	Weight Recovered	Recovery As a Percent of Generation
Paper and paperboard	68.43	42.50	62.1%
Glass	11.78	3.00	25.5%
Metals			
Steel	15.62	5.23	33.5%
Aluminum	3.40	0.69	20.3%
Other nonferrous metals*	1.89	1.30	68.8%
Total metals	*20.91*	*7.22*	*34.5%*
Plastics	29.83	2.12	7.1%
Rubber and leather	7.49	1.07	14.3%
Textiles	12.73	1.90	14.9%
Wood	15.84	2.23	14.1%
Other materials	4.64	1.23	26.5%
Total Materials in Products	*171.65*	*61.27*	*35.7%*
Other wastes			
Food, other**	34.29	0.85	2.5%
Yard trimmings	33.20	19.90	59.9%
Miscellaneous inorganic wastes	3.82	Neg.	Neg.
Total Other Wastes	*71.31*	*20.75*	*29.1%*
TOTAL MUNICIPAL SOLID WASTE	242.96	82.02	33.8%

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 2009 is shown in Figure ES-4. Containers and packaging comprised the largest portion of products generated in MSW, at 29.5 percent (71.6 million tons). Nondurable goods were the second-largest fraction, at 22 percent (53.4 million tons). The third-largest category of products is durable goods, which made up 19.2 percent (46.6 million tons) of total MSW generation.

Figure ES-4. Products Generated in MSW, 2009
243 Million Tons (before recycling)



The generation and recovery of the product categories in MSW in 2009 are shown in Table ES-5. This table shows that recovery of containers and packaging was the highest of the three product categories—47.8 percent of containers and packaging generated in MSW in 2009 were recovered for recycling. About 51 percent of all aluminum cans in MSW was recovered (37.5 percent of all aluminum packaging, including foil), while 66.2 percent of steel packaging (mostly cans) in MSW was recovered. Paper and paperboard containers and packaging were recovered at a rate of 62.4 percent; corrugated containers accounted for most of that amount.

Approximately 31 percent of glass containers in MSW were recovered, while about 22 percent of wood packaging (mostly wood pallets removed from service) was recovered for recycling. About 14 percent of plastic containers and packaging in MSW were recovered—mostly bottles and jars.

Overall recovery of *nondurable goods* in MSW was at 35.3 percent in 2009. Most of this recovery comes from paper products such as newspapers and high-grade office papers (e.g., white papers). Newspapers constituted the largest portion of this recovery, with 88 percent of newspapers generated being recovered for recycling. An estimated 74 percent of high-grade office papers and 66 percent of other commercial printing was recovered in 2009. Newspaper, high-grade office paper, and other commercial printing recovery increased in percentage from 2008 to 2009.

Recovery percentages of the other paper products in the nondurable goods category also increased between 2008 and 2009, with standard mail* recovered at an estimated 63 percent, and magazines at an estimated 54 percent.

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

Table ES-5. Generation and Recovery of Products in MSW by Material, 2009 (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	13.34	3.72	27.9%
Aluminum	1.35	Neg.	Neg.
Other non-ferrous metals*	1.89	1.30	68.8%
Glass	2.12	Neg.	Neg.
Plastics	10.65	0.40	3.8%
Rubber and leather	6.43	1.07	16.6%
Wood	5.76	Neg.	Neg.
Textiles	3.49	0.44	12.6%
Other materials	1.61	1.23	76.4%
Total durable goods	46.64	8.16	17.5%
Nondurable Goods			
Paper and paperboard	33.48	17.43	52.1%
Plastics	6.65	Neg.	Neg.
Rubber and leather	1.06	Neg.	Neg.
Textiles	9.00	1.46	16.2%
Other materials	3.25	Neg.	Neg.
Total nondurable goods	53.44	18.89	35.3%
Containers and Packaging			
Steel	2.28	1.51	66.2%
Aluminum	1.84	0.69	37.5%
Glass	9.66	3.00	31.1%
Paper and paperboard	34.94	25.07	62.4%
Plastics	12.53	1.72	13.7%
Wood	10.08	2.23	22.1%
Other materials	0.24	Neg.	Neg.
Total containers and packaging	71.57	34.22	47.8%
Other Wastes			
Food, other**	34.29	0.85	2.5%
Yard trimmings	33.20	19.9	59.9%
Miscellaneous inorganic wastes	3.82	Neg.	Neg.
Total other wastes	71.31	20.75	29.1%
TOTAL MUNICIPAL SOLID WASTE	242.96	82.02	33.8%

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.

The nondurable goods category also includes clothing and other textile products—16.2 percent of these products were recovered for recycling or export in 2009.

Overall, *durable goods* were recovered at a rate of 17.5 percent in 2009. Nonferrous metals other than aluminum had one of the highest recovery rates, at 68.8 percent, due to the high rate of lead recovery from lead-acid batteries. Recovery of steel in all durable goods was 27.9 percent, with high rates of recovery from appliances.

One of the products with a very high recovery rate was lead-acid batteries, recovered at a rate of about 96 percent in 2009. Other products with particularly high recovery rates were newspapers (88 percent), corrugated boxes (81 percent), major appliances (67percent), steel packaging (66.2 percent), and aluminum cans (51 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 estimate 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.

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 33.8 percent (82 million tons) of MSW generation in 2009.

- There were about 9,000 curbside recycling programs in the United States in 2009.

- In 2009, close to 3,000 yard trimmings composting programs were documented.

Combustion with Energy Recovery

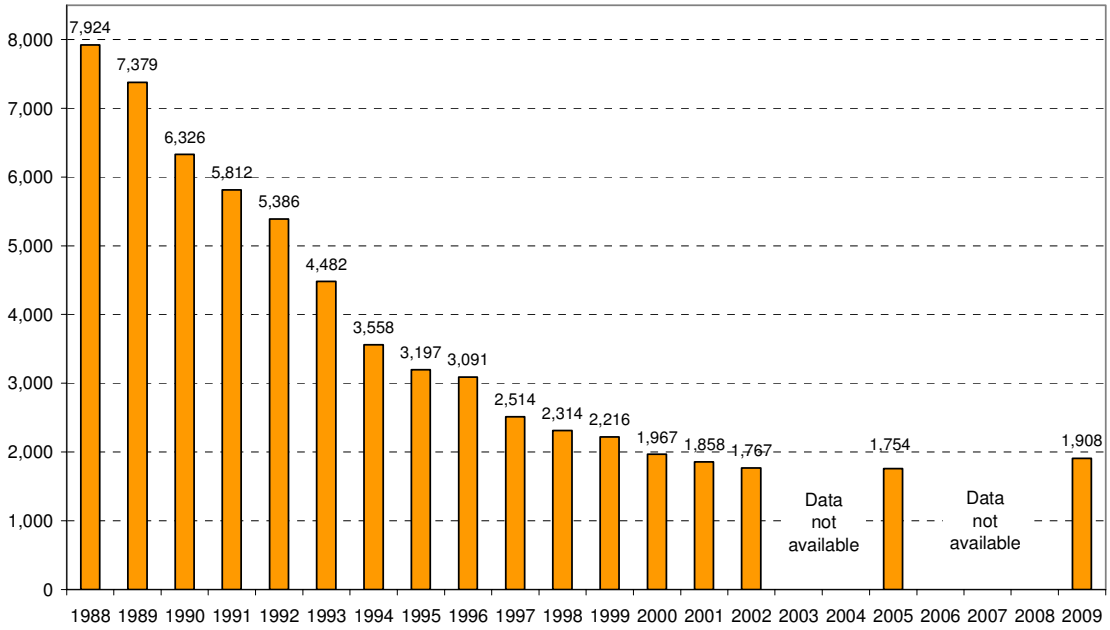
MSW combustion with energy recovery increased substantially between 1980 and 1990 (from 2.7 million tons in 1980 to 29.7 million tons in 1990). From 1990 to 2000, the quantity of MSW combusted with energy recovery increased over 13 percent to 33.7 million tons. After 2000, the quantity of MSW combusted with energy recovery has decreased to an estimated 29.0 million tons (11.9 percent of MSW generation) in 2009 (see Tables ES-1 and ES-2), less than the 29.7 million tons estimated in 1990.

Disposal

During 2009, about 54 percent of MSW was landfilled, similar to the percentage landfilled in 2007 and 2008. As shown in Figure ES-5, the number of MSW landfills decreased substantially over the past 21 years, from nearly 8,000 in 1988 to 1,900 in 2009—while average landfill size increased. At the national level, capacity does not appear to be a problem, although regional dislocations sometimes occur.

- The percentage of MSW landfilled remained about the same as 2008. Over time, the tonnage of MSW landfilled in 1990 was 145.3 million tons (see Table ES-1), but decreased to 139.4 million tons in 2000. The tonnage increased to 140.9 million tons in 2005, then declined to 131.9 in 2009. 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.

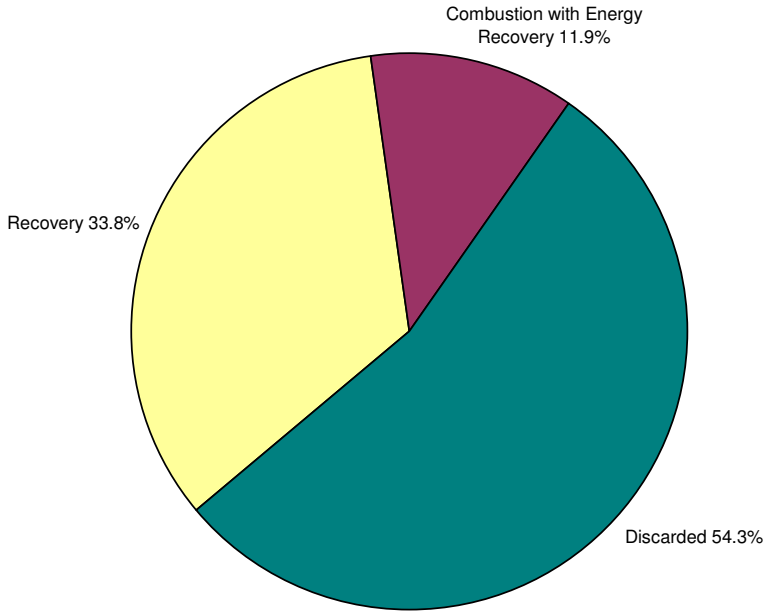
Figure ES-5. Number of Landfills in the United States, 1988 - 2009



- In 2009, the net per capita discard rate (after materials recovery and combustion with energy recovery) was 2.36 pounds per person per day. The net per capita discard rate has decreased steadily since 1990. The 1990 rate was 3.19 pounds per person per day, the 2000 rate was 2.71 pounds per person per day, the 2005 rate was 2.61 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 2009 is shown in Figure ES-6. In 2009, 82 millions tons (33.8 percent) of MSW were recycled, 29.0 million tons (11.9 percent) were combusted with energy recovery, and 131.9 million tons (54.3 percent) were landfilled or otherwise disposed. (Relatively small amounts of this total undoubtedly were incinerated without energy recovery, littered, or illegally dumped rather than landfilled.)

Figure ES- 6. Management of MSW in the United States, 2009



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. Recycling also provides significant economic and job creation impacts, a topic discussed at http://www.epa.gov/epawaste/conserve/rrr/rmd/econ.htm.

Nationally, we recycled and composted 82 million tons of MSW. This provides an annual benefit of 178 million metric tons of carbon dioxide equivalent emissions reduced, comparable to the annual greenhouse gas emissions from almost 33 million passenger vehicles. 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 Waste Reduction Model (WARM). Please see: www.epa.gov/warm.

FOR FURTHER INFORMATION

This report and related additional data are available on the Internet at www.epa.gov/epawaste/nonhaz/municipal/msw99.htm.

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 49-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 *Estimating 2003 Building-Related Construction and Demolition Materials Amounts*, EPA530-R-09-002, March 2009. 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:

Sources and Examples	**Example Products**
Residential (single-and multi-family homes)	Newspapers, clothing, disposable tableware, food packaging, cans and bottles, food scraps, yard trimmings
Commercial (office buildings, retail and wholesale establishments, restaurants)	Corrugated boxes, food scraps, office papers, disposable tableware, paper napkins, yard trimmings
Institutional (schools, libraries, hospitals, prisons)	Cafeteria and restroom trash can wastes, office papers, classroom wastes, yard trimmings
Industrial (packaging and administrative; *not* 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-A, 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 process wastes	Oil and gas wastes
Construction and demolition debris	Mining wastes
Land clearing debris	Auto bodies
Transportation parts and equipment	Fats, grease, and oils

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-A) 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 2009 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.

CHAPTER 1

REFERENCES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2001 Facts and Figures*. EPA/530-R-03-011. October 2003. http://www.epa.gov/wastes/nonhaz/municipal/pubs/msw2001.pdf

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2005 Facts and Figures*. EPA530-R-06-011. October 2006. http://www.epa.gov/wastes/nonhaz/municipal/pubs/mswchar05.pdf

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2007 Facts and Figures*. EPA530-R-08-010. November 2008. http://www.epa.gov/wastes/nonhaz/municipal/pubs/msw07-rpt.pdf

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

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

CHAPTER 2

CHARACTERIZATION OF MUNICIPAL SOLID WASTE BY WEIGHT

INTRODUCTION

The tables and figures in this chapter present the results of the update of EPA's municipal solid waste characterization report through 2009. The data presented also incorporate some revisions to previously reported data for 1990 through 2008. 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 and food scraps, recovery includes estimates of the material 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 2009 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 2009
(In thousands of tons and percent of total generation)

	Thousands of Tons								
Materials	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Paper and Paperboard	29,990	44,310	55,160	72,730	87,740	84,840	82,530	77,420	68,430
Glass	6,720	12,740	15,130	13,100	12,760	12,540	12,520	12,150	11,780
Metals									
Ferrous	10,300	12,360	12,620	12,640	14,110	14,990	15,640	15,730	15,620
Aluminum	340	800	1,730	2,810	3,200	3,330	3,360	3,410	3,400
Other Nonferrous	180	670	1,160	1,100	1,600	1,860	1,880	1,960	1,890
Total Metals	*10,820*	*13,830*	*15,510*	*16,550*	*18,910*	*20,180*	*20,880*	*21,100*	*20,910*
Plastics	390	2,900	6,830	17,130	25,540	29,260	30,750	30,060	29,830
Rubber and Leather	1,840	2,970	4,200	5,790	6,710	7,360	7,540	7,630	7,490
Textiles	1,760	2,040	2,530	5,810	9,440	11,380	11,940	12,430	12,730
Wood	3,030	3,720	7,010	12,210	13,600	14,790	15,280	15,540	15,840
Other **	70	770	2,520	3,190	4,000	4,280	4,550	4,670	4,640
Total Materials in Products	54,620	83,280	108,890	146,510	178,700	184,630	185,990	181,000	171,650
Other Wastes									
Food Scraps	12,200	12,800	13,000	23,860	29,810	31,990	32,610	33,340	34,290
Yard Trimmings	20,000	23,200	27,500	35,000	30,530	32,070	32,630	32,900	33,200
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,690	3,750	3,780	3,820
Total Other Wastes	33,500	37,780	42,750	61,760	63,840	67,750	68,990	70,020	71,310
Total MSW Generated - Weight	88,120	121,060	151,640	208,270	242,540	252,380	254,980	251,020	242,960
	Percent of Total Generation								
Materials	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Paper and Paperboard	34.0%	36.6%	36.4%	34.9%	36.2%	33.6%	32.4%	30.8%	28.2%
Glass	7.6%	10.5%	10.0%	6.3%	5.3%	5.0%	4.9%	4.8%	4.8%
Metals									
Ferrous	11.7%	10.2%	8.3%	6.1%	5.8%	5.9%	6.1%	6.3%	6.4%
Aluminum	0.4%	0.7%	1.1%	1.3%	1.3%	1.3%	1.3%	1.4%	1.4%
Other Nonferrous	0.2%	0.6%	0.8%	0.5%	0.7%	0.7%	0.7%	0.8%	0.8%
Total Metals	*12.3%*	*11.4%*	*10.2%*	*7.9%*	*7.8%*	*8.0%*	*8.2%*	*8.4%*	*8.6%*
Plastics	0.4%	2.4%	4.5%	8.2%	10.5%	11.6%	12.1%	12.0%	12.3%
Rubber and Leather	2.1%	2.5%	2.8%	2.8%	2.8%	2.9%	3.0%	3.0%	3.1%
Textiles	2.0%	1.7%	1.7%	2.8%	3.9%	4.5%	4.7%	5.0%	5.2%
Wood	3.4%	3.1%	4.6%	5.9%	5.6%	5.9%	6.0%	6.2%	6.5%
Other **	0.1%	0.6%	1.7%	1.5%	1.6%	1.7%	1.8%	1.9%	1.9%
Total Materials in Products	62.0%	68.8%	71.8%	70.3%	73.7%	73.2%	72.9%	72.1%	70.6%
Other Wastes									
Food Scraps	13.8%	10.6%	8.6%	11.5%	12.3%	12.7%	12.8%	13.3%	14.1%
Yard Trimmings	22.7%	19.2%	18.1%	16.8%	12.6%	12.7%	12.8%	13.1%	13.7%
Miscellaneous Inorganic Wastes	1.5%	1.5%	1.5%	1.4%	1.4%	1.5%	1.5%	1.5%	1.6%
Total Other Wastes	38.0%	31.2%	28.2%	29.7%	26.3%	26.8%	27.1%	27.9%	29.4%
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 2009
(In thousands of tons and percent of generation of each material)

	Thousands of Tons								
Materials	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Paper and Paperboard	5,080	6,770	11,740	20,230	37,560	41,960	44,480	42,940	42,500
Glass	100	160	750	2,630	2,880	2,590	2,880	2,810	3,000
Metals									
Ferrous	50	150	370	2,230	4,680	5,030	5,280	5,310	5,230
Aluminum	Neg.	10	310	1,010	860	690	730	720	690
Other Nonferrous	Neg.	320	540	730	1,060	1,280	1,300	1,360	1,300
Total Metals	*50*	*480*	*1,220*	*3,970*	*6,600*	*7,000*	*7,310*	*7,390*	*7,220*
Plastics	Neg.	Neg.	20	370	1,480	1,770	2,100	2,130	2,120
Rubber and Leather	330	250	130	370	820	1,100	1,140	1,140	1,070
Textiles	50	60	160	660	1,320	1,850	1,920	1,910	1,900
Wood	Neg.	Neg.	Neg.	130	1,370	1,830	2,020	2,130	2,230
Other **	Neg.	300	500	680	980	1,210	1,240	1,300	1,230
Total Materials in Products	5,610	8,020	14,520	29,040	53,010	59,310	63,090	61,750	61,270
Other Wastes									
Food Scraps	Neg.	Neg.	Neg.	Neg.	680	690	810	800	850
Yard Trimmings	Neg.	Neg.	Neg.	4,200	15,770	19,860	20,900	21,300	19,900
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	20,550	21,710	22,100	20,750
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,460	79,860	84,800	83,850	82,020
	Percent of Generation of Each Material								
Materials	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Paper and Paperboard	16.9%	15.3%	21.3%	27.8%	42.8%	49.5%	53.9%	55.5%	62.1%
Glass	1.5%	1.3%	5.0%	20.1%	22.6%	20.7%	23.0%	23.1%	25.5%
Metals									
Ferrous	0.5%	1.2%	2.9%	17.6%	33.2%	33.6%	33.8%	33.8%	33.5%
Aluminum	Neg.	1.3%	17.9%	35.9%	26.9%	20.7%	21.7%	21.1%	20.3%
Other Nonferrous	Neg.	47.8%	46.6%	66.4%	66.3%	68.8%	69.1%	69.4%	68.8%
Total Metals	*0.5%*	*3.5%*	*7.9%*	*24.0%*	*34.9%*	*34.7%*	*35.0%*	*35.0%*	*34.5%*
Plastics	Neg.	Neg.	0.3%	2.2%	5.8%	6.0%	6.8%	7.1%	7.1%
Rubber and Leather	17.9%	8.4%	3.1%	6.4%	12.2%	14.9%	15.1%	14.9%	14.3%
Textiles	2.8%	2.9%	6.3%	11.4%	14.0%	16.3%	16.1%	15.4%	14.9%
Wood	Neg.	Neg.	Neg.	1.1%	10.1%	12.4%	13.2%	13.7%	14.1%
Other **	Neg.	39.0%	19.8%	21.3%	24.5%	28.3%	27.3%	27.8%	26.5%
Total Materials in Products	10.3%	9.6%	13.3%	19.8%	29.7%	32.1%	33.9%	34.1%	35.7%
Other Wastes									
Food, Other^	Neg.	Neg.	Neg.	Neg.	2.3%	2.2%	2.5%	2.4%	2.5%
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	51.7%	61.9%	64.1%	64.7%	59.9%
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	6.8%	25.8%	30.3%	31.5%	31.6%	29.1%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.0%	28.6%	31.6%	33.3%	33.4%	33.8%

* 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 2009
(In thousands of tons and percent of total discards)

	Thousands of Tons								
Materials	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Paper and Paperboard	24,910	37,540	43,420	52,500	50,180	42,880	38,050	34,480	25,930
Glass	6,620	12,580	14,380	10,470	9,880	9,950	9,640	9,340	8,780
Metals									
Ferrous	10,250	12,210	12,250	10,410	9,430	9,960	10,360	10,420	10,390
Aluminum	340	790	1,420	1,800	2,340	2,640	2,630	2,690	2,710
Other Nonferrous	180	350	620	370	540	580	580	600	590
Total Metals	*10,770*	*13,350*	*14,290*	*12,580*	*12,310*	*13,180*	*13,570*	*13,710*	*13,690*
Plastics	390	2,900	6,810	16,760	24,060	27,490	28,650	27,930	27,710
Rubber and Leather	1,510	2,720	4,070	5,420	5,890	6,260	6,400	6,490	6,420
Textiles	1,710	1,980	2,370	5,150	8,120	9,530	10,020	10,520	10,830
Wood	3,030	3,720	7,010	12,080	12,230	12,960	13,260	13,410	13,610
Other **	70	470	2,020	2,510	3,020	3,070	3,310	3,370	3,410
Total Materials in Products	49,010	75,260	94,370	117,470	125,690	125,320	122,900	119,250	110,380
Other Wastes									
Food Scraps	12,200	12,800	13,000	23,860	29,130	31,300	31,800	32,540	33,440
Yard Trimmings	20,000	23,200	27,500	30,800	14,760	12,210	11,730	11,600	13,300
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,690	3,750	3,780	3,820
Total Other Wastes	33,500	37,780	42,750	57,560	47,390	47,200	47,280	47,920	50,560
Total MSW Discarded - Weight	82,510	113,040	137,120	175,030	173,080	172,520	170,180	167,170	160,940
	Percent of Total Discards								
Materials	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Paper and Paperboard	30.2%	33.2%	31.7%	30.0%	29.0%	24.9%	22.4%	20.6%	16.1%
Glass	8.0%	11.1%	10.5%	6.0%	5.7%	5.8%	5.7%	5.6%	5.5%
Metals									
Ferrous	12.4%	10.8%	8.9%	5.9%	5.4%	5.8%	6.1%	6.2%	6.5%
Aluminum	0.4%	0.7%	1.0%	1.0%	1.4%	1.5%	1.5%	1.6%	1.7%
Other Nonferrous	0.2%	0.3%	0.5%	0.2%	0.3%	0.3%	0.3%	0.4%	0.4%
Total Metals	*13.1%*	*11.8%*	*10.4%*	*7.2%*	*7.1%*	*7.6%*	*8.0%*	*8.2%*	*8.5%*
Plastics	0.5%	2.6%	5.0%	9.6%	13.9%	15.9%	16.8%	16.7%	17.2%
Rubber and Leather	1.8%	2.4%	3.0%	3.1%	3.4%	3.6%	3.8%	3.9%	4.0%
Textiles	2.1%	1.8%	1.7%	2.9%	4.7%	5.5%	5.9%	6.3%	6.7%
Wood	3.7%	3.3%	5.1%	6.9%	7.1%	7.5%	7.8%	8.0%	8.5%
Other **	0.1%	0.4%	1.5%	1.4%	1.7%	1.8%	1.9%	2.0%	2.1%
Total Materials in Products	59.4%	66.6%	68.8%	67.1%	72.6%	72.6%	72.2%	71.3%	68.6%
Other Wastes									
Food Scraps	14.8%	11.3%	9.5%	13.6%	16.8%	18.1%	18.7%	19.5%	20.8%
Yard Trimmings	24.2%	20.5%	20.1%	17.6%	8.5%	7.1%	6.9%	6.9%	8.3%
Miscellaneous Inorganic Wastes	1.6%	1.6%	1.6%	1.7%	2.0%	2.1%	2.2%	2.3%	2.4%
Total Other Wastes	40.6%	33.4%	31.2%	32.9%	27.4%	27.4%	27.8%	28.7%	31.4%
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.

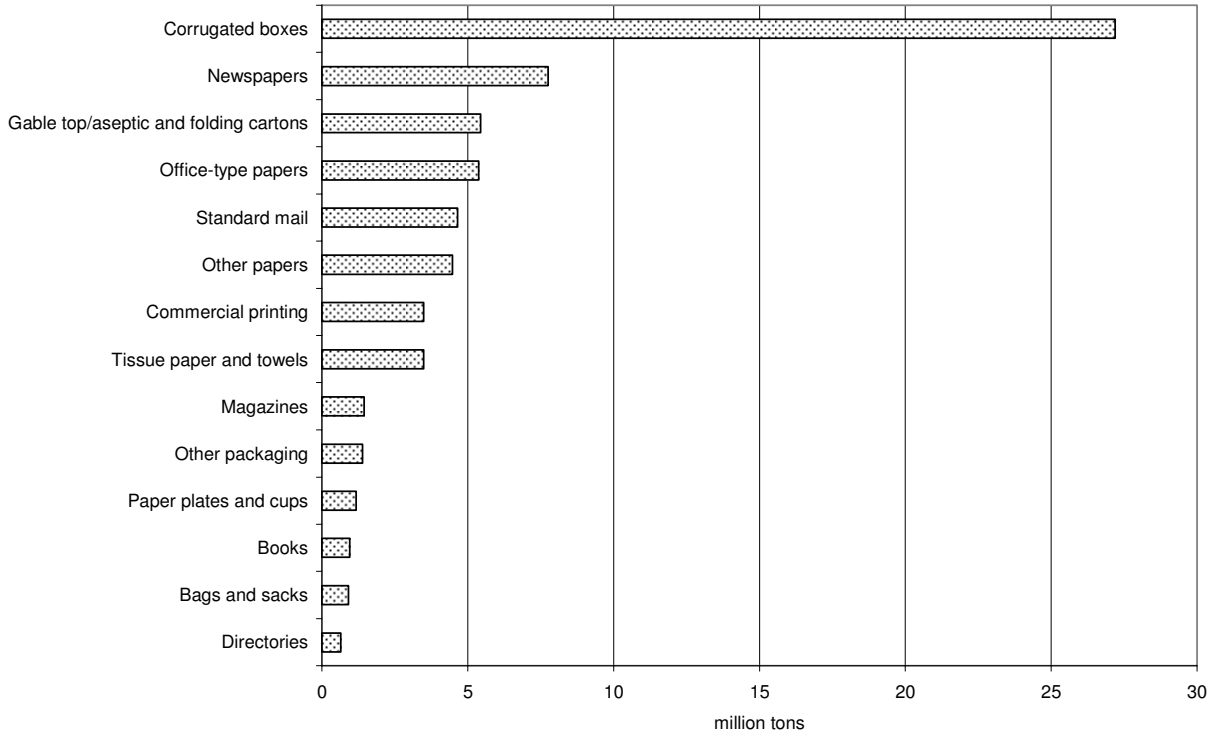
Details may not add to totals due to rounding.

Source: Franklin Associates, A Division of ERG

Paper and Paperboard

Collectively, the many products made of paper and paperboard[1] 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, 2009



Total generation of paper and paperboard in MSW has grown from 30 million tons in 1960 to 68 million tons in 2009 (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 28.2 percent of total MSW generation in 2009.

[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, 2009
(In thousands of tons and percent of generation)

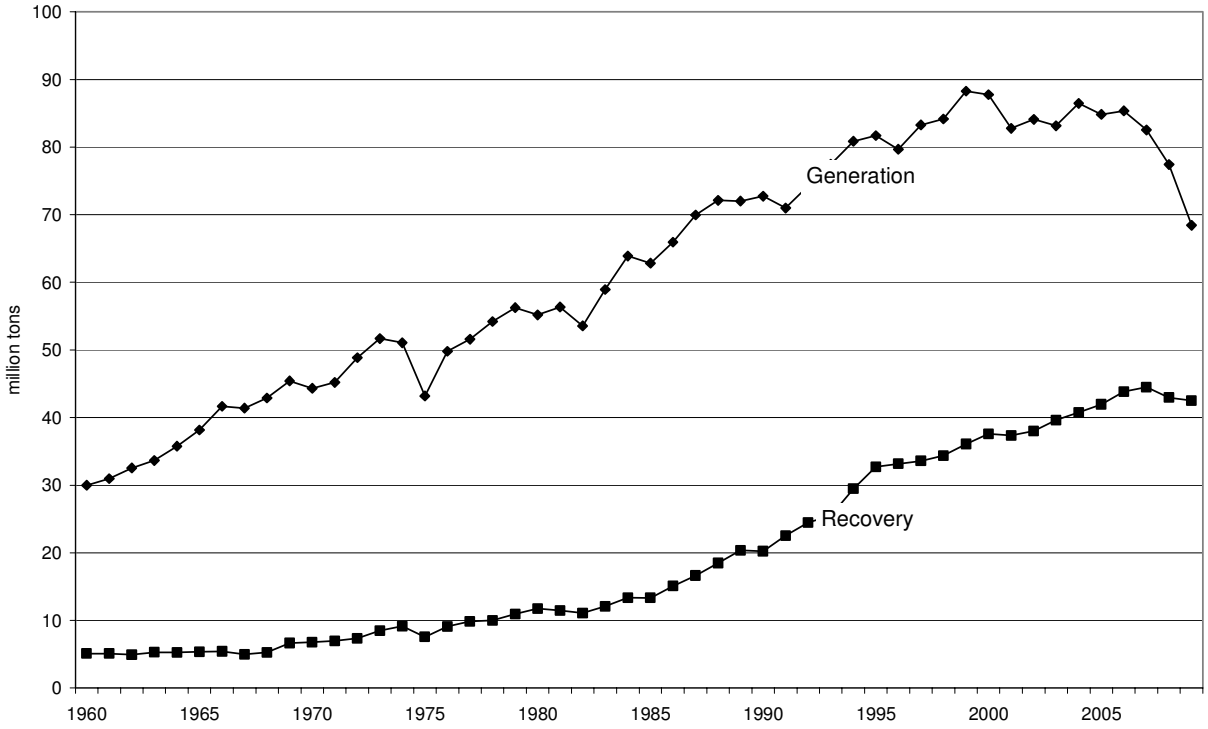
Product Category	Generation (Thousand tons)	Recovery† (Thousand tons)	Recovery† (Percent of generation)	Discards (Thousand tons)
Nondurable Goods				
Newspapers				
Newsprint	5,060	4,490	88.7%	570
Groundwood Inserts	2,700	2,350	87.0%	350
Total Newspapers	7,760	6,840	88.1%	920
Books	960	320	33.3%	640
Magazines	1,450	780	53.8%	670
Office-type Papers*	5,380	3,990	74.2%	1,390
Telephone Directories	650	240	36.9%	410
Standard Mail**	4,650	2,950	63.4%	1,700
Other Commercial Printing	3,490	2,310	66.2%	1,180
Tissue Paper and Towels	3,490	Neg.	Neg.	3,490
Paper Plates and Cups	1,170	Neg.	Neg.	1,170
Other Nonpackaging Paper***	4,480	Neg.	Neg.	4,480
Total Paper and Paperboard Nondurable Goods	33,480	17,430	52.1%	16,050
Containers and Packaging				
Corrugated Boxes	27,190	22,100	81.3%	5,090
Gable Top/Aseptic Cartons‡	460	30	6.5%	430
Folding Cartons	4,980	2,490	50.0%	2,490
Other Paperboard Packaging	90	Neg.	Neg.	90
Bags and Sacks	910	450	49.5%	460
Other Paper Packaging	1,310	Neg.	Neg.	1,310
Total Paper and Paperboard Containers and Packaging	34,940	25,070	71.8%	9,870
Total Paper and Paperboard^	68,420	42,500	62.1%	25,920

† Since 2008, recycling rates increased due to generation going down and applying default values to increased single stream recovered mixed paper products.
* 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.
‡ Includes milk, juice, and other products packaged in gable top cartons and liquid food aseptic cartons
^ 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 2000, and declined after 2000 to 68 million tons in 2009.

Figure 3. Paper and paperboard generation and recovery, 1960 to 2009



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. This sensitivity is most obvious after 2006.

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 2009. 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, 81.3 percent of all corrugated boxes were recovered for recycling in 2009; this is up from 67.3 percent in 2000 (Table 21). Newspapers were recovered at a rate of 88.1 percent, and high grade office papers at 74.2 percent, with lesser percentages of other papers being recovered also. Approximately 43 million tons of postconsumer paper were recovered in 2009––62.1 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 25.9 million tons in 2009, or 16.1 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

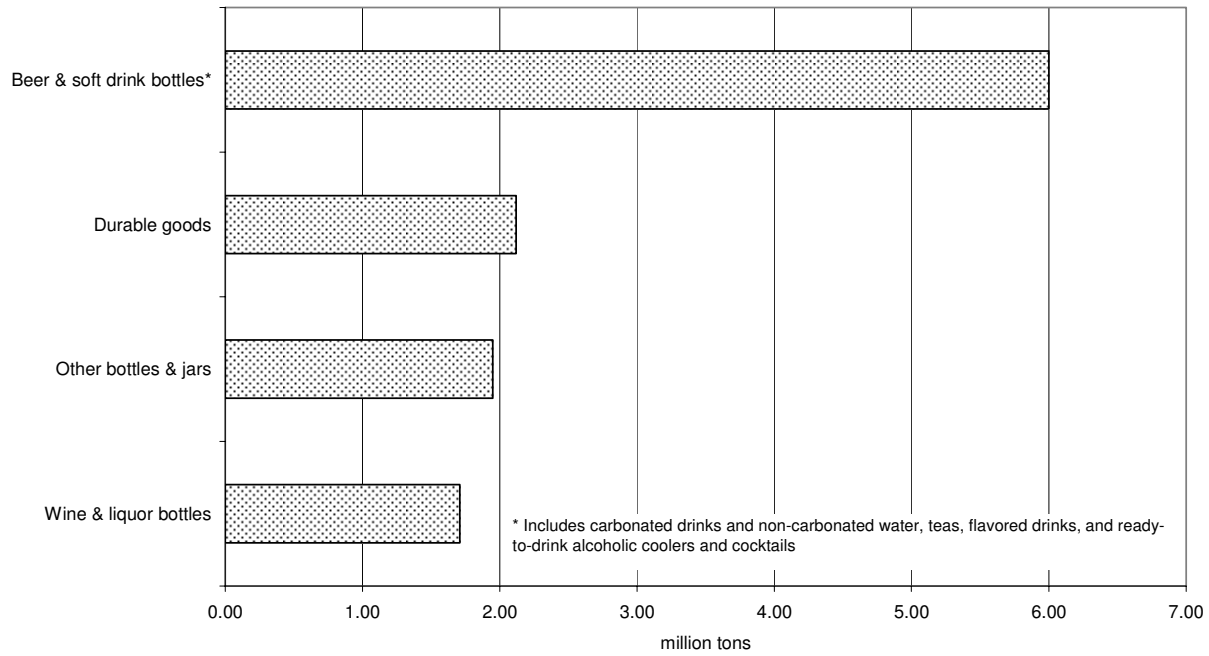
GLASS PRODUCTS IN MSW, 2009
(In thousands of tons and percent of generation)

Product Category	Generation (Thousand tons)	Recovery (Thousand tons)	Recovery (Percent of generation)	Discards (Thousand tons)
Durable Goods*	2,120	Neg.	Neg.	2,120
Containers and Packaging				
Beer and Soft Drink Bottles**	6,000	2,340	39.0%	3,660
Wine and Liquor Bottles	1,710	310	18.1%	1,400
Other Bottles and Jars	1,950	350	17.9%	1,600
Total Glass Containers	9,660	3,000	31.1%	6,660
Total Glass	11,780	3,000	25.5%	8,780

* Glass as a component of appliances, furniture, consumer electronics, etc.
** Includes carbonated drinks and non-carbonated water, teas, flavored drinks, and ready-to-drink alcoholic coolers and cocktails.
Neg. = Less than 5,000 tons or 0.05 percent.
Details may not add to totals due to rounding.

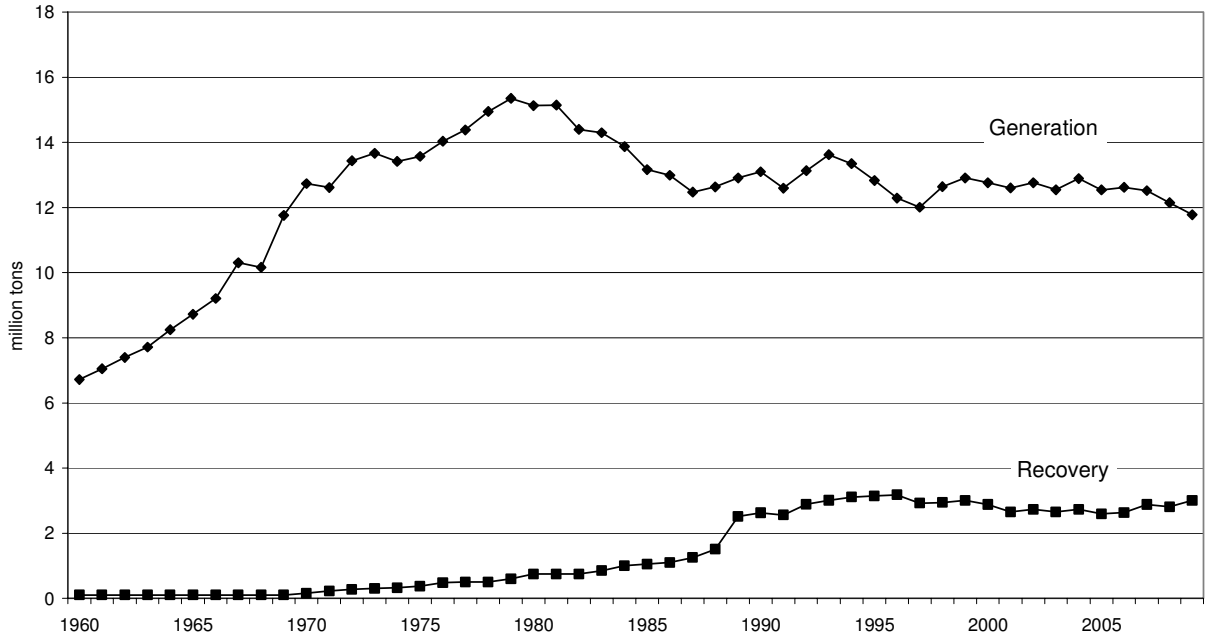
Source: Franklin Associates, A Division of ERG

Figure 4. Glass products generated in MSW, 2009



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. After 2000, glass generation trended downward from 12.8 to 11.8 million tons in 2009. Glass was 10 percent of MSW generation in 1980, declining to 4.8 percent in 2009.

Figure 5. Glass generation and recovery, 1960 to 2009



Recovery. Recovered glass containers (bottles) are used to make new glass containers and other uses such as fiberglass insulation, aggregate, and glasphalt 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 3.0 million tons in 2009, up from an estimated 2.8 million tons in 2008.

Discards After Recovery. Recovery for recycling lowered discards of glass to 8.8 million tons in 2009 or 5.5 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 2009 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 slow 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 2009 (Table 1). The percentage of ferrous metals generation in total MSW has declined from 11.7 percent in 1960 to 6.4 percent in 2009.

Table 6

METAL PRODUCTS IN MSW, 2009
(In thousands of tons and percent of generation)

Product Category	Generation (Thousand tons)	Recovery (Thousand tons)	Recovery (Percent of generation)	Discards (Thousand tons)
Durable Goods				
Ferrous Metals*	13,340	3,720	27.9%	9,620
Aluminum**	1,350	Neg.	Neg.	1,350
Lead†	1,350	1,300	96.3%	50
Other Nonferrous Metals‡	540	Neg.	Neg.	540
Total Metals in Durable Goods	16,580	5,020	30.3%	11,560
Nondurable Goods				
Aluminum	210	Neg.	Neg.	210
Containers and Packaging				
Steel				
Cans	1,940	1,280	66.0%	660
Other Steel Packaging	340	230	67.6%	110
Total Steel Packaging	2,280	1,510	66.2%	770
Aluminum				
Beer and Soft Drink Cans	1,360	690	50.7%	670
Other Cans	70	NA		70
Foil and Closures	410	NA		410
Total Aluminum Packaging	1,840	690	37.5%	1,150
Total Metals in Containers and Packaging	4,120	2,200	53.4%	1,920
Total Metals	20,910	7,220	34.5%	13,690
Ferrous	15,620	5,230	33.5%	10,390
Aluminum	3,400	690	20.3%	2,710
Other nonferrous	1,890	1,300	68.8%	590

* 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. NA = Not Available
Details may not add to totals due to rounding.
Source: Franklin Associates, A Division of ERG

Figure 6. Metal products generated in MSW, 2009

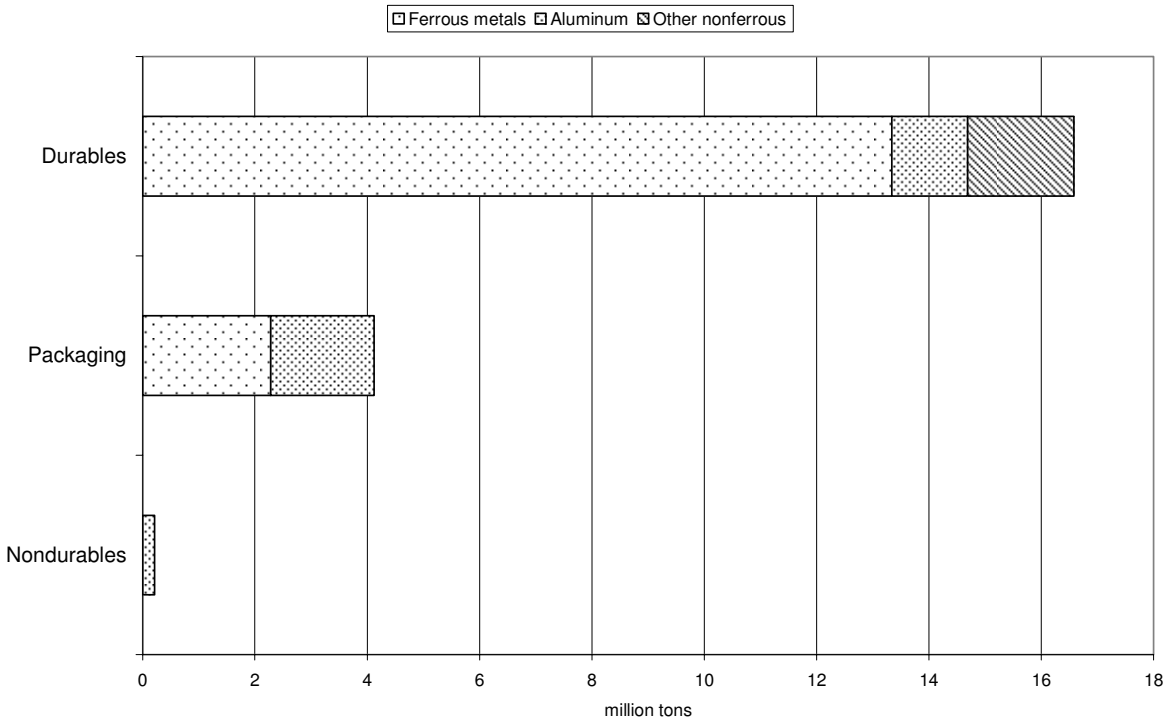
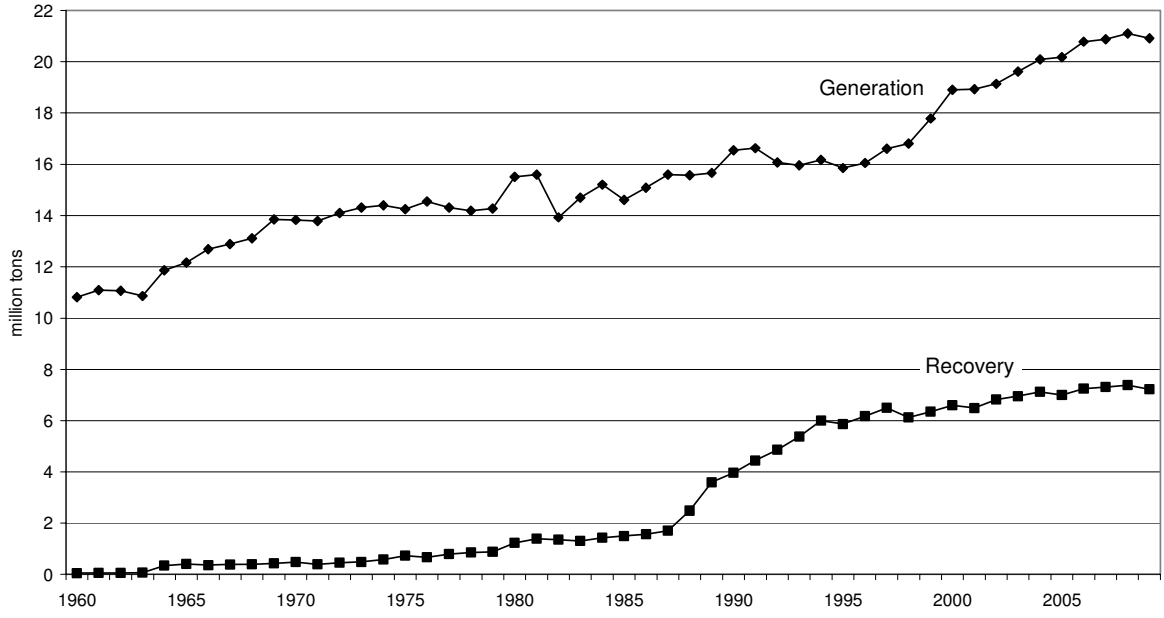


Figure 7. Metals generation and recovery, 1960 to 2009



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 2009. Recovery of all materials in appliances (including ferrous metals) was estimated at 66.8 percent (Table 13). Overall recovery of ferrous metals from durable goods (large and small appliances, furniture, and tires) was estimated to be 27.9 percent (3.7 million tons) in 2009 (Table 6).

Steel cans were estimated to be recovered at a rate of 66.0 percent (1.3 million tons) in 2009. Approximately 230,000 tons of other steel packaging, including strapping, crowns, and drums, were estimated to have been recovered for recycling in 2008. Recovery of ferrous metals includes material collected through recycling programs as well as metal recovered at combustion facilities.

Discards After Recovery. In 2009, discards of ferrous metals after recovery were 10.4 million tons, or 6.5 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 2009, 1.8 million tons of aluminum were generated as containers and packaging, while approximately 1.6 million tons were found in durable and nondurable goods. The total–3.4 million tons–was 1.4 percent of total MSW generation in 2009 (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 50.7 percent of generation (0.7 million tons) in 2009, and 37.5 percent of all aluminum in containers and packaging (beverage containers, food containers, foil, and other aluminum packaging) was recovered for recycling in 2009.

Discards After Recovery. In 2009, about 2.7 million tons of aluminum were discarded in MSW after recovery, which was 1.7 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 1.9 million tons in 2009. Lead in batteries accounted for 1.4 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.

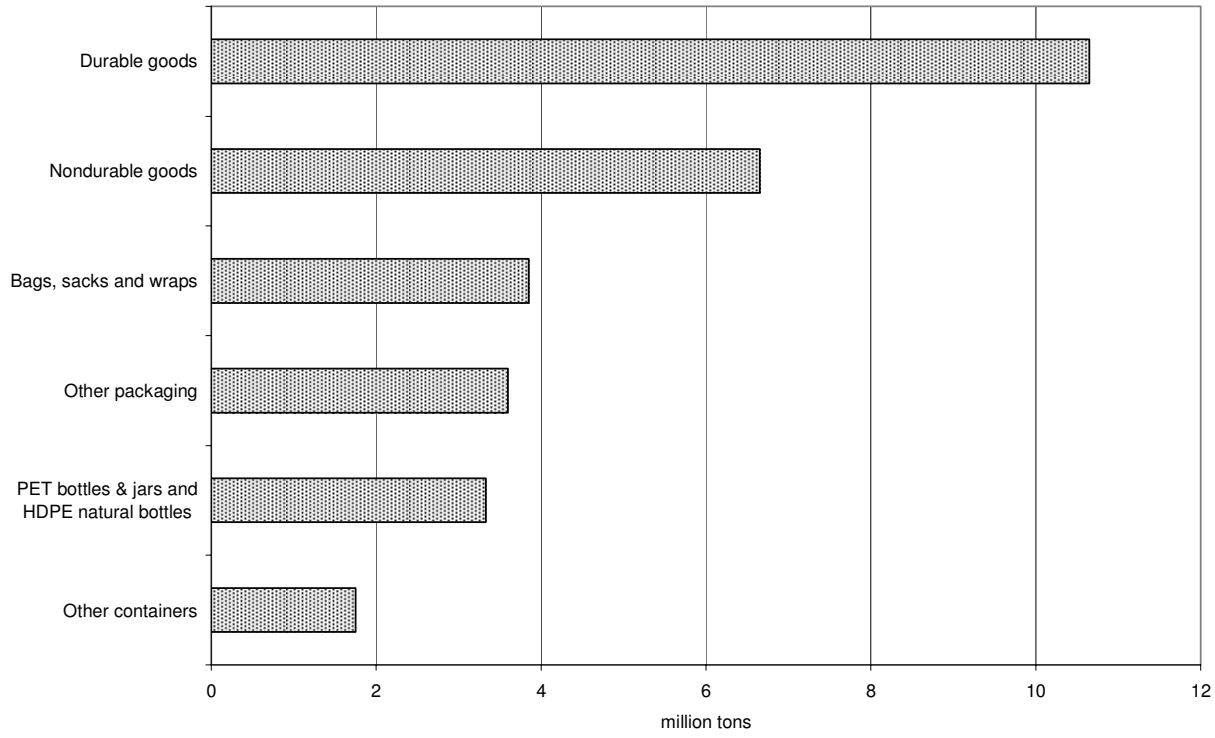
Recovery. Recovery of the other nonferrous metals was 1.3 million tons in 2009, with most of this being lead recovered from batteries. It was estimated about 96 percent of battery lead was recovered in 2009.

Discards After Recovery. In 2009, 590,000 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, PET bottles, jars and HDPE natural bottles, and other containers) has the most plastic tonnage at 12.5 million tons in 2009 (Figure 8 and Table 7).

Figure 8. Plastics products generated in MSW, 2009



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, 2009
(In thousands of tons, and percent of generation by resin)

Product Category	Generation (Thousand tons)	Recovery (Thousand tons)	Recovery (Percent of Gen.)	Discards (Thousand tons)
Durable Goods				
PET	410			
HDPE	1,190			
PVC	360			
LDPE/LLDPE	900			
PP	2,630			
PS	710			
Other resins	4,450			
Total Plastics in Durable Goods	**10,650**	**400**	**3.8%**	**10,250**
Nondurable Goods				
Plastic Plates and Cups				
LDPE/LLDPE	20			20
PP	170			170
PS	710			710
Subtotal Plastic Plates and Cups	900	Neg.		900
Trash Bags				
HDPE	230			230
LDPE/LLDPE	770			770
Subtotal Trash Bags	1,000			1,000
All other nondurables*				
PET	400			400
HDPE	410			410
PVC	330			330
LDPE/LLDPE	1,390			1,390
PP	890			890
PS	580			580
Other resins	750			750
Subtotal All Other Nondurables	4,750			4,750
Total Plastics in Nondurable Goods, by resin				
PET	400			400
HDPE	640			640
PVC	330			330
LDPE/LLDPE	2,180			2,180
PP	1,060			1,060
PS	1,290			1,290
Other resins	750			750
Total Plastics in Nondurable Goods	**6,650**	**Neg.**	**Neg.**	**6,650**
Plastic Containers & Packaging				
Bottles and Jars**				
PET	2,570	720	28.0%	1,850
Natural Bottles†				
HDPE	760	220	28.9%	540

HDPE = High density polyethylene
LDPE = Low density polyethylene
LLDPE = Linear low density polyethylene
PET = Polyethylene terephthalate
PP = Polypropylene
PS = Polystyrene
PVC = Polyvinyl chloride
Neg. = negligible, less than 5,000 tons or 0.05 percent

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

** Injection stretch blow molded PET containers as defined in the 2008 Report on Postconsumer PET Container Recycling Activity Final Report. National Association for PET Container Resources.

† White translucent homopolymer bottles as defined in the 2007 United States National Postconsumer Plastics Bottles Recycling Report. American Chemistry Council and the Association of Postconsumer Plastic Recyclers.

Source: Franklin Associates, A Division of ERG

Table 7 (continued)

PLASTICS IN PRODUCTS IN MSW, 2009
(In thousands of tons, and percent of generation by resin)

Product Category	Generation (Thousand tons)	Recovery (Thousand tons)	Recovery (Percent of Gen.)	Discards (Thousand tons)
Plastic Containers & Packaging, cont.				
Other plastic containers				
HDPE	1,340	270	20.1%	1,070
PVC	30	Neg.		30
LDPE/LLDPE	40	Neg.		40
PP	270	20	7.4%	250
PS	70	Neg.		70
Subtotal Other Containers	**1,750**	**290**	**16.6%**	**1,460**
Bags, sacks, & wraps				
HDPE	660	40	6.1%	620
PVC	60			60
LDPE/LLDPE	2,380	320	13.4%	2,060
PP	640			640
PS	110			110
Subtotal Bags, Sacks, & Wraps	**3,850**	**360**	**9.4%**	**3,490**
Other Plastics Packaging‡				
PET	150	10	6.7%	140
HDPE	620	60	9.7%	560
PVC	340	Neg.		340
LDPE/LLDPE	800	Neg.		800
PP	930	30	3.2%	900
PS	290	20	6.9%	270
Other resins	470	10	2.1%	460
Subtotal Other Packaging	**3,600**	**130**	**3.6%**	**3,470**
Total Plastics in Containers & Packaging, by resin				
PET	2,720	730	26.8%	1,990
HDPE	3,380	590	17.5%	2,790
PVC	430			430
LDPE/LLDPE	3,220	320	9.9%	2,900
PP	1,840	50	2.7%	1,790
PS	470	20	4.3%	450
Other resins	470	10	2.1%	460
Total Plastics in Cont. & Packaging	**12,530**	**1,720**	**13.7%**	**10,810**
Total Plastics in MSW, by resin				
PET	3,530	730	20.7%	2,800
HDPE	5,210	590	11.3%	4,620
PVC	1,120			1,120
LDPE/LLDPE	6,300	320	5.1%	5,980
PP	5,530	50	0.9%	5,480
PS	2,470	20	0.8%	2,450
Other resins	5,670	410	7.2%	5,260
Total Plastics in MSW	**29,830**	**2,120**	**7.1%**	**27,710**

HDPE = High density polyethylene
LDPE = Low density polyethylene
LLDPE = Linear low density polyethylene
PET = Polyethylene terephthalate
PP = Polypropylene
NA = Not Available
PS = Polystyrene
PVC = Polyvinyl chloride

‡ Other plastic packaging includes coatings, closures, lids, caps, clamshells, egg cartons, produce baskets, trays, shapes, loose fill, etc.

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

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) beverage 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.

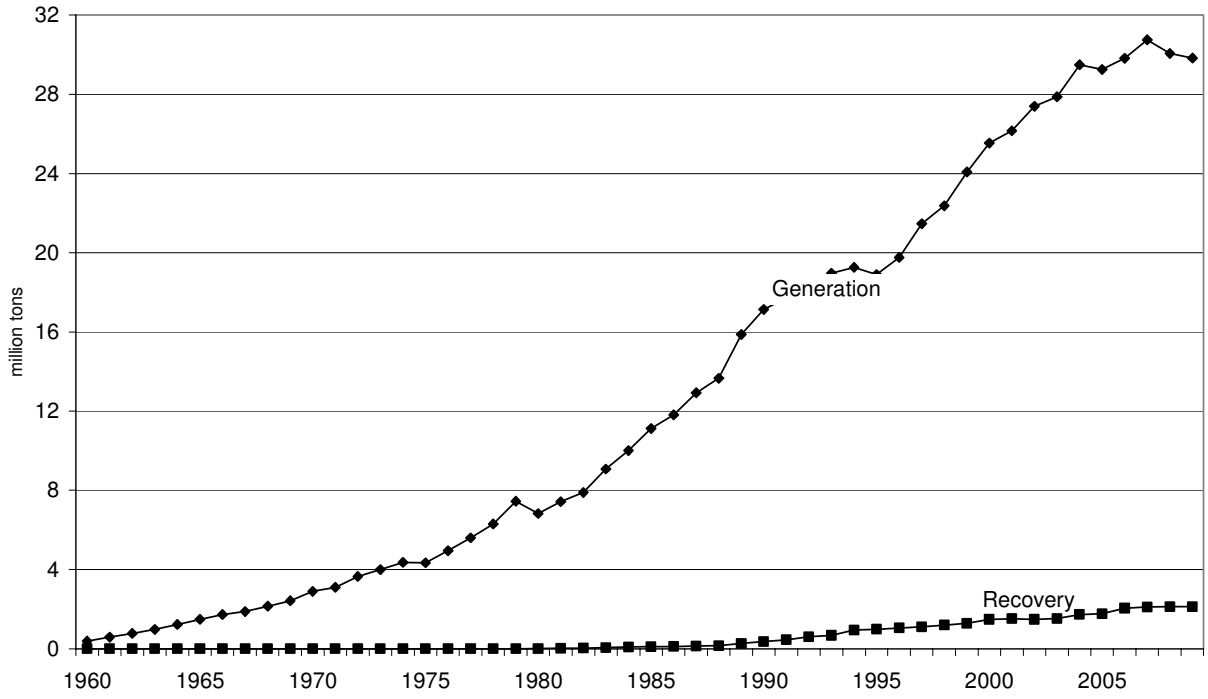
Generation. Production data on plastics resin use in products are taken from the American Chemistry Council's annual resin reports. The basic data are adjusted for product service life, fabrication losses, and net imports of plastic products to derive generation of plastics in the various products in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

Plastics made up an estimated 390,000 tons of MSW generation in 1960. The quantity has increased relatively steadily to 29.8 million tons in 2009 (Figure 9). As a percentage of MSW generation, plastics were less than one percent in 1960, increasing to 12.3 percent in 2009.

Recovery for Recycling. While overall recovery of plastics for recycling is relatively small – 2.1 million tons, or 7.1 percent of plastics generation in 2009 (Table 7) – recovery of some plastic containers is more significant. PET bottles and jars were recovered at a rate of 28.0 percent in 2009. Recovery of high-density polyethylene natural bottles was estimated at 28.9 percent in 2009. Significant recovery of plastics from polypropylene 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 27.7 million tons, or 17.2 percent of total MSW discards in 2009 (Table 3).

Figure 9. Plastics generation and recovery, 1960 to 2009



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 2009. 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 2009. This is 35.2 percent of rubber in tires in 2009 (Table 8). (This recovery estimate does not include tires retreaded or energy recovery from tires.) Overall, 14.3 percent of rubber and leather in MSW was recovered in 2009.

Table 8

RUBBER AND LEATHER PRODUCTS IN MSW, 2009
(In thousands of tons and percent of generation)

	Generation	Recovery		Discards
Product Category	**(Thousand tons)**	**(Thousand tons)**	**(Percent of generation)**	**(Thousand tons)**
Durable Goods				
Rubber in Tires*	3,040	1,070	35.2%	1,970
Other Durables**	3,390	Neg.	Neg.	3,390
Total Rubber & Leather Durable Goods	6,430	1,070	16.6%	5,360
Nondurable Goods				
Clothing and Footwear	790	Neg.	Neg.	790
Other Nondurables	270	Neg.	Neg.	270
Total Rubber & Leather Nondurable Goods	1,060	Neg.	Neg.	1,060
Total Rubber & Leather	7,490	1,070	14.3%	6,420

* 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 2009 (4.0 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 12.7 million tons of textiles were generated in 2009 or 5.2 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 13.8 percent of textiles in clothing and footwear and 17.1 percent of items such as sheets and pillowcases was recovered for export or reprocessing in 2009 (1.4 million tons) (Table 16). The recovery rate for all textiles is 14.9 percent in 2009 (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 15.8 million tons in 2009 (6.5 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 2.2 million tons in 2009.

Accounting for recovery for recycling, wood discards were 13.6 million tons in 2009, or 8.5 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 manufacturing 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 34.3 million tons in 2009 (14.1 percent of total generation) (Table 1). Food scrap generation has increased, from earlier versions of this report, due to increased population and revised commercial sampling study data.

Significant amounts of food products are donated by residents and commercial establishments (such as grocery stores and restaurants) to local food banks and charities. A good portion of these food donations (in particular, the commercial establishment donations of wholesome but not-for-retail food products) represents waste diversion by removing food scraps that would otherwise need to be managed either through composting or disposal. Data on these types of programs are limited. For example, Portland, Oregon reported 14,000 tons of food

products diverted from the commercial sector through donations. 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 560,000 tons food scraps composted in 2009 (an increase of 100,000 tons from 2008). A separate *BioCycle* publication estimated 290,000 tons of MSW composted in 2009 (a decrease of 50,000 tons from 2008). MSW composting includes the composting of food scraps as well as other organic materials found in MSW. The total – 850,000 tons of food scraps and other organic materials composted in 2009 – is shown in the recovery tables.

Yard Trimmings

Yard trimmings[2] include grass, leaves, and tree and brush trimmings from residential, institutional, and commercial sources.

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

[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.

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 23 states-representing about 50 percent of the nation's population have legislation affecting disposal of yard trimmings. In addition, some local and regional jurisdictions regulate 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 since the early 1990's. However, we are unable to estimate the influence of backyard composting and use of mulching mowers on a yearly basis.

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 since 2000 (i.e., increasing as natural population and residential dwelling units increase). An estimated 33.2 million tons of yard trimmings were generated in MSW in 2009.

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 2009. State reported composting tonnages may vary on a yearly basis with the amount of storm debris composted. Analysis of this information resulted in an estimate of 19.9 million tons of yard trimmings removed for composting or wood waste mulching in 2009 – a significant increase over the 2000 estimate of 15.8 million tons.

It should be noted that the estimated 19.9 million tons recovered for composting in 2009 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 2009. No recovery of these products was identified; discards are the same as generation.

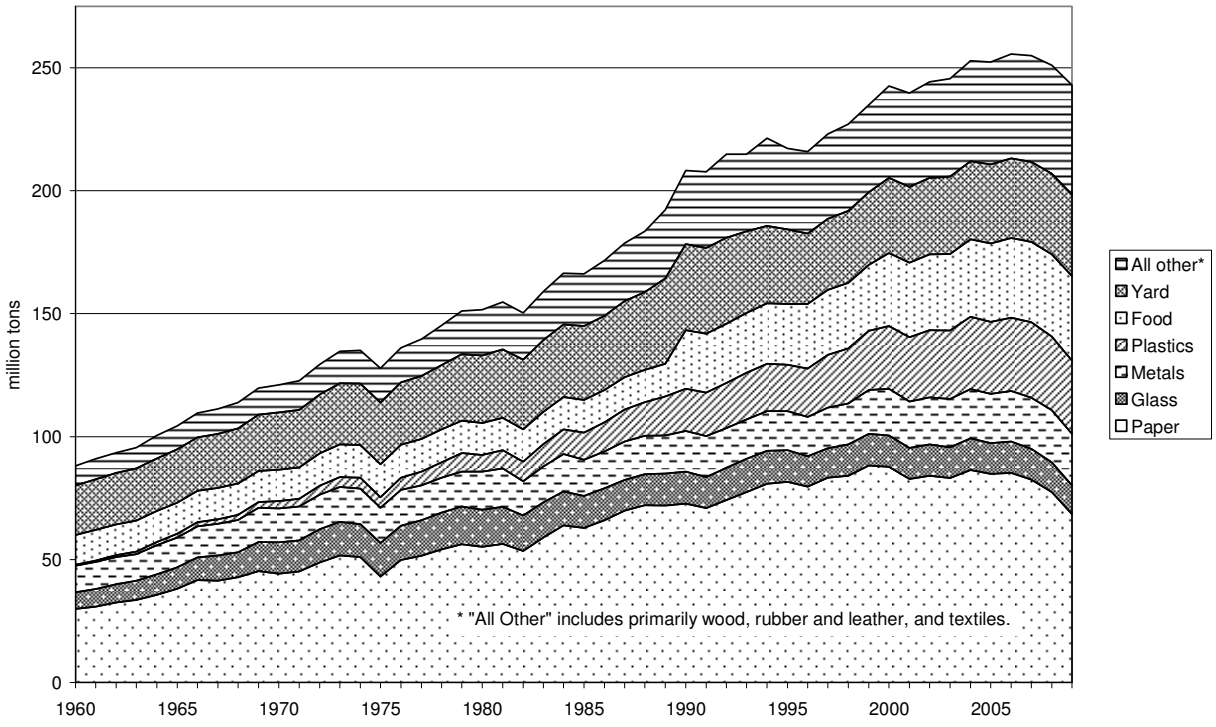
Summary of Materials in Municipal Solid Waste

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 243.0 million tons in 2009.

Over the years paper and paperboard has been the dominant material category generated in MSW, accounting for 68 million tons (28.2 percent of generation) in 2009. Food scraps, the second largest material component of MSW at 34.3 million tons (14.1 percent of MSW generation) have increased in terms of MSW tonnage and percentage of total MSW. Yard trimmings, the third largest material component of MSW at 33.2 million tons (13.7 percent of generation) has declined as a percentage of MSW since 1990 due to state and local legislated landfill disposal restrictions and increased emphasis on backyard composting and other source reduction measures such as the use of mulching mowers.

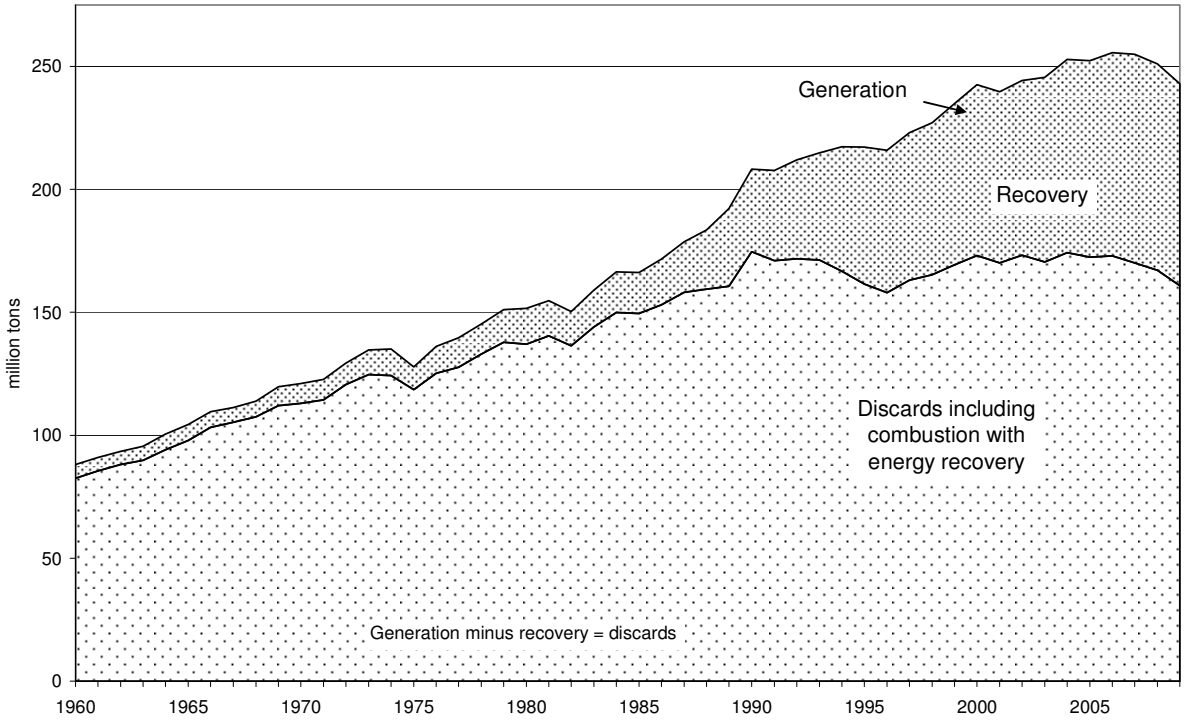
Metals account for 20.9 million tons (8.6 percent of MSW generation) and have remained fairly constant as a source of MSW since 2000. Glass increased until the 1980s; decreasing in tonnage and as a percent of MSW generation since the 1990s. Glass generation was 11.8 million tons in 2009, 4.8 percent of generation. 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 2009 (behind paper, food scraps, and yard trimmings) at 29.8 million tons, and account for 12.3 percent of MSW generation.

Figure 10. Generation of materials in MSW, 1960 to 2009



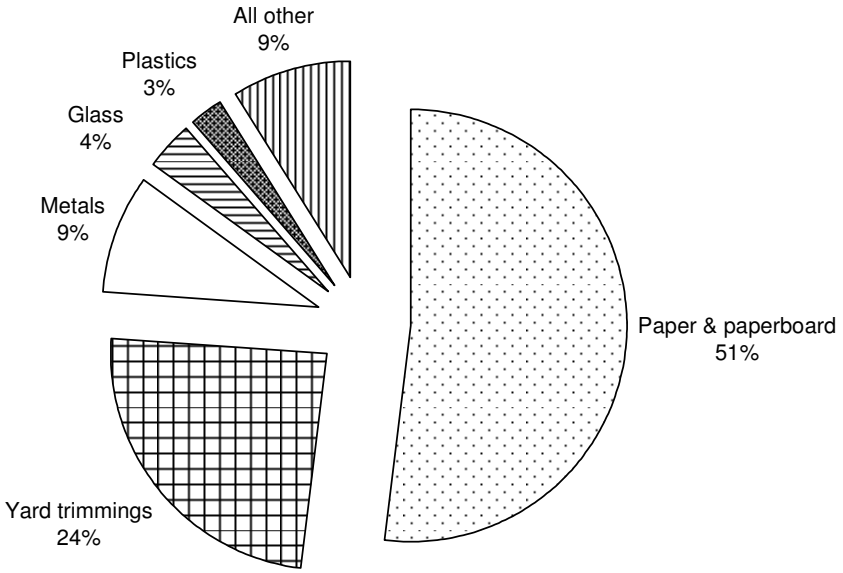
Recovery and Discards. The effect of recovery on MSW discards is illustrated in Figure 11. Recovery of materials for recycling and composting grew at a rather slow pace from 1960 to the 1980s, increasing only from 5.6 million tons (6.4 percent of generation) in 1960 to 14.5 million tons (9.6 percent) 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 16.0 percent of generation (33.2 million tons), increasing to 69.5 million tons (28.6 percent) in 2000, and 82 million tons (33.8 percent of generation) in 2009.

Figure 11. Recovery and discards of materials in MSW, 1960 to 2009



Estimated recovery of materials (including composting) is shown in Figure 12. In 2009, recovery of paper and paperboard dominated materials recovery at 51 percent of total tonnage recovered, while yard trimmings contributed 24 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.

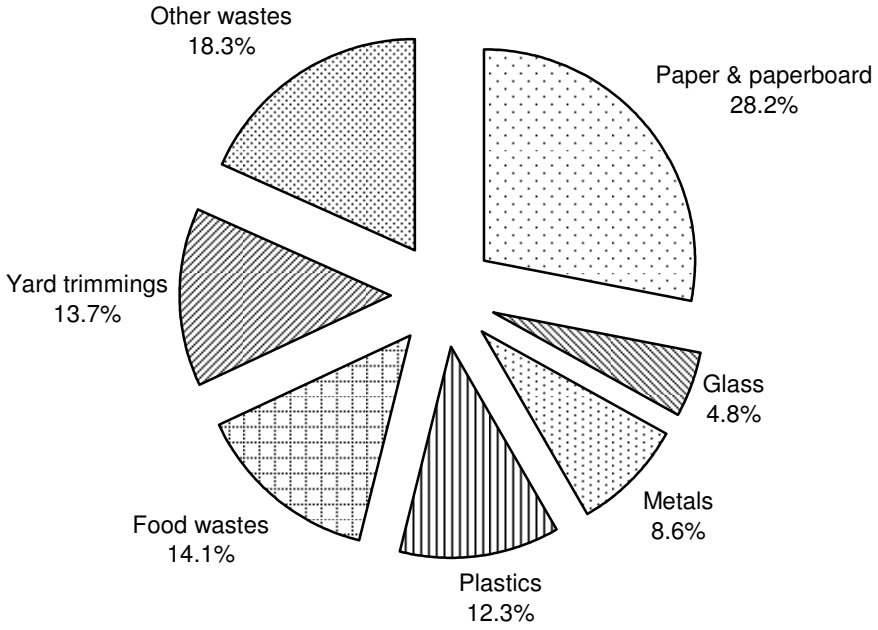
Figure 12. Materials recovery,* 2009



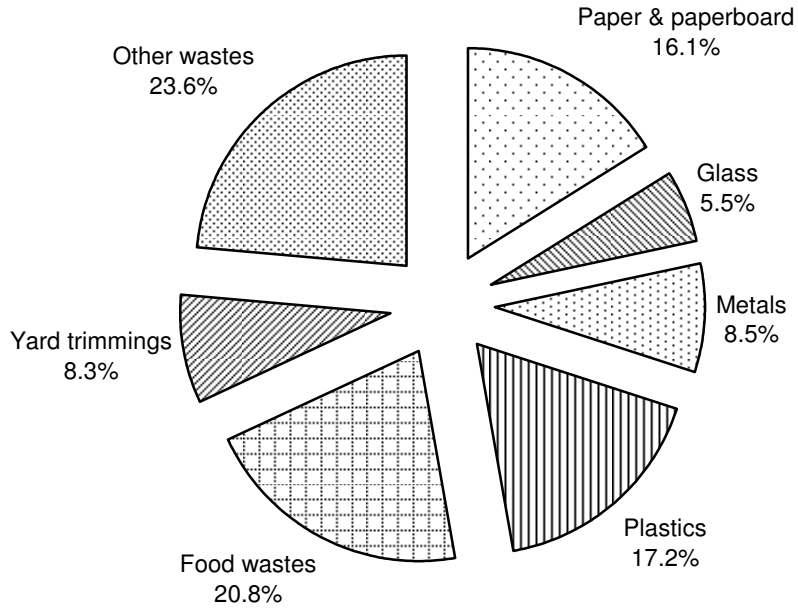
* In percent by weight of total recovery

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 28.2 percent of MSW generated in 2009, but after recovery, paper and paperboard products were 16.1 percent of discards. Materials that have less recovery exhibit a larger percentage of MSW discards compared to generation. For example, plastic products were 12.3 percent of MSW generated in 2009 and, after recovery, were 17.2 percent of discards.

Figure 13. Materials generated and discarded* in municipal solid waste, 2009 (In percent of total generation and discards)



Generation



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 243 million tons of MSW were generated, recycled (including composted) and disposed of. The following section breaks out the same 243 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" – 242.96 million tons in 2009 – with detail provided in different categories – durable goods, nondurable goods, or containers and packaging. For Table 10 and related tables, the "bottom line" is MSW is recovered – 82.02 million tons; and for Table 11 and related tables, the "bottom line" is MSW discarded – 160.94 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 2009, 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 46.6 million tons in 2009 (19.2 percent of total MSW generation). After recovery for recycling, 38.5 million tons of durable goods remained as discards in 2009.

Table 9

CATEGORIES OF PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2009
(In thousands of tons and percent of total generation)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 12)*	9,920	14,660	21,800	29,810	38,850	44,650	45,770	46,400	46,640
Nondurable Goods *(Detail in Table 15)*	17,330	25,060	34,420	52,170	64,010	63,650	61,760	58,690	53,440
Containers and Packaging *(Detail in Table 18)*	27,370	43,560	52,670	64,530	75,840	76,330	78,460	75,910	71,570
***Total Product** Wastes*	54,620	83,280	108,890	146,510	178,700	184,630	185,990	181,000	171,650
Other Wastes									
Food Scraps	12,200	12,800	13,000	23,860	29,810	31,990	32,610	33,340	34,290
Yard Trimmings	20,000	23,200	27,500	35,000	30,530	32,070	32,630	32,900	33,200
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,690	3,750	3,780	3,820
Total Other Wastes	33,500	37,780	42,750	61,760	63,840	67,750	68,990	70,020	71,310
Total MSW Generated - Weight	88,120	121,060	151,640	208,270	242,540	252,380	254,980	251,020	242,960
	Percent of Total Generation								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 12)*	11.3%	12.1%	14.4%	14.3%	16.0%	17.7%	18.0%	18.5%	19.2%
Nondurable Goods *(Detail in Table 15)*	19.7%	20.7%	22.7%	25.0%	26.4%	25.2%	24.2%	23.4%	22.0%
Containers and Packaging *(Detail in Table 19)*	31.1%	36.0%	34.7%	31.0%	31.3%	30.2%	30.8%	30.2%	29.5%
***Total Product** Wastes*	62.0%	68.8%	71.8%	70.3%	73.7%	73.2%	72.9%	72.1%	70.6%
Other Wastes									
Food Scraps	13.8%	10.6%	8.6%	11.5%	12.3%	12.7%	12.8%	13.3%	14.1%
Yard Trimmings	22.7%	19.2%	18.1%	16.8%	12.6%	12.7%	12.8%	13.1%	13.7%
Miscellaneous Inorganic Wastes	1.5%	1.5%	1.5%	1.4%	1.4%	1.5%	1.5%	1.5%	1.6%
Total Other Wastes	38.0%	31.2%	28.2%	29.7%	26.3%	26.8%	27.1%	27.9%	29.4%
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 2009
(In thousands of tons and percent of generation of each category)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods	350	940	1,360	3,460	6,580	8,040	8,220	8,360	8,160
(Detail in Table 13)									
Nondurable Goods	2,390	3,730	4,670	8,800	17,560	19,770	20,970	19,310	18,890
(Detail in Table 16)									
Containers and Packaging	2,870	3,350	8,490	16,780	28,870	31,500	33,900	34,080	34,220
(Detail in Table 20)									
***Total Product** Wastes*	5,610	8,020	14,520	29,040	53,010	59,310	63,090	61,750	61,270
Other Wastes									
Food, Other^	Neg.	Neg.	Neg.	Neg.	680	690	810	800	850
Yard Trimmings	Neg.	Neg.	Neg.	4,200	15,770	19,860	20,900	21,300	19,900
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	20,550	21,710	22,100	20,750
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,460	79,860	84,800	83,850	82,020
	Percent of Generation of Each Category								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods	3.5%	6.4%	6.2%	11.6%	16.9%	18.0%	18.0%	18.0%	17.5%
(Detail in Table 13)									
Nondurable Goods	13.8%	14.9%	13.6%	16.9%	27.4%	31.1%	34.0%	32.9%	35.3%
(Detail in Table 16)									
Containers and Packaging	10.5%	7.7%	16.1%	26.0%	38.1%	41.3%	43.2%	44.9%	47.8%
(Detail in Table 21)									
***Total Product** Wastes*	10.3%	9.6%	13.3%	19.8%	29.7%	32.1%	33.9%	34.1%	35.7%
Other Wastes									
Food, Other^	Neg.	Neg.	Neg.	Neg.	2.3%	2.2%	2.5%	2.4%	2.5%
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	51.7%	61.9%	64.1%	64.7%	59.9%
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	6.8%	25.8%	30.3%	31.5%	31.6%	29.1%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.0%	28.6%	31.6%	33.3%	33.4%	33.8%

* Recovery of postconsumer wastes; does not include converting/fabrication scrap.
** Other than food products.
^ Includes recovery of paper and mixed MSW 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 2009
(In thousands of tons and percent of total discards)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 14)*	9,570	13,720	20,440	26,350	32,270	36,610	37,550	38,040	38,480
Nondurable Goods *(Detail in Table 17)*	14,940	21,330	29,750	43,370	46,450	43,880	40,790	39,380	34,550
Containers and Packaging *(Detail in Table 22)*	24,500	40,210	44,180	47,750	46,970	44,830	44,560	41,830	37,350
***Total Product** Wastes*	49,010	75,260	94,370	117,470	125,690	125,320	122,900	119,250	110,380
Other Wastes									
Food Wastes	12,200	12,800	13,000	23,860	29,130	31,300	31,800	32,540	33,440
Yard Trimmings	20,000	23,200	27,500	30,800	14,760	12,210	11,730	11,600	13,300
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,690	3,750	3,780	3,820
Total Other Wastes	33,500	37,780	42,750	57,560	47,390	47,200	47,280	47,920	50,560
Total MSW Discarded - Weight	82,510	113,040	137,120	175,030	173,080	172,520	170,180	167,170	160,940
	Percent of Total Discards								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 14)*	11.6%	12.1%	14.9%	15.1%	18.6%	21.2%	22.1%	22.8%	23.9%
Nondurable Goods *(Detail in Table 17)*	18.1%	18.9%	21.7%	24.8%	26.8%	25.4%	24.0%	23.6%	21.5%
Containers and Packaging *(Detail in Table 23)*	29.7%	35.6%	32.2%	27.3%	27.1%	26.0%	26.2%	25.0%	23.2%
***Total Product** Wastes*	59.4%	66.6%	68.8%	67.1%	72.6%	72.6%	72.2%	71.3%	68.6%
Other Wastes									
Food Scraps	14.8%	11.3%	9.5%	13.6%	16.8%	18.1%	18.7%	19.5%	20.8%
Yard Trimmings	24.2%	20.5%	20.1%	17.6%	8.5%	7.1%	6.9%	6.9%	8.3%
Miscellaneous Inorganic Wastes	1.6%	1.6%	1.6%	1.7%	2.0%	2.1%	2.2%	2.3%	2.4%
Total Other Wastes	40.6%	33.4%	31.2%	32.9%	27.4%	27.4%	27.8%	28.7%	31.4%
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 25 years.

Generation of major appliances has increased very slowly over the years. In 2009, generation was 3.8 million tons, or 1.5 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 2.5 million tons in 2009, leaving 1.3 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 1.6 million tons of small appliances were generated in 2009. 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 2009
(WITH DETAIL ON DURABLE GOODS)
(In thousands of tons and percent of total generation)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods									
Major Appliances	1,630	2,170	2,950	3,310	3,640	3,610	3,620	3,690	3,760
Small Appliances**				460	1,040	1,180	1,390	1,530	1,630
Furniture and Furnishings	2,150	2,830	4,760	6,790	7,990	8,870	9,340	9,610	9,870
Carpets and Rugs**				1,660	2,570	2,980	3,140	3,220	3,450
Rubber Tires	1,120	1,890	2,720	3,610	4,930	4,960	5,000	5,020	4,730
Batteries, Lead-Acid	Neg.	820	1,490	1,510	2,280	2,740	2,800	2,930	2,800
Miscellaneous Durables									
Selected Consumer Electronics***					1,900	2,630	3,010	3,160	3,190
Other Miscellaneous Durables					14,500	17,680	17,470	17,240	17,210
Total Miscellaneous Durables	5,020	6,950	9,880	12,470	16,400	20,310	20,480	20,400	20,400
Total Durable Goods	9,920	14,660	21,800	29,810	38,850	44,650	45,770	46,400	46,640
Nondurable Goods	17,330	25,060	34,420	52,170	64,010	63,650	61,760	58,690	53,440
(Detail in Table 15)									
Containers and Packaging	27,370	43,560	52,670	64,530	75,840	76,330	78,460	75,910	71,570
(Detail in Table 18)									
Total Product Wastes†	54,620	83,280	108,890	146,510	178,700	184,630	185,990	181,000	171,650
Other Wastes									
Food Scraps	12,200	12,800	13,000	23,860	29,810	31,990	32,610	33,340	34,290
Yard Trimmings	20,000	23,200	27,500	35,000	30,530	32,070	32,630	32,900	33,200
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,690	3,750	3,780	3,820
Total Other Wastes	33,500	37,780	42,750	61,760	63,840	67,750	68,990	70,020	71,310
Total MSW Generated - Weight	88,120	121,060	151,640	208,270	242,540	252,380	254,980	251,020	242,960
	Percent of Total Generation								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods									
Major Appliances	1.8%	1.8%	1.9%	1.6%	1.5%	1.4%	1.4%	1.5%	1.5%
Small Appliances**				0.2%	0.4%	0.5%	0.5%	0.6%	0.7%
Furniture and Furnishings	2.4%	2.3%	3.1%	3.3%	3.3%	3.5%	3.7%	3.8%	4.1%
Carpets and Rugs**				0.8%	1.1%	1.2%	1.2%	1.3%	1.4%
Rubber Tires	1.3%	1.6%	1.8%	1.7%	2.0%	2.0%	2.0%	2.0%	1.9%
Batteries, Lead-Acid	Neg.	0.7%	1.0%	0.7%	0.9%	1.1%	1.1%	1.2%	1.2%
Miscellaneous Durables									
Selected Consumer Electronics***					0.8%	1.0%	1.2%	1.3%	1.3%
Other Miscellaneous Durables					6.0%	7.0%	6.9%	6.9%	7.1%
Total Miscellaneous Durables	5.7%	5.7%	6.5%	6.0%	6.8%	8.0%	8.0%	8.1%	8.4%
Total Durable Goods	11.3%	12.1%	14.4%	14.3%	16.0%	17.7%	18.0%	18.5%	19.2%
Nondurable Goods	19.7%	20.7%	22.7%	25.0%	26.4%	25.2%	24.2%	23.4%	22.0%
(Detail in Table 15)									
Containers and Packaging	31.1%	36.0%	34.7%	31.0%	31.3%	30.2%	30.8%	30.2%	29.5%
(Detail in Table 19)									
Total Product Wastes†	62.0%	68.8%	71.8%	70.3%	73.7%	73.2%	72.9%	72.1%	70.6%
Other Wastes									
Food Scraps	13.8%	10.6%	8.6%	11.5%	12.3%	12.7%	12.8%	13.3%	14.1%
Yard Trimmings	22.7%	19.2%	18.1%	16.8%	12.6%	12.7%	12.8%	13.1%	13.7%
Miscellaneous Inorganic Wastes	1.5%	1.5%	1.5%	1.4%	1.4%	1.5%	1.5%	1.5%	1.6%
Total Other Wastes	38.0%	31.2%	28.2%	29.7%	26.3%	26.8%	27.1%	27.9%	29.4%
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. Preliminary data; may undergo revision.

† 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 2009
(WITH DETAIL ON DURABLE GOODS)
(In thousands of tons and percent of generation of each product)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods									
Major Appliances	10	50	130	1,070	2,000	2,420	2,430	2,470	2,510
Small Appliances**				10	20	20	20	110	110
Furniture and Furnishings	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	10	10
Carpets and Rugs**				Neg.	190	250	280	270	270
Rubber Tires	330	250	150	440	1,290	1,720	1,770	1,780	1,670
Batteries, Lead-Acid	Neg.	620	1,040	1,470	2,130	2,630	2,690	2,810	2,680
Miscellaneous Durables									
Selected Consumer Electronics***					190	360	550	560	600
Other Miscellaneous Durables					760	640	480	350	310
Total Miscellaneous Durables	10	20	40	470	950	1,000	1,030	910	910
Total Durable Goods	350	940	1,360	3,460	6,580	8,040	8,220	8,360	8,160
Nondurable Goods	2,390	3,730	4,670	8,800	17,560	19,770	20,970	19,310	18,890
(Detail in Table 16)									
Containers and Packaging	2,870	3,350	8,490	16,780	28,870	31,500	33,900	34,080	34,220
(Detail in Table 20)									
Total Product Wastes†	5,610	8,020	14,520	29,040	53,010	59,310	63,090	61,750	61,270
Other Wastes									
Food Scraps	Neg.	Neg.	Neg.	Neg.	680	690	810	800	850
Yard Trimmings	Neg.	Neg.	Neg.	4,200	15,770	19,860	20,900	21,300	19,900
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	20,550	21,710	22,100	20,750
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,460	79,860	84,800	83,850	82,020
	Percent of Generation of Each Product								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods									
Major Appliances	0.6%	2.3%	4.4%	32.3%	54.9%	67.0%	67.1%	66.9%	66.8%
Small Appliances**				2.2%	1.9%	1.7%	1.4%	7.2%	6.7%
Furniture and Furnishings	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	0.1%	0.1%
Carpets and Rugs**				Neg.	7.4%	8.4%	8.9%	8.4%	7.8%
Rubber Tires	29.5%	13.2%	5.5%	12.2%	26.2%	34.7%	35.4%	35.5%	35.3%
Batteries, Lead-Acid	Neg.	75.6%	69.8%	97.4%	93.4%	96.0%	96.1%	95.9%	95.7%
Miscellaneous Durables									
Selected Consumer Electronics***					10.0%	13.7%	18.3%	17.7%	18.8%
Other Miscellaneous Durables					5.2%	3.6%	2.7%	2.0%	1.8%
Total Miscellaneous Durables	0.2%	0.3%	0.4%	3.8%	5.8%	4.9%	5.0%	4.5%	4.5%
Total Durable Goods	3.5%	6.4%	6.2%	11.6%	16.9%	18.0%	18.0%	18.0%	17.5%
Nondurable Goods	13.8%	14.9%	13.6%	16.9%	27.4%	31.1%	34.0%	32.9%	35.3%
(Detail in Table 16)									
Containers and Packaging	10.5%	7.7%	16.1%	26.0%	38.1%	41.3%	43.2%	44.9%	47.8%
(Detail in Table 21)									
Total Product Wastes†	10.3%	9.6%	13.3%	19.8%	29.7%	32.1%	33.9%	34.1%	35.7%
Other Wastes									
Food Scraps	Neg.	Neg.	Neg.	Neg.	2.3%	2.2%	2.5%	2.4%	2.5%
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	51.7%	61.9%	64.1%	64.7%	59.9%
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	6.8%	25.8%	30.3%	31.5%	31.6%	29.1%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.0%	28.6%	31.6%	33.3%	33.4%	33.8%

* 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 2009
(WITH DETAIL ON DURABLE GOODS)
(In thousands of tons and percent of total discards)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods									
Major Appliances	1,620	2,120	2,820	2,240	1,640	1,190	1,190	1,220	1,250
Small Appliances**				450	1,020	1,160	1,370	1,420	1,520
Furniture and Furnishings	2,150	2,830	4,760	6,790	7,990	8,870	9,340	9,600	9,860
Carpets and Rugs**				1,660	2,380	2,730	2,860	2,950	3,180
Rubber Tires	790	1,640	2,570	3,170	3,640	3,240	3,230	3,240	3,060
Batteries, Lead-Acid	Neg.	200	450	40	150	110	110	120	120
Miscellaneous Durables									
Selected Consumer Electronics***					1,710	2,270	2,460	2,600	2,590
Other Miscellaneous Durables					13,740	17,040	16,990	16,890	16,900
Total Miscellaneous Durables	5,010	6,930	9,840	12,000	15,450	19,310	19,450	19,490	19,490
Total Durable Goods	9,570	13,720	20,440	26,350	32,270	36,610	37,550	38,040	38,480
Nondurable Goods	14,940	21,330	29,750	43,370	46,450	43,880	40,790	39,380	34,550
(Detail in Table 17)									
Containers and Packaging	24,500	40,210	44,180	47,750	46,970	44,830	44,560	41,830	37,350
(Detail in Table 22)									
Total Product Wastes†	49,010	75,260	94,370	117,470	125,690	125,320	122,900	119,250	110,380
Other Wastes									
Food Scraps	12,200	12,800	13,000	23,860	29,130	31,300	31,800	32,540	33,440
Yard Trimmings	20,000	23,200	27,500	30,800	14,760	12,210	11,730	11,600	13,300
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,690	3,750	3,780	3,820
Total Other Wastes	33,500	37,780	42,750	57,560	47,390	47,200	47,280	47,920	50,560
Total MSW Discarded - Weight	82,510	113,040	137,120	175,030	173,080	172,520	170,180	167,170	160,940
	Percent of Total Discards								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods									
Major Appliances	2.0%	1.9%	2.1%	1.3%	0.9%	0.7%	0.7%	0.7%	0.8%
Small Appliances**				0.3%	0.6%	0.7%	0.8%	0.8%	0.9%
Furniture and Furnishings	2.6%	2.5%	3.5%	3.9%	4.6%	5.1%	5.5%	5.7%	6.1%
Carpets and Rugs**				0.9%	1.4%	1.6%	1.7%	1.8%	2.0%
Rubber Tires	1.0%	1.5%	1.9%	1.8%	2.1%	1.9%	1.9%	1.9%	1.9%
Batteries, Lead-Acid	Neg.	0.2%	0.3%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%
Miscellaneous Durables									
Selected Consumer Electronics***					1.0%	1.3%	1.4%	1.6%	1.6%
Other Miscellaneous Durables					7.9%	9.9%	10.0%	10.1%	10.5%
Total Miscellaneous Durables	6.1%	6.1%	7.2%	6.9%	8.9%	11.2%	11.4%	11.7%	12.1%
Total Durable Goods	11.6%	12.1%	14.9%	15.1%	18.6%	21.2%	22.1%	22.8%	23.9%
Nondurable Goods	18.1%	18.9%	21.7%	24.8%	26.8%	25.4%	24.0%	23.6%	21.5%
(Detail in Table 17)									
Containers and Packaging	29.7%	35.6%	32.2%	27.3%	27.1%	26.0%	26.2%	25.0%	23.2%
(Detail in Table 23)									
Total Product Wastes†	59.4%	66.6%	68.8%	67.1%	72.6%	72.6%	72.2%	71.3%	68.6%
Other Wastes									
Food Scraps	14.8%	11.3%	9.5%	13.6%	16.8%	18.1%	18.7%	19.5%	20.8%
Yard Trimmings	24.2%	20.5%	20.1%	17.6%	8.5%	7.1%	6.9%	6.9%	8.3%
Miscellaneous Inorganic Wastes	1.6%	1.6%	1.6%	1.7%	2.0%	2.1%	2.2%	2.3%	2.4%
Total Other Wastes	40.6%	33.4%	31.2%	32.9%	27.4%	27.4%	27.8%	28.7%	31.4%
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 represents products at the end-of-life (after primary use and reuse by secondary owners). Generation of furniture and furnishings in MSW has increased from 2.2 million tons in 1960 to 9.9 million tons in 2009 (4.1 percent of total MSW). The only recovery of materials from furniture identified was mattress recovery. According to an industry representative, mattress recovery is estimated at 10,000 tons. 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 3.5 million tons of carpets and rugs were generated in MSW in 2009, which was 1.4 percent of total generation.

Recovery of carpet fiber, backing, and padding – estimated from industry data – was 270,000 tons in 2009 (7.8 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 4.7 million tons in 2009 (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 35.3 percent in 2009. From 2005 to 2008, the quantity of tires generated and recovered through recycling remained relatively steady. In 2009, the quantity of tires generated and recovered through recycling decreased; however, the recycling rate remained about the same as 2008. After recovery, 3.1 million tons of tires were discarded in 2009. (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 2.8 million tons of lead-acid batteries from automobiles, trucks, and motorcycles were generated in MSW in 2009 (1.2 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 96 percent; recovery has increased since 1980 as a growing number of communities have restricted batteries from disposal at landfills or combustion facilities. In 2009, 95.7 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 120,000 tons in 2009. (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 20.4 million tons of these goods were generated in 2009, amounting to 8.4 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 2009, an estimated 3.2 million tons of these goods were generated. Of this, approximately 600,000 tons of selected consumer electronics were collected for recycling. Selected consumer electronics include products such as TVs, VCRs, DVD players, video cameras, stereo systems, telephones, and computer equipment. EPA has analyzed television, computer products, and cell phone management separately in the 2010 report *Electronics Waste Management in the United States Through 2009*.

The miscellaneous durable goods category, as a whole, includes ferrous metals as well as plastics, glass, rubber, wood, and other metals. An estimated 310,000 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 2009, bringing total recovery from this category to 910,000 tons. Discards of miscellaneous durable goods were 19.5 million tons in 2009.

Nondurable Goods

The Department of Commerce defines nondurable goods as those products 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 53.4 million tons in 2009 (22.0 percent of total generation). Recovery of paper products in this category is quite significant, resulting in 18.9 million tons of nondurable goods recovered in 2009 (35.3 percent of nondurables generation). This means that 34.5 million tons of nondurable goods were discarded in 2009 (21.5 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 2009 was shown earlier in Table 4. Generation of paper and paperboard nondurable products declined from 47.8 million tons in 2000 to 33.5 million tons in 2009. Each of the paper and paperboard product categories in nondurable goods is discussed briefly below.

- Newspapers are the largest single component of the paper products in the nondurable goods category, at 7.8 million tons generated in 2009 (3.2 percent of total MSW). In 2009, an estimated 6.8 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 groundwood[3] 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 960,000 tons, or 0.4 percent of total MSW generation, in 2009. Recovery of books is not well documented, but it was estimated that approximately 320,000 tons of books were recovered in 2009. Books are made of both groundwood and chemical pulp.

[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.

- Magazines accounted for an estimated 1.5 million tons, or 0.6 percent of total MSW generation, in 2009. Like books, recovery of magazines is not well documented. It was estimated that 780,000 tons of magazines were recovered in 2009. 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 5.4 million tons, or 2.2 percent of total MSW generation in 2009. 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 4.0 million tons of office-type papers were recovered in 2009.

- Directories were estimated to generate 650,000 tons (0.3 percent of total MSW) in 2009. These directories are made of groundwood. It was estimated that 240,000 tons of directories were recovered in 2009.

- Standard mail includes catalogs and other direct bulk mailings; these amounted to an estimated 4.7 million tons, or 1.9 percent of MSW generation, in 2009. Both groundwood and chemical pulps are used in these mailings. It was estimated that 3.0 million tons were recovered in 2009. 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 3.5 million tons, or 1.4 percent of MSW generation, in 2009, with recovery estimated at 2.3 million tons.

- Tissue paper and towels generation includes facial and sanitary tissues and table napkins, but not bathroom tissue, which is nearly all diverted from MSW into the wastewater treatment system. Other examples include decorative and laminated tissue papers and crepe papers. Tissue products are used in homes, restaurants, other commercial establishments, and institutions such as hospitals. Tissue paper and towels (not including bathroom tissue) amounted to 3.5 million tons (1.4 percent of total MSW generation) in 2009. 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 1.2 million tons (0.4 percent of total MSW generation) in 2009. No significant recovery for recycling of these products was identified, although there is some composting of these items.

- Other nonpackaging papers–including posters, photographic papers, cards, and games – accounted for 4.4 million tons (1.8 percent of total MSW generation) in 2009. No significant recovery for recycling of these papers was identified.

Overall, generation of paper and paperboard products in nondurable goods was 33.5 million tons in 2009 (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 52.1 percent in 2009. Thus 16.1 million tons of paper in nondurables were discarded in 2009.

Table 15

PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2009
(WITH DETAIL ON NONDURABLE GOODS)
(In thousands of tons and percent of total generation)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 12)*	9,920	14,660	21,800	29,810	38,850	44,650	45,770	46,400	46,640
Nondurable Goods									
Newspapers	7,110	9,510	11,050	13,430	14,790	12,790	10,780	8,800	7,760
Books and Magazines	1,920	2,470	3,390						
Books**				970	1,240	1,100	1,270	1,340	960
Magazines**				2,830	2,230	2,580	2,550	2,050	1,450
Office-Type Papers	1,520	2,650	4,000	6,410	7,420	6,620	6,060	6,050	5,380
Directories**				610	680	660	760	840	650
Standard Mail***				3,820	5,570	5,830	5,910	5,510	4,650
Other Commercial Printing	1,260	2,130	3,120	4,460	7,380	6,440	6,200	5,130	3,490
Tissue Paper and Towels	1,090	2,080	2,300	2,960	3,220	3,460	3,500	3,460	3,490
Paper Plates and Cups	270	420	630	650	960	1,160	1,230	1,250	1,170
Plastic Plates and Cups†			190	650	870	930	860	780	900
Trash Bags**				780	850	1,060	1,070	930	1,000
Disposable Diapers	Neg.	350	1,930	2,700	3,230	3,410	3,730	3,770	3,810
Other Nonpackaging Paper	2,700	3,630	4,230	3,840	4,250	4,490	4,260	4,630	4,420
Clothing and Footwear	1,360	1,620	2,170	4,010	6,470	7,890	8,320	8,820	9,080
Towels, Sheets and Pillowcases**				710	820	980	1,100	1,160	1,230
Other Miscellaneous Nondurables	100	200	1,410	3,340	4,030	4,250	4,160	4,170	4,000
Total Nondurable Goods	17,330	25,060	34,420	52,170	64,010	63,650	61,760	58,690	53,440
Containers and Packaging *(Detail in Table 18)*	27,370	43,560	52,670	64,530	75,840	76,330	78,460	75,910	71,570
Total Product Wastes‡	54,620	83,280	108,890	146,510	178,700	184,630	185,990	181,000	171,650
Other Wastes	33,500	37,780	42,750	61,760	63,840	67,750	68,990	70,020	71,310
Total MSW Generated - Weight	88,120	121,060	151,640	208,270	242,540	252,380	254,980	251,020	242,960
	Percent of Total Generation								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 12)*	11.3%	12.1%	14.4%	14.3%	16.0%	17.7%	18.0%	18.5%	19.2%
Nondurable Goods									
Newspapers	8.1%	7.9%	7.3%	6.4%	6.1%	5.1%	4.2%	3.5%	3.2%
Books and Magazines	2.2%	2.0%	2.2%						
Books**				0.5%	0.5%	0.4%	0.5%	0.5%	0.4%
Magazines**				1.4%	0.9%	1.0%	1.0%	0.8%	0.6%
Office-Type Papers***	1.7%	2.2%	2.6%	3.1%	3.1%	2.6%	2.4%	2.4%	2.2%
Directories**				0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Standard Mail§				1.8%	2.3%	2.3%	2.3%	2.2%	1.9%
Other Commercial Printing	1.4%	1.8%	2.1%	2.1%	3.0%	2.6%	2.4%	2.0%	1.4%
Tissue Paper and Towels	1.2%	1.7%	1.5%	1.4%	1.3%	1.4%	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 Cups†			0.1%	0.3%	0.4%	0.4%	0.3%	0.3%	0.4%
Trash Bags**				0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Disposable Diapers	Neg.	0.3%	1.3%	1.3%	1.3%	1.4%	1.5%	1.5%	1.6%
Other Nonpackaging Paper	3.1%	3.0%	2.8%	1.8%	1.8%	1.8%	1.7%	1.8%	1.8%
Clothing and Footwear	1.5%	1.3%	1.4%	1.9%	2.7%	3.1%	3.3%	3.5%	3.7%
Towels, Sheets and Pillowcases**				0.3%	0.3%	0.4%	0.4%	0.5%	0.5%
Other Miscellaneous Nondurables	0.1%	0.2%	0.9%	1.6%	1.7%	1.7%	1.6%	1.7%	1.6%
Total Nondurables	19.7%	20.7%	22.7%	25.0%	26.4%	25.2%	24.2%	23.4%	22.0%
Containers and Packaging *(Detail in Table 19)*	31.1%	36.0%	34.7%	31.0%	31.3%	30.2%	30.8%	30.2%	29.5%
Total Product Wastes‡	62.0%	68.8%	71.8%	70.3%	73.7%	73.2%	72.9%	72.1%	70.6%
Other Wastes	38.0%	31.2%	28.2%	29.7%	26.3%	26.8%	27.1%	27.9%	29.4%
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 2009
(WITH DETAIL ON NONDURABLE GOODS)
(In thousands of tons and percent of generation of each product)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 13)*	350	940	1,360	3,460	6,580	8,040	8,220	8,360	8,160
Nondurable Goods									
Newspapers	1,820	2,250	3,020	5,110	8,720	9,360	8,550	7,740	6,840
Books and Magazines	100	260	280						
Books**				100	240	270	360	390	320
Magazines**				300	710	960	1,010	820	780
Office-Type Papers	250	710	870	1,700	4,090	4,110	4,300	4,290	3,990
Directories**				50	120	120	140	180	240
Standard Mail***				200	1,830	2,090	2,380	2,240	2,950
Other Commercial Printing	130	340	350	700	810	1,440	2,790	2,200	2,310
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	170	190	200	210
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	19,770	20,970	19,310	18,890
Containers and Packaging *(Detail in Table 20)*	2,870	3,350	8,490	16,780	28,870	31,500	33,900	34,080	34,220
Total Product Wastes‡	5,610	8,020	14,520	29,040	53,010	59,310	63,090	61,750	61,270
Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	20,550	21,710	22,100	20,750
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,460	79,860	84,800	83,850	82,020
	Percent of Generation of Each Product								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 13)*	3.5%	6.4%	6.2%	11.6%	16.9%	18.0%	18.0%	18.0%	17.5%
Nondurable Goods									
Newspapers	25.6%	23.7%	27.3%	38.0%	59.0%	73.2%	79.3%	88.0%	88.1%
Books and Magazines	5.2%	10.5%	8.3%						
Books**				10.3%	19.4%	24.5%	28.3%	29.1%	33.3%
Magazines**				10.6%	31.8%	37.2%	39.6%	40.0%	53.8%
Office-Type Papers***	16.4%	26.8%	21.8%	26.5%	55.1%	62.1%	71.0%	70.9%	74.2%
Directories**				8.2%	17.6%	18.2%	18.4%	21.4%	36.9%
Standard Mail§				5.2%	32.9%	35.8%	40.3%	40.7%	63.4%
Other Commercial Printing	10.3%	16.0%	11.2%	15.7%	11.0%	22.4%	45.0%	42.9%	66.2%
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%	15.8%	15.0%	14.2%	13.8%
Towels, Sheets and Pillowcases**				16.9%	17.1%	17.3%	17.3%	17.2%	17.1%
Other Miscellaneous Nondurables	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Nondurables	13.8%	14.9%	13.6%	16.9%	27.4%	31.1%	34.0%	32.9%	35.3%
Containers and Packaging *(Detail in Table 21)*	10.5%	7.7%	16.1%	26.0%	38.1%	41.3%	43.2%	44.9%	47.8%
Total Product Wastes‡	10.3%	9.6%	13.3%	19.8%	29.7%	32.1%	33.9%	34.1%	35.7%
Other Wastes	Neg.	Neg.	Neg.	6.8%	25.8%	30.3%	31.5%	31.6%	29.1%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.0%	28.6%	31.6%	33.3%	33.4%	33.8%

* 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 2009
(WITH DETAIL ON NONDURABLE GOODS)
(In thousands of tons and percent of total discards)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 14)*	9,570	13,720	20,440	26,350	32,270	36,610	37,550	38,040	38,480
Nondurable Goods									
Newspapers	5,290	7,260	8,030	8,320	6,070	3,430	2,230	1,060	920
Books and Magazines	1,820	2,210	3,110						
Books**				870	1,000	830	910	950	640
Magazines**				2,530	1,520	1,620	1,540	1,230	670
Office-Type Papers	1,270	1,940	3,130	4,710	3,330	2,510	1,760	1,760	1,390
Directories**				560	560	540	620	660	410
Standard Mail***				3,620	3,740	3,740	3,530	3,270	1,700
Other Commercial Printing	1,130	1,790	2,770	3,760	6,570	5,000	3,410	2,930	1,180
Tissue Paper and Towels	1,090	2,080	2,300	2,960	3,220	3,460	3,500	3,460	3,490
Paper Plates and Cups	270	420	630	650	960	1,160	1,230	1,250	1,170
Plastic Plates and Cups†			190	650	870	930	860	780	900
Trash Bags**				780	850	1,060	1,070	930	1,000
Disposable Diapers	Neg.	350	1,930	2,700	3,230	3,410	3,730	3,770	3,810
Other Nonpackaging Paper	2,660	3,520	4,230	3,840	4,250	4,490	4,260	4,630	4,420
Clothing and Footwear	1,310	1,560	2,020	3,490	5,570	6,640	7,070	7,570	7,830
Towels, Sheets and Pillowcases**				590	680	810	910	960	1,020
Other Miscellaneous Nondurables	100	200	1,410	3,340	4,030	4,250	4,160	4,170	4,000
Total Nondurable Goods	14,940	21,330	29,750	43,370	46,450	43,880	40,790	39,380	34,550
Containers and Packaging *(Detail in Table 22)*	24,500	40,210	44,180	47,750	46,970	44,830	44,560	41,830	37,350
Total Product Wastes‡	49,010	75,260	94,370	117,470	125,690	125,320	122,900	119,250	110,380
Other Wastes	33,500	37,780	42,750	57,560	47,390	47,200	47,280	47,920	50,560
Total MSW Discarded - Weight	82,510	113,040	137,120	175,030	173,080	172,520	170,180	167,170	160,940
	Percent of Total Discards								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 14)*	11.6%	12.1%	14.9%	15.1%	18.6%	21.2%	22.1%	22.8%	23.9%
Nondurable Goods									
Newspapers	6.4%	6.4%	5.9%	4.8%	3.5%	2.0%	1.3%	0.6%	0.6%
Books and Magazines	2.2%	2.0%	2.3%						
Books**				0.5%	0.6%	0.5%	0.5%	0.6%	0.4%
Magazines**				1.4%	0.9%	0.9%	0.9%	0.7%	0.4%
Office-Type Papers***	1.5%	1.7%	2.3%	2.7%	1.9%	1.5%	1.0%	1.1%	0.9%
Directories**				0.3%	0.3%	0.3%	0.4%	0.4%	0.3%
Standard Mail§				2.1%	2.2%	2.2%	2.1%	2.0%	1.1%
Other Commercial Printing	1.4%	1.6%	2.0%	2.1%	3.8%	2.9%	2.0%	1.8%	0.7%
Tissue Paper and Towels	1.3%	1.8%	1.7%	1.7%	1.9%	2.0%	2.1%	2.1%	2.2%
Paper Plates and Cups	0.3%	0.4%	0.5%	0.4%	0.6%	0.7%	0.7%	0.7%	0.7%
Plastic Plates and Cups†			0.1%	0.4%	0.5%	0.5%	0.5%	0.5%	0.6%
Trash Bags**				0.4%	0.5%	0.6%	0.6%	0.6%	0.6%
Disposable Diapers	Neg.	0.3%	1.4%	1.5%	1.9%	2.0%	2.2%	2.3%	2.4%
Other Nonpackaging Paper	3.2%	3.1%	3.1%	2.2%	2.5%	2.6%	2.5%	2.8%	2.7%
Clothing and Footwear	1.6%	1.4%	1.5%	2.0%	3.2%	3.8%	4.2%	4.5%	4.9%
Towels, Sheets and Pillowcases**				0.3%	0.4%	0.5%	0.5%	0.6%	0.6%
Other Miscellaneous Nondurables	0.1%	0.2%	1.7%	1.9%	2.3%	2.5%	2.4%	2.5%	2.5%
Total Nondurables	18.1%	18.9%	21.7%	24.8%	26.8%	25.4%	24.0%	23.6%	21.5%
Containers and Packaging *(Detail in Table 23)*	29.7%	35.6%	32.2%	27.3%	27.1%	26.0%	26.2%	25.0%	23.2%
Total Product Wastes‡	59.4%	66.6%	68.8%	67.1%	72.6%	72.6%	72.2%	71.3%	68.6%
Other Wastes	40.6%	33.4%	31.2%	32.9%	27.4%	27.4%	27.8%	28.7%	31.4%
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

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 900,000 tons of these products were generated in 2009, or 0.4 percent of total MSW (Table 15). No significant recovery for recycling was identified in 2009.

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 1.0 million tons in 2009 (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 3.8 million tons of disposable diapers were generated in 2009, or 1.6 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 2009.

Clothing and Footwear. Generation of clothing and footwear was estimated to be 9.1 million tons in 2009 (3.7 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 2009. (Reuse occurs before generation and is not included in the generation or recycling estimates.)

Towels, Sheets, and Pillowcases. An estimated 1.2 million tons of towels, sheets, and pillowcases were generated in 2009. Generation was estimated using a methodology similar to that for clothing. An estimated 210,000 tons of these textiles were recovered for export or recycling in 2009.

Other Miscellaneous Nondurables. Generation of other miscellaneous nondurables was estimated to be 4.0 million tons in 2009 (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 71.6 million tons of generation in 2009 (29.5 percent of total generation). Generation in this category has recently trended downward; Table 18 shows a 3.3 percent decrease between 2007 and 2008 followed by a 5.7 percent decrease between 2008 and 2009 (to 71.6 million tons). Generation of all packaging materials decreased (with the exception of wood) over this time period, with a greater rate of reduced generation between 2008 and 2009.

Steel packaging exhibited the greatest percentage decline; a 4.5 percent decrease between 2007 and 2008 and a 14.5 percent decrease between 2008 and 2009. Aluminum packaging generation declined only 2.1 percent over the two year period 2007 to 2009.

Paper and paperboard packaging generation declined 4.1 percent between 2007 and 2008 and 8.7 percent between 2008 and 2009 (12.5 percent over the two year period). Plastic packaging and glass packaging generation exhibited a slower rate of decline; plastic packaging generation decreased 4.5 percent from 2007 and 2008 and 3.7 percent between 2008 and 2009 (8.1 percent decline over the two year period), and glass packaging generation declined 3.5 percent between 2007 and 2008 and 3.9 percent between 2008 and 2009 (7.2 percent between 2007 and 2009). 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 2009, 47.8 percent of containers and packaging generated was recovered for recycling. Because of this recovery, containers and packaging comprised 23.2 percent of total MSW discards in 2009.

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, flavored drinks containing not more than 10 percent fruit juice and ready-to-drink alcoholic coolers and cocktails), wine and liquor bottles, and bottles and jars for food, cosmetics, and other products. Prior to 2009, generation of glass containers was estimated using Department of Commerce data. In 2009, the Glass Packaging Institute provided production 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 9.7 million tons in 2009, or 4.0 percent of MSW generation (Tables 18 and 19). This tonnage is lower than was generated in any of the previous years.

An estimated 3.0 million tons of glass containers were recovered for recycling, or 31.1 percent of generation, in 2009. Glass container discards were 6.7 million tons in 2009, or 4.1 percent of total MSW discards.

Steel Containers and Packaging. Steel food and other cans, and other steel packaging (e.g., strapping, crowns, and steel barrels and drums), totaled 2.3 million tons in 2009 (0.9 percent of total MSW generation), with most of that amount being cans for food products (Tables 18 and 19). Generation estimates are based on data supplied by the Steel Recycling Institute (SRI), the Reusable Industrial Packaging Association, and the Can Manufacturers Institute (CMI). Estimates include adjustments for net imports.

The Steel Recycling Institute (SRI) provided recovery data for steel containers and packaging. An estimated 1.5 million tons of steel packaging were recovered in 2009, or 66.2 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 (including semi rigid foil containers, caps, closures, and flexible packaging). 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 based on Aluminum Association 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 2009 was 1.8 million tons, or 0.8 percent of total MSW generation.

Aluminum can recovery data are provided by the Aluminum Association; the industry association 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 2009 was 690,000 tons, or 50.7 percent of generation. Recovery data for the other aluminum packaging categories are not available for 2009. After recovery for recycling, 1.2 million tons of aluminum packaging were discarded in 2009.

Table 18

PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2009
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In thousands of tons)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods	9,920	14,660	21,800	29,810	38,850	44,650	45,770	46,400	46,640
(Detail in Table 12)									
Nondurable Goods	17,330	25,060	34,420	52,170	64,010	63,650	61,760	58,690	53,440
(Detail in Table 15)									
Containers and Packaging									
Glass Packaging									
Beer and Soft Drink Bottles**	1,400	5,580	6,740	5,640	5,710	6,540	6,760	6,350	6,000
Wine and Liquor Bottles	1,080	1,900	2,450	2,030	1,910	1,630	1,620	1,610	1,710
Other Bottles & Jars	3,710	4,440	4,780	4,160	3,420	2,290	2,030	2,090	1,950
Total Glass Packaging	6,190	11,920	13,970	11,830	11,040	10,460	10,410	10,050	9,660
Steel Packaging									
Beer and Soft Drink Cans	640	1,570	520	150	Neg.	Neg.	Neg.	Neg.	Neg.
Cans	3,760	3,540	2,850	2,540	2,630	2,130	2,430	2,310	1,940
Other Steel Packaging	260	270	240	200	240	240	240	240	340
Total Steel Packaging	4,660	5,380	3,610	2,890	2,870	2,370	2,670	2,550	2,280
Aluminum Packaging									
Beer and Soft Drink Cans	Neg.	100	850	1,550	1,520	1,450	1,420	1,390	1,360
Other Cans	Neg.	60	40	20	50	80	30	70	70
Foil and Closures	170	410	380	330	380	400	430	420	410
Total Aluminum Packaging	170	570	1,270	1,900	1,950	1,930	1,880	1,880	1,840
Paper & Paperboard Pkg									
Corrugated Boxes	7,330	12,760	17,080	24,010	30,210	30,930	31,230	29,710	27,190
Gable Top/Aseptic Cartons‡			790	510	550	500	500	490	460
Folding Cartons			3,820	4,300	5,820	5,530	5,530	5,340	4,980
Other Paperboard Packaging	3,840	4,830	230	290	200	160	150	120	90
Bags and Sacks			3,380	2,440	1,490	1,120	1,140	1,170	910
Wrapping Papers			200	110	Neg.	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	2,940	3,810	850	1,020	1,670	1,400	1,390	1,460	1,310
Total Paper & Board Pkg	14,110	21,400	26,350	32,680	39,940	39,640	39,940	38,290	34,940
Plastics Packaging									
PET Bottles and Jars			260	430	1,720	2,540	2,840	2,680	2,570
HDPE Natural Bottles			230	530	690	800	820	750	760
Other Containers	60	910	890	1,430	1,740	1,420	1,910	1,900	1,750
Bags and Sacks			390	940	1,650	1,640	1,010	940	660
Wraps			840	1,530	2,550	2,810	3,180	3,020	3,190
Subtotal Bags, Sacks, and Wraps			1,230	2,470	4,200	4,450	4,190	3,960	3,850
Other Plastics Packaging	60	1,180	790	2,040	2,840	3,210	3,870	3,720	3,600
Total Plastics Packaging	120	2,090	3,400	6,900	11,190	12,420	13,630	13,010	12,530
Wood Packaging	2,000	2,070	3,940	8,180	8,610	9,230	9,610	9,820	10,040
Other Misc. Packaging	120	130	130	150	240	280	320	310	280
Total Containers & Pkg	27,370	43,560	52,670	64,530	75,840	76,330	78,460	75,910	71,570
Total Product Wastes†	54,620	83,280	108,890	146,510	178,700	184,630	185,990	181,000	171,650
Other Wastes									
Food Scraps	12,200	12,800	13,000	23,860	29,810	31,990	32,610	33,340	34,290
Yard Trimmings	20,000	23,200	27,500	35,000	30,530	32,070	32,630	32,900	33,200
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,690	3,750	3,780	3,820
Total Other Wastes	33,500	37,780	42,750	61,760	63,840	67,750	68,990	70,020	71,310
Total MSW Generated - Weight	88,120	121,060	151,640	208,270	242,540	252,380	254,980	251,020	242,960

* Generation before materials recovery or combustion.

** Includes carbonated drinks and non-carbonated water, teas, flavored drinks, and ready-to-drink alcoholic coolers and cocktails.

† Other than food products.

‡ Includes milk, juice, and other products packaged in gable top cartons and liquid food aseptic cartons.

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 19

PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2009
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of total generation)

	Percent of Total Generation								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods	11.3%	12.1%	14.4%	14.3%	16.0%	17.7%	18.0%	18.0%	19.2%
(Detail in Table 12)									
Nondurable Goods	19.7%	20.7%	22.7%	25.0%	26.4%	25.2%	24.2%	24.2%	22.0%
(Detail in Table 15)									
Containers and Packaging									
Glass Packaging									
Beer and Soft Drink Bottles**	1.6%	4.6%	4.4%	2.7%	2.4%	2.6%	2.7%	2.7%	2.5%
Wine and Liquor Bottles	1.2%	1.6%	1.6%	1.0%	0.8%	0.6%	0.6%	0.6%	0.7%
Other Bottles & Jars	4.2%	3.7%	3.2%	2.0%	1.4%	0.9%	0.8%	0.8%	0.8%
Total Glass Packaging	7.0%	9.8%	9.2%	5.7%	4.6%	4.1%	4.1%	4.1%	4.0%
Steel Packaging									
Beer and Soft Drink Cans	0.7%	1.3%	0.3%	0.1%	Neg.	Neg.	Neg.	Neg.	Neg.
Cans	4.3%	2.9%	1.9%	1.2%	1.1%	0.8%	1.0%	1.0%	0.8%
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%	0.9%	1.0%	1.0%	0.9%
Aluminum Packaging									
Beer and Soft Drink Cans	Neg.	0.1%	0.6%	0.7%	0.6%	0.6%	0.6%	0.6%	0.6%
Other Cans	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	0.01%	0.01%	0.03%
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%	0.7%	0.7%	0.8%
Paper & Paperboard Pkg									
Corrugated Boxes	8.3%	10.5%	11.3%	11.5%	12.5%	12.3%	12.2%	12.2%	11.2%
Gable Top/Aseptic 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%	2.2%	2.0%
Other Paperboard Packaging	4.4%	4.0%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%
Bags and Sacks			2.2%	1.2%	0.6%	0.4%	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%	0.5%	0.5%	0.5%
Total Paper & Board Pkg	16.0%	17.7%	17.4%	15.7%	16.5%	15.7%	15.7%	15.7%	14.4%
Plastics Packaging									
PET Bottles and Jars			0.2%	0.2%	0.7%	1.0%	1.1%	1.1%	1.1%
HDPE Natural 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%	0.7%	0.6%	0.7%	0.7%	0.7%
Bags and Sacks			0.3%	0.5%	0.7%	0.6%	0.4%	0.4%	0.3%
Wraps			0.6%	0.7%	1.1%	1.1%	1.2%	1.2%	1.3%
Subtotal Bags, Sacks, and Wraps			0.8%	1.2%	1.7%	1.8%	1.6%	1.6%	1.6%
Other Plastics Packaging	0.1%	1.0%	0.5%	1.0%	1.2%	1.3%	1.5%	1.5%	1.5%
Total Plastics Packaging	0.1%	1.7%	2.2%	3.3%	4.6%	4.9%	5.3%	5.3%	5.2%
Wood Packaging	2.3%	1.7%	2.6%	3.9%	3.5%	3.7%	3.8%	3.8%	4.1%
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%	31.0%	31.3%	30.2%	30.8%	30.8%	29.5%
Total Product Wastes†	62.0%	68.8%	71.8%	70.3%	73.7%	73.2%	72.9%	72.9%	70.6%
Other Wastes									
Food Scraps	13.8%	10.6%	8.6%	11.5%	12.3%	12.7%	12.8%	12.8%	14.1%
Yard Trimmings	22.7%	19.2%	18.1%	16.8%	12.6%	12.7%	12.8%	12.8%	13.7%
Miscellaneous Inorganic Wastes	1.5%	1.5%	1.5%	1.4%	1.4%	1.5%	1.5%	1.5%	1.6%
Total Other Wastes	38.0%	31.2%	28.2%	29.7%	26.3%	26.8%	27.1%	27.1%	29.4%
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.

** Includes carbonated drinks and non-carbonated water, teas, flavored drinks, and ready-to-drink alcoholic coolers and cocktails.

† Other than food products.

‡ Includes milk, juice, and other products packaged in gable top cartons and liquid food aseptic cartons.

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 20

RECOVERY* OF PRODUCTS IN MUNICIPAL SOLID WASTE, 1960 TO 2009
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In thousands of tons)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods	350	940	1,360	3,460	6,580	8,040	8,220	8,360	8,160
(Detail in Table 13)									
Nondurable Goods	2,390	3,730	4,670	8,800	17,560	19,770	20,970	19,310	18,890
(Detail in Table 16)									
Containers and Packaging									
Glass Packaging									
Beer and Soft Drink Bottles**	90	140	730	1,890	1,530	2,000	2,340	2,260	2,340
Wine and Liquor Bottles	10	10	20	210	430	250	240	240	310
Other Bottles & Jars	Neg.	Neg.	Neg.	520	920	340	300	310	350
Total Glass Packaging	100	150	750	2,620	2,880	2,590	2,880	2,810	3,000
Steel Packaging									
Beer and Soft Drink Cans	10	20	50	40	Neg.	Neg.	Neg.	Neg.	Neg.
Cans	20	60	150	590	1,530	1,340	1,570	1,450	1,280
Other Steel Packaging	Neg.	Neg.	Neg.	60	160	160	160	160	230
Total Steel Packaging	30	80	200	690	1,690	1,500	1,730	1,610	1,510
Aluminum Packaging									
Beer and Soft Drink Cans	Neg.	10	320	990	830	650	690	670	690
Other Cans	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	10	NA
Foil and Closures	Neg.	Neg.	Neg.	20	30	40	40	40	NA
Total Aluminum Pkg	Neg.	10	320	1,010	860	690	730	720	690
Paper & Paperboard Pkg									
Corrugated Boxes	2,520	2,760	6,390	11,530	20,330	22,100	22,980	22,760	22,100
Gable Top/Aseptic Cartons‡			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	30
Folding Cartons			520	340	410	1,190	1,550	1,880	2,490
Other Paperboard Packaging			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Bags and Sacks			Neg.	200	300	320	420	440	450
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	23,610	24,950	25,080	25,070
Plastics Packaging									
PET Bottles and Jars			10	140	380	590	700	730	720
HDPE Natural Bottles			Neg.	20	210	230	230	220	220
Other Containers	Neg.	Neg.	Neg.	20	170	140	190	280	290
Bags and Sacks									
Wraps									
Subtotal Bags, Sacks, and Wraps			Neg.	60	180	230	380	370	360
Other Plastics Packaging	Neg.	Neg.	Neg.	20	90	90	90	130	130
Total Plastics Packaging	Neg.	Neg.	10	260	1,030	1,280	1,590	1,730	1,720
Wood Packaging	Neg.	Neg.	Neg.	130	1,370	1,830	2,020	2,130	2,230
Other Misc. Packaging	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Containers & Pkg	2,870	3,350	8,490	16,780	28,870	31,500	33,900	34,080	34,220
Total Product Wastes†	5,610	8,020	14,520	29,040	53,010	59,310	63,090	61,750	61,270
Other Wastes									
Food Scraps	Neg.	Neg.	Neg.	Neg.	680	690	810	800	850
Yard Trimmings	Neg.	Neg.	Neg.	4,200	15,770	19,860	20,900	21,300	19,900
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	4,200	16,450	20,550	21,710	22,100	20,750
Total MSW Recovered - Weight	5,610	8,020	14,520	33,240	69,460	79,860	84,800	83,850	82,020

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

** Includes carbonated drinks and non-carbonated water, teas, flavored drinks, and ready-to-drink alcoholic coolers and cocktails.

† Other than food products.

‡ Includes milk, juice, and other products packaged in gable top cartons and liquid food aseptic cartons.

Details may not add to totals due to rounding.

Neg. = Less than 5,000 tons or 0.05 percent. NA = Not Available

Source: Franklin Associates, A Division of ERG

Table 21

RECOVERY* OF PRODUCTS IN MUNICIPAL SOLID WASTE, 1960 TO 2009
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of generation of each product)

	Percent of Generation of Each Product								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 13)*	3.5%	6.4%	6.2%	11.6%	16.9%	18.0%	18.0%	18.0%	17.5%
Nondurable Goods *(Detail in Table 16)*	13.8%	14.9%	13.6%	16.9%	27.4%	31.1%	34.0%	32.9%	35.3%
Containers and Packaging									
Glass Packaging									
Beer and Soft Drink Bottles**	6.4%	2.5%	10.8%	33.5%	26.8%	30.6%	34.6%	35.6%	39.0%
Wine and Liquor Bottles	Neg.	Neg.	Neg.	10.3%	22.5%	15.3%	14.8%	14.9%	18.1%
Other Bottles & Jars	Neg.	Neg.	Neg.	12.5%	26.9%	14.8%	14.8%	14.8%	17.9%
Total Glass Packaging	1.6%	1.3%	5.4%	22.1%	26.1%	24.8%	27.7%	28.0%	31.1%
Steel Packaging									
Beer and Soft Drink Cans	1.6%	1.3%	9.6%	26.7%	Neg.	Neg.	Neg.	Neg.	Neg.
Cans	Neg.	1.7%	5.3%	23.2%	58.2%	62.9%	64.6%	62.8%	66.0%
Other Steel Packaging	Neg.	Neg.	Neg.	30.0%	66.7%	66.7%	66.7%	66.7%	67.6%
Total Steel Packaging	Neg.	1.5%	5.5%	23.9%	58.9%	63.3%	64.8%	63.1%	66.2%
Aluminum Packaging									
Beer and Soft Drink Cans	Neg.	10.0%	37.6%	63.9%	54.6%	44.8%	48.6%	48.2%	50.7%
Other Cans	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	14.3%	NA
Foil and Closures	Neg.	Neg.	Neg.	6.1%	7.9%	10.0%	9.3%	9.5%	NA
Total Aluminum Pkg	Neg.	1.8%	25.2%	53.2%	44.1%	35.8%	38.8%	38.3%	37.5%
Paper & Paperboard Pkg									
Corrugated Boxes	34.4%	21.6%	37.4%	48.0%	67.3%	71.5%	73.6%	76.6%	81.3%
Gable Top/Aseptic Cartons‡			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	6.5%
Folding Cartons			Neg.	Neg.	7.0%	21.5%	28.0%	35.2%	50.0%
Other Paperboard Packaging			Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Bags and Sacks			Neg.	Neg.	20.1%	28.6%	36.8%	37.6%	49.5%
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%	59.6%	62.5%	65.5%	71.8%
Plastics Packaging									
PET Bottles and Jars			3.8%	32.6%	22.1%	23.2%	24.6%	27.2%	28.0%
HDPE Natural Bottles			Neg.	3.8%	30.4%	28.8%	28.0%	29.3%	28.9%
Other Containers	Neg.	Neg.	Neg.	1.4%	9.8%	9.9%	9.9%	14.7%	16.6%
Bags and Sacks									
Wraps									
Subtotal Bags, Sacks, and Wraps			Neg.	2.4%	4.3%	5.2%	9.1%	9.3%	9.4%
Other Plastics Packaging	Neg.	Neg.	Neg.	1.0%	3.2%	2.8%	2.3%	3.5%	3.6%
Total Plastics Packaging	Neg.	Neg.	Neg.	3.8%	9.2%	10.3%	11.7%	13.3%	13.7%
Wood Packaging	Neg.	Neg.	Neg.	1.6%	15.9%	19.8%	21.0%	21.7%	22.2%
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%	41.3%	43.2%	44.9%	47.8%
Total Product Wastes†	10.3%	9.6%	13.3%	19.8%	29.7%	32.1%	33.9%	34.1%	35.7%
Other Wastes									
Food Scraps	Neg.	Neg.	Neg.	Neg.	2.3%	2.2%	2.5%	2.4%	2.5%
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	51.7%	61.9%	64.1%	64.7%	59.9%
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	6.8%	25.8%	30.3%	31.5%	31.6%	29.1%
Total MSW Recovered - %	6.4%	6.6%	9.6%	16.0%	28.6%	31.6%	33.3%	33.4%	33.8%

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

** Includes carbonated drinks and non-carbonated water, teas, flavored drinks, and ready-to-drink alcoholic coolers and cocktails.

† Other than food products.

‡ Includes milk, juice, and other products packaged in gable top cartons and liquid food aseptic cartons.

Details may not add to totals due to rounding.

Neg. = Less than 5,000 tons or 0.05 percent. NA = Not Available

Source: Franklin Associates, A Division of ERG

Table 22

PRODUCTS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2009
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In thousands of tons)

	Thousands of Tons								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods *(Detail in Table 14)*	9,570	13,720	20,440	26,350	32,270	36,610	37,550	38,040	38,480
Nondurable Goods *(Detail in Table 17)*	14,940	21,330	29,750	43,370	46,450	43,880	40,790	39,380	34,550
Containers and Packaging									
Glass Packaging									
Beer and Soft Drink Bottles**	1,310	5,440	6,010	3,750	4,180	4,540	4,420	4,090	3,660
Wine and Liquor Bottles	1,070	1,890	2,430	1,820	1,480	1,380	1,380	1,370	1,400
Other Bottles & Jars	3,710	4,440	4,780	3,640	2,500	1,950	1,730	1,780	1,600
Total Glass Packaging	6,090	11,770	13,220	9,210	8,160	7,870	7,530	7,240	6,660
Steel Packaging									
Beer and Soft Drink Cans	630	1,550	470	110	Neg.	Neg.	Neg.	Neg.	Neg.
Cans	3,740	3,480	2,700	1,950	1,100	790	860	860	660
Other Steel Packaging	260	270	240	140	80	80	80	80	110
Total Steel Packaging	4,630	5,300	3,410	2,200	1,180	870	940	940	770
Aluminum Packaging									
Beer and Soft Drink Cans	Neg.	90	530	560	690	800	730	720	670
Other Cans	Neg.	60	40	20	50	80	30	60	70
Foil and Closures	170	410	380	310	350	360	390	380	410
Total Aluminum Pkg	170	560	950	890	1,090	1,240	1,150	1,160	1,150
Paper & Paperboard Pkg									
Corrugated Boxes	4,810	10,000	10,690	12,480	9,880	8,830	8,250	6,950	5,090
Gable Top/Aseptic Cartons‡			790	510	550	500	500	490	430
Folding Cartons			3,300	3,960	5,410	4,340	3,980	3,460	2,490
Other Paperboard Packaging	3,840	4,830	230	290	200	160	150	120	90
Bags and Sacks			3,380	2,240	1,190	800	720	730	460
Wrapping Papers			200	110	Neg.	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	2,720	3,460	550	1,020	1,670	1,400	1,390	1,460	1,310
Total Paper & Board Pkg	11,370	18,290	19,140	20,610	18,900	16,030	14,990	13,210	9,870
Plastics Packaging									
PET Bottles and Jars			250	290	1,340	1,950	2,140	1,950	1,850
HDPE Natural Bottles			230	510	480	570	590	530	540
Other Containers	60	910	890	1,410	1,570	1,280	1,720	1,620	1,460
Bags and Sacks									
Wraps									
Subtotal Bags, Sacks, and Wraps			1,230	2,410	4,020	4,220	3,810	3,590	3,490
Other Plastics Packaging	60	1,180	790	2,020	2,750	3,120	3,780	3,590	3,470
Total Plastics Packaging	120	2,090	3,390	6,640	10,160	11,140	12,040	11,280	10,810
Wood Packaging	2,000	2,070	3,940	8,050	7,240	7,400	7,590	7,690	7,810
Other Misc. Packaging	120	130	130	150	240	280	320	310	280
Total Containers & Pkg	24,500	40,210	44,180	47,750	46,970	44,830	44,560	41,830	37,350
Total Product Wastes†	49,010	75,260	94,370	117,470	125,690	125,320	122,900	119,250	110,380
Other Wastes									
Food Scraps	12,200	12,800	13,000	23,860	29,130	31,300	31,800	32,540	33,440
Yard Trimmings	20,000	23,200	27,500	30,800	14,760	12,210	11,730	11,600	13,300
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	3,500	3,690	3,750	3,780	3,820
Total Other Wastes	33,500	37,780	42,750	57,560	47,390	47,200	47,280	47,920	50,560
Total MSW Discarded - Weight	82,510	113,040	137,120	175,030	173,080	172,520	170,180	167,170	160,940

* 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 carbonated drinks and non-carbonated water, teas, flavored drinks, and ready-to-drink alcoholic coolers and cocktails.
† Other than food products.
‡ Includes milk, juice, and other products packaged in gable top cartons and liquid food aseptic cartons.
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 2009
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of total discards)

	Percent of Total Discards								
Products	**1960**	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Durable Goods	11.6%	12.1%	14.9%	15.1%	18.6%	21.2%	22.1%	22.8%	23.9%
(Detail in Table 14)									
Nondurable Goods	18.1%	18.9%	21.7%	24.8%	26.8%	25.4%	24.0%	23.6%	21.5%
(Detail in Table 17)									
Containers and Packaging									
Glass Packaging									
Beer and Soft Drink Bottles**	1.6%	4.8%	4.4%	2.1%	2.4%	2.6%	2.6%	2.4%	2.3%
Wine and Liquor Bottles	1.3%	1.7%	1.8%	1.0%	0.9%	0.8%	0.8%	0.8%	0.9%
Other Bottles & Jars	4.5%	3.9%	3.5%	2.1%	1.4%	1.1%	1.0%	1.1%	1.0%
Total Glass Packaging	7.4%	10.4%	9.6%	5.3%	4.7%	4.6%	4.4%	4.3%	4.1%
Steel Packaging									
Beer and Soft Drink Cans	0.8%	1.4%	0.3%	0.1%	Neg.	Neg.	Neg.	Neg.	Neg.
Cans	4.5%	3.1%	2.0%	1.1%	0.6%	0.5%	0.5%	0.5%	0.4%
Other Steel Packaging	0.3%	0.2%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%
Total Steel Packaging	5.6%	4.7%	2.5%	1.3%	0.7%	0.5%	0.6%	0.6%	0.5%
Aluminum Packaging									
Beer and Soft Drink Cans	Neg.	0.1%	0.4%	0.3%	0.4%	0.5%	0.4%	0.4%	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%	0.3%
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%	7.1%	5.7%	5.1%	4.8%	4.2%	3.2%
Gable Top/Aseptic Cartons‡			0.6%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Folding Cartons			2.4%	2.3%	3.1%	2.5%	2.3%	2.1%	1.5%
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%	0.5%	0.4%	0.4%	0.3%
Wrapping Papers			0.1%	0.1%	Neg.	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	3.3%	3.1%	0.4%	0.6%	1.0%	0.8%	0.8%	0.9%	0.8%
Total Paper & Board Pkg	13.8%	16.2%	14.0%	11.8%	10.9%	9.3%	8.8%	7.9%	6.1%
Plastics Packaging									
PET Bottles and Jars			0.2%	0.2%	0.8%	1.1%	1.3%	1.2%	1.1%
HDPE Natural 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%	0.9%	0.7%	1.0%	1.0%	0.9%
Bags and Sacks									
Wraps									
Subtotal Bags, Sacks, and Wraps			0.9%	1.4%	2.3%	2.4%	2.2%	2.1%	2.2%
Other Plastics Packaging	0.1%	1.0%	0.6%	1.2%	1.6%	1.8%	2.2%	2.1%	2.2%
Total Plastics Packaging	0.1%	1.8%	2.5%	3.8%	5.9%	6.5%	7.1%	6.7%	6.7%
Wood Packaging	2.4%	1.8%	2.9%	4.6%	4.2%	4.3%	4.5%	4.6%	4.9%
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%	27.3%	27.1%	26.0%	26.2%	25.0%	23.2%
Total Product Wastes†	59.4%	66.6%	68.8%	67.1%	72.6%	72.6%	72.2%	71.3%	68.6%
Other Wastes									
Food Scraps	14.8%	11.3%	9.5%	13.6%	16.8%	18.1%	18.7%	19.5%	20.8%
Yard Trimmings	24.2%	20.5%	20.1%	17.6%	8.5%	7.1%	6.9%	6.9%	8.3%
Miscellaneous Inorganic Wastes	1.6%	1.6%	1.6%	1.7%	2.0%	2.1%	2.2%	2.3%	2.4%
Total Other Wastes	40.6%	33.4%	31.2%	32.9%	27.4%	27.4%	27.8%	28.7%	31.4%
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 carbonated drinks and non-carbonated water, teas, flavored drinks, and ready-to-drink alcoholic coolers and cocktails.
† Other than food products.
‡ Includes milk, juice, and other products packaged in gable top cartons and liquid food aseptic cartons.
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 27.2 million tons generated, or 11.2 percent of total generation, in 2009. Corrugated boxes also represent the largest single category of product recovery; at 22.1 million tons of recovery in 2009, 81.3 percent of boxes generated were recovered. After recovery, 5.1 million tons of corrugated boxes were discarded, or 3.2 percent of MSW discards in 2009.

Other paper and paperboard packaging in MSW includes gable top and aseptic cartons (includes milk, juice, and other products packaged in gable top cartons and liquid food aseptic cartons), folding cartons (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, cosmetic, and candy boxes). Overall, paper and paperboard containers and packaging totaled 34.9 million tons of MSW generation in 2009, or 14.4 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 about 3.0 million tons in 2009). The overall recovery rate for paper and paperboard packaging in 2009 was 71.8 percent. Other paper packaging such as cartons 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 clamshells, trays, caps, lids, egg cartons, loose fill, produce baskets, 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 12.5 million tons in 2009 (5.2 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. PET bottles and jars were estimated to have been recovered at a 28.0 percent rate in 2009 (720,000 tons). Recovery of HDPE natural bottles (e.g., milk and water bottles) was estimated to have been 220,000 tons, or 28.9 percent of generation. Overall, recovery of plastic containers and packaging was estimated to be 1.7 million tons, or 13.7 percent in 2009. Discards of plastic packaging thus were 10.8 million tons in 2009, or 6.7 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 2009, 10.0 million tons of wood pallets and other wood packaging were estimated to have been generated, or 4.1 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 2.2 million tons in 2009.

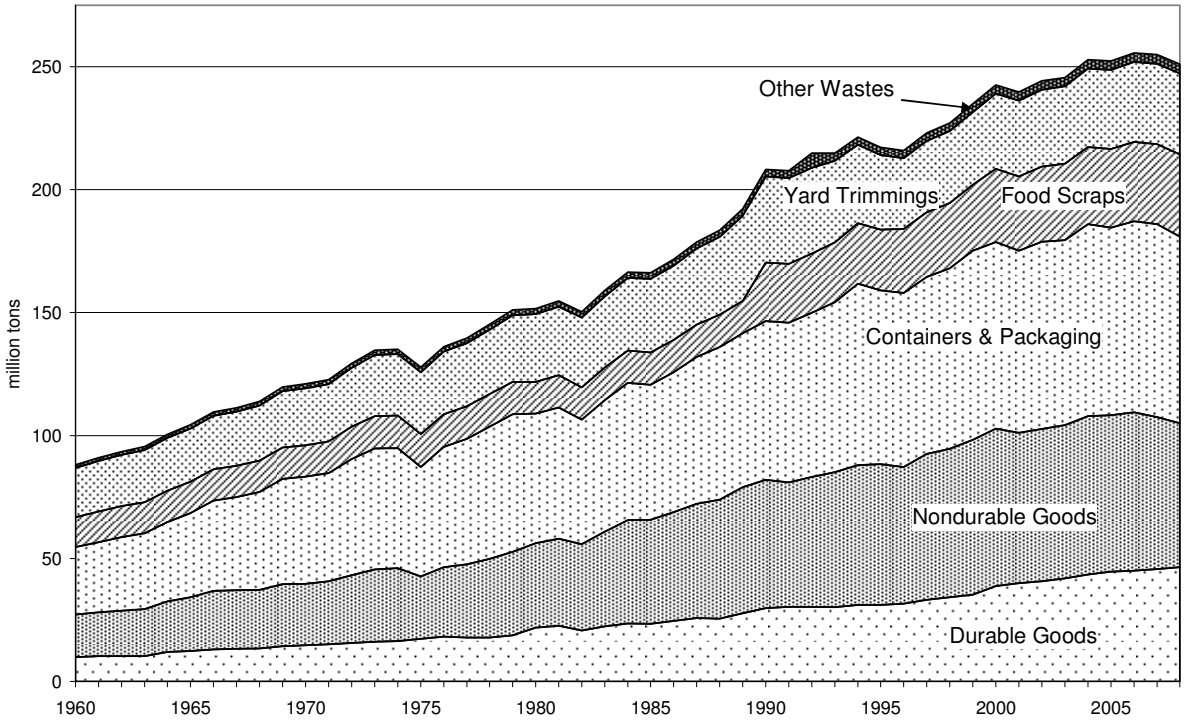
Accounting for pallet reuse and recovery for recycling, wood packaging discards were 7.8 million tons in 2009, or 4.9 percent of total MSW discards.

Other Packaging. Estimates are included for some other miscellaneous packaging such as bags made of textiles, small amounts of leather, and the like. These latter quantities are not well documented; it was estimated that 280,000 tons were generated in 2009.

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 2009

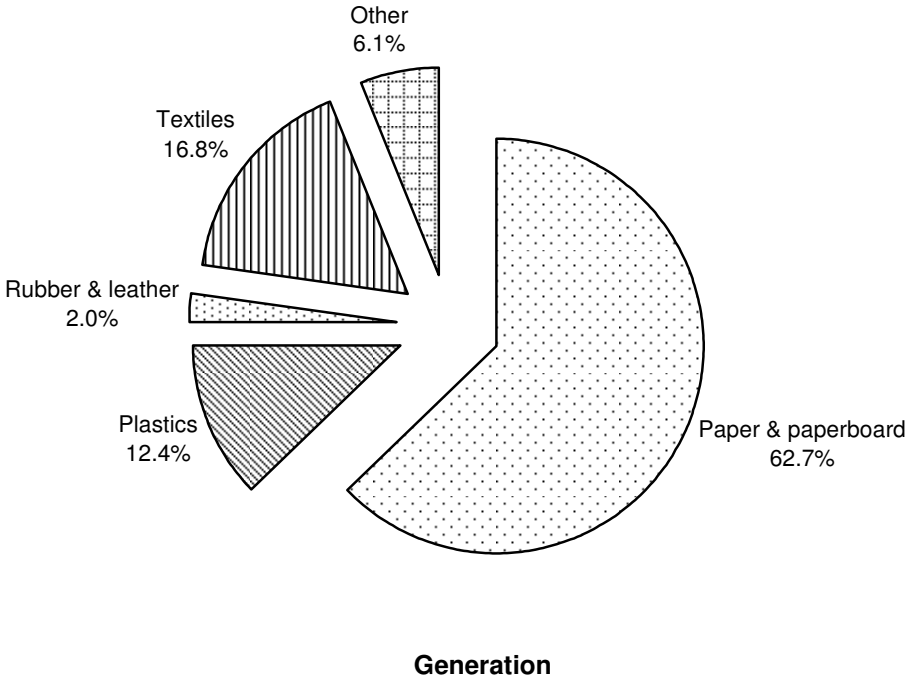


The materials composition of nondurable goods in 2009 is shown in Figure 15. Paper and paperboard made up 62.7 percent of nondurables in MSW generation, with plastics contributing 12.4 percent, and textiles 16.8 percent. Other materials contributed lesser percentages. After recovery for recycling, paper and paperboard were 46.5 percent of nondurable discards, with plastics being 19.2 percent, and textiles 21.8 percent.

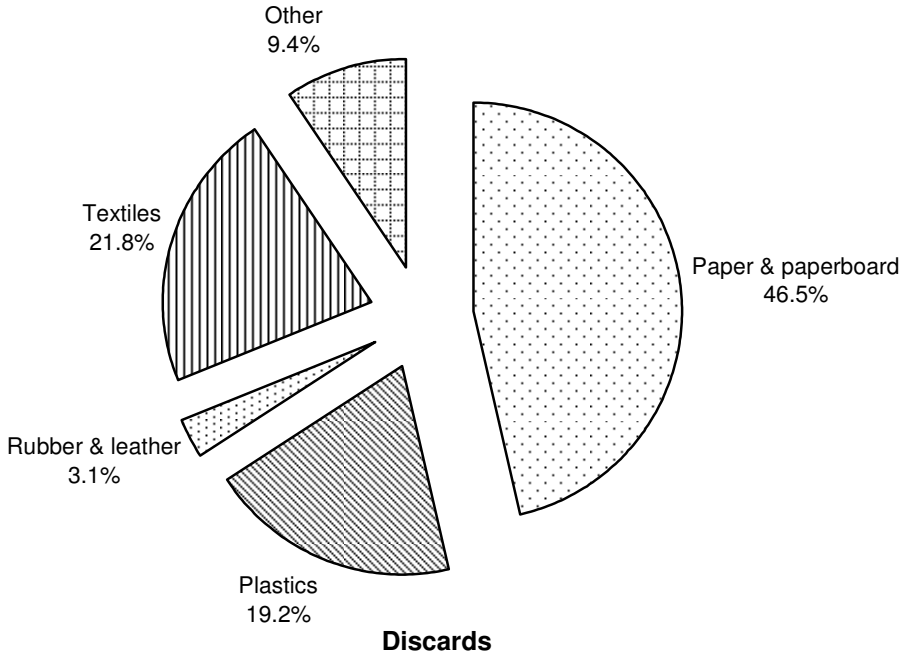
The materials composition of containers and packaging in MSW in 2009 is shown in Figure 16. By weight, paper and paperboard products made up 48.8 percent of containers and packaging generation; plastics accounted for 17.5 percent. Glass was 13.5 percent, wood was 14.4 percent, and metals were 5.8 percent.

The percentage of materials discards from containers and packaging is affected by recovery for recycling. After recovery for recycling, paper and paperboard dropped to 26.4 percent of discards. Glass containers accounted for 17.8 percent of discards of containers and packaging, plastics were 28.9 percent, wood was 21.7 percent, and metals were 5.2 percent.

Figure 15. Nondurable goods generated and discarded* in municipal solid waste, 2009 (In percent of total generation and discards)



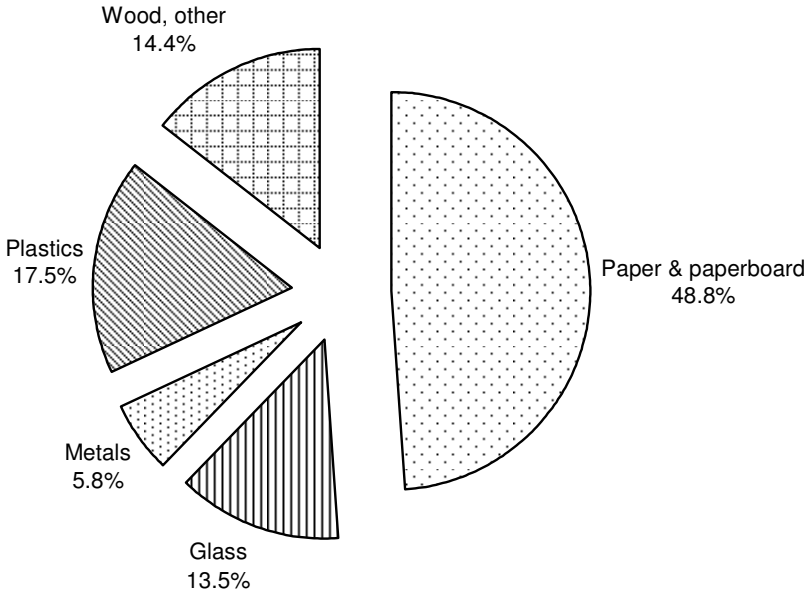
Generation



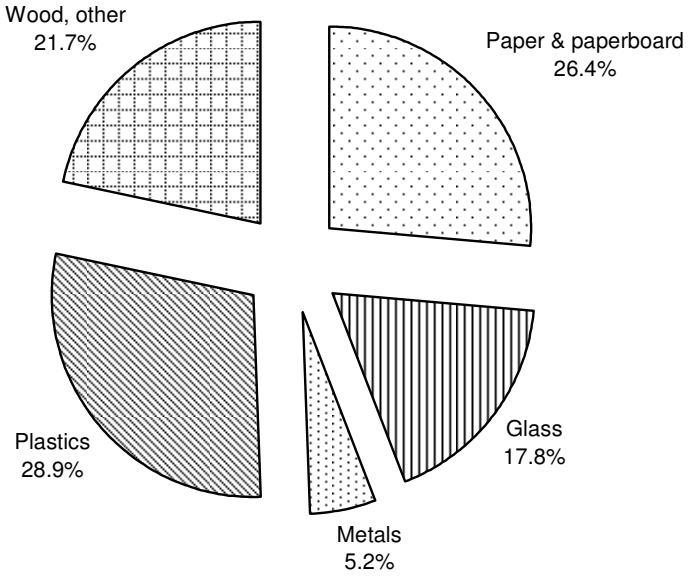
Discards

*Discards in this figure include combustion with energy recovery.

Figure 16. Containers and packaging generated and discarded* in municipal solid waste, 2009 (In percent of total generation and discards)



Generation



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 2009 was 243 million tons, which was similar to 2000 when 242.5 million tons were generated. This compares to 1990, when total generation of MSW was 208.3 million tons.

- Paper and paperboard products made up the largest percentage of all the materials in MSW, at 28.2 percent of total generation. Generation of paper and paperboard products declined from 87.7 million tons in 2000 to 68.4 million tons in 2009. 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 34 and 28 percent of generation since 2005.

- Yard trimmings comprised the third largest material category, estimated at 33.2 million tons, or 13.7 percent of total generation, in 2009. This compares to 35.0 million tons (16.8 percent of total generation) in 1990. The decline in yard trimmings generation since 1990 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 2009 was 29.8 million tons, or 12.3 percent of generation. This was a decrease of 920,000 tons from 2007 to 2009. This decrease in plastics generation came mostly from the containers and packaging category. Although plastics generation has grown from 8.2 percent of generation in 1990 to 12.3 percent in 2009, plastic generation as a percent of total generation has remained fairly steady over the past few years.

MSW Recovery

- Recovery of materials in MSW increased from 5.6 million tons in 1960 (6.4 percent of total generation) to 69.5 million tons in 2000 (28.6 percent of generation) to 82.0 million tons in 2009 (33.8 percent of generation).

- Although recovery of products and other wastes (food scraps and yard trimmings) in MSW decreased 1.8 million tons from 2008 to 2009, generation also decreased (8 million tons from 2008 to 2009). The result is an increase in the recovery rate from 33.4 percent in 2008 to 33.8 percent in 2009.

- Recovery of paper and paperboard products, the largest component of recovery, increased from 55.5 percent in 2008 to 62.1 percent in 2009.

- 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 2008 and 2009, all paper products showed increased recovery rates.

- The newspaper recovery rate increased from 88.0 percent to 88.1 percent between 2008 and 2009. Newspaper generation decreased from 8.8 million tons in 2008 to 7.8 million tons in 2009. 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 34.1 million tons in 2008 to 34.2 million tons in 2009; percentage recovery increased from 44.9 percent to 47.8 percent. Nondurable goods recovery decreased from 19.3 million tons in 2008 to 18.9 million tons in 2009. However, due to decreased generation, the percentage recovery of nondurable goods increased from 32.9 percent to 35.3 percent.

- Measured by tonnage, the most recovered products and materials in 2009 were corrugated boxes (22.1 million tons), yard trimmings (19.9 million tons), newspapers (6.8 million tons), high grade office papers (4.0 million tons), standard mail (3.0 million tons), glass containers (3.0 million tons), lead-acid batteries (2.7 million tons), major appliances (2.5 million tons), folding cartons (2.5 million tons), other commercial printing (2.3 million tons), wood packaging (2.2 million tons), tires (1.7 million tons), and steel cans (1.3 million tons). Collectively, these products accounted for 90 percent of total MSW recovery in 2009.

- Measured by percentage of generation, products with the highest recovery rates in 2009 were lead-acid batteries (95.7 percent), newspapers (88.1 percent), corrugated boxes (81.3 percent), office-type papers (74.2 percent), major appliances (66.8 percent), steel packaging (66.2 percent), yard trimmings (59.9 percent), other commercial printing (66.2 percent), aluminum cans (50.7 percent), standard mail (63.4 percent), magazines (53.8 percent), folding cartons (50.0 percent), tires (35.3 percent), and glass packaging (31.1 percent).

Long Term Trends

- Generation of MSW has increased (except in recession years), from 88.1 million tons in 1960 to 243 million tons in 2009. Due to the depressed economy, generation decreased in 2008 and again in 2009.

- 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 68.4 million tons in 2009. Generation of yard trimmings has increased since 2000. Generation of other material categories also fluctuates from year to year, but overall MSW generation increased from 1960 to 2007, with the trend reversing after 2007.

- 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 (33.8 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 39 years. Some examples:

	1970	**1980**	**1990**	**2000**	**2009**
Paper and paperboard	15%	21%	28%	43%	62%
Glass	1%	5%	20%	23%	26%
Metals	4%	8%	24%	35%	35%
Plastics	Neg.	<1%	2%	6%	7%
Yard trimmings	Neg.	Neg.	12%	52%	60%
Selected Consumer Electronics				10%	19%
Lead-acid batteries	76%	70%	97%	93%	96%

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

CHAPTER 2

REFERENCES

GENERAL

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

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

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

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

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

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

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

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

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2005 Facts and Figures*. EPA530-R-06-011. October 2006. http://www.epa.gov/wastes/nonhaz/municipal/pubs/mswchar05.pdf.

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

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2001 Facts and Figures*. EPA/530-R-03-011. October 2003. http://www.epa.gov/wastes/nonhaz/muncipal/pubs/msw2001.pdf.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2000 Facts and Figures*. EPA/530-R-02-001. June 2002. http://www.epa.gov/wastes/nonhaz/municipal/pubs/report-00.pdf.

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

ALUMINUM CONTAINERS AND PACKAGING

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

The Aluminum Association. www.aluminum.org.

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

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

Resource Recycling Container Recycling Update. Various issues.

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

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

CARPETS AND RUGS

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

Modern Plastics. "Resin Statistics." January issue. Various years.

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

Personal communication with a representative of the Polyurethane Foam Association (PFA). The Center for the Polyurethanes Industry (CPI). July 2007-2010.

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

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

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

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

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

CONSUMER ELECTRONICS

Alster, Norm. "Are Old PC's Poisoning Us?" *Business Week*. June 2000.

"Annual and Monthly Buying Guide." *Consumer Reports*. Various Issues 1984 – 1995.

Best Buy website. www.bestbuy.com

Canon Communications LLC. U.S. Appliance Industry Statistical Review: 1999 to 2008. *Appliance Magazine.* Market Research Report. July 2009. www.ApplianceMagazine.com/MarketResearch

Consumer Electronics Association. Fast Facts Data. Various years.

Dana Chase Publications, Inc. *Appliance Statistical Review*. Various years.

Dann, Carolyn. *End-of-Life Electronics Equipment Pilot Collection Program Summary Report - Alachua County, Florida*. October 1999. Center for Environmental Communications.

Franklin County Solid Waste Management District. *Consumer Electronics Collection Report DEP Technical Assistance Grant*. October 1998. Franklin County, MA. Average age of products recovered.

Jun Fujimoto, Tetsuya Tamura, et al. NEC Corporation. *A New Era Computer Product Focused on Environmentally Relevant Factors*. 1995 IEEE International Symposium on Electronics and the Environment. May 1995. Composition of notebook-type computers.

Lehman, Richard L., Reggie Caudill, Julian Kliokis. *Processes and Products for Utilization of Reclaimed CRT Glass*. Presentation at Demanufacturing of Electronic Equipment for Reuse and Recycling [DEER^2] Information Exchange. October 26 - 27, 1999. Center for Ceramics Research. Rutgers University.

Materials for The Future Foundation. The Monitor of Electronics Recycling Issues. *CRT Smelting*. January 2002. www.materials4future.org.

Materials for The Future Foundation. The Monitor of Electronics Recycling Issues. *CRT Glass to CRT Glass Recycling.* September 2001. www.materials4future.org.

Matthews, H. Scott, Francis C. McMichael, et al. *Disposition and End-of-Life Options for Personal Computers*. Green Design Initiative Technical Report #97-10. Carnegie Mellon University.

Minnesota Office of Environmental Assistance. *Management of waste electronic appliances*. August 1995.

Minnesota Office of Environmental Assistance. *Recycling Used Electronics. Report on Minnesota's Demonstration Project.* July 2001.

National Recycling Coalition. Electronics Recycling Initiative. *Contracting for Proper Recovery and Recycling of Electronic Products*. March 2, 2000. www.nrc-recycle.org/programs

National Recycling Coalition. Electronics Recycling Initiative. *Proper Management of End-of-Life Electronic Products (other than CRTs)*. January 27, 2000. www.nrc-recycle.org/programs

National Recycling Coalition. Electronics Recycling Initiative. *State and Local Policy Initiative and Voluntary Programs*. December 2, 1999. www.nrc-recycle.org/programs

National Recycling Coalition. Electronics Recycling Initiative. *Trends in Electronics Recycling in the United States*. November 3, 1999. www.nrc-recycle.org/programs

National Safety Council. *Electronic Product Recovery and Recycling Baseline Report*. May 1999.

Northeast Recycling Council. *Setting Up & Operating Electronics Recycling/Reuse Programs: A Manual for Municipalities & Counties*. March 2002. www.nerc.org.

Pasco County and Center for Environmental Communications. *The Recycling and Demanufacturing of Computers and Electronic Equipment in Pasco County, Florida.* April 2000.

Pitts, Greg. *Computer and Electronics Disposition Eco-Industrial Park*. Presentation at Demanufacturing of Electronic Equipment for Reuse and Recycling [DEER^2] Information Exchange. October 26 - 27, 1999.

Southern Waste Information eXchange, Inc. SWIX. *Used TV & Computer Recycling & Management in Florida: A Resource Guide*. September 1999.

U.S. Census Bureau. U.S. Department of Commerce. Economics and Statistics Administration. Economic Census. Industry Series. *Audio and Video Equipment Manufacturing*. EC97M-3343A. Various years.

U.S. Census Bureau. U.S. Department of Commerce. *Current Industrial Report: Communication Equipment.* Various years.

U.S. Census Bureau. U.S. Department of Commerce. *Current Industrial Report: Computers and Office and Accounting Machines.* Various years.

U.S. Census Bureau. U.S. Department of Commerce. *Current Industrial Report: Consumer Electronics.* Various years.

U.S. Department of Commerce. U.S. International Trade Commission (USITC). Tariff and trade online database. http://dataweb.usitc.gov/scripts/user_set.asp

U.S. Environmental Protection Agency. *Electronics Waste Management in the United States Approach 1.* (Revised baseline report.) July 2008. EPA530-R-08-009.

U.S. Environmental Protection Agency. *Electronics Waste Management in the United States Approach 1.* April 2007. EPA530-R-07-004a.

U.S. Environmental Protection Agency. *Electronics Waste Management in the United States Approach 2.* April 2007. EPA530-R-07-004a.

U.S. Environmental Protection Agency. *Energy and Greenhouse Gas Factors for Personal Computers.* Franklin Associates, Ltd. August 7, 2002. Contract No. 68-W-99-001.

U.S. Environmental Protection Agency. Office of Resource Conservation and Recovery. *Electronics Waste Management in the United States Through 2009.* Final Report. 2010.

DISPOSABLE DIAPERS

Franklin Associates, A Division of ERG. Industry data. September 2007 and previous years.

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

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

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

U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. *National Vital Statistics Reports*. "Births: Preliminary Data for 2008, Volume 58, Number 16." April 6, 2010.

FOOD SCRAPS

Allegheny County, PA. *Establishing a Pre-Consumer Food Waste Collection and Composting Pilot Program in Allegheny County, Pennsylvania*. RW Beck. January 30, 2003.

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

California Integrated Waste Management Board. *Waste Disposal Rates for Business Types.* http://www.calrecycle.ca.gov/wastechar/DispRate.htm.

CDC Centers for Disease Control and Prevention. *Faststats - Nursing Home Care.* www.cdc.gov/nchs/fastats/nursingh.htm

City of San Clemente, CA. *Pilot Food Waste Project.* "CR&R Waste & Recycling Services." http://san-clemente.org/sc/Services/Environmental/SolidWaste/PilotFoodWasteProjectJuly10.pdf

City of Wayzata, MN. *Curbside Collection of Source-Separated Organics in the City of Wayzata Final Report - Phase 1*. January 2005.

City of Wayzata, MN. *Curbside Collection Of Source-Separated Organics in the City of Wayzata Final Report - Phase 2*. June 2005. http://wayzata.govoffice.com

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

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

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

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

Food Service Director. *College Census Report.* "Performance report for top colleges." 2008 and 2009. http://www.fsdmag.com/census-reports.html

Food Service Director. *Hospital Census Report.* "Performance report for top 50 hospitals." 2009. http://www.fsdmag.com/census-reports.html

Food Service Director. *Long-term Care Census Report.* "Performance report for top 75 long-term care chains." 2008. http://www.fsdmag.com/census-reports.html

Food Service Director. *VA Martinsburg Wins Sustainability Award.* June 15, 2010. http://www.leanpath.com/docs/martinsburg.pdf

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

Goldstein, Nora. Unpublished analyses of the food waste composting industry. August 2006, August 2007, and August 2008.

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

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

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

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

Kim, T., Shanklin, C.W., Su, A.Y., Hackes, B.L. and Ferris, D. 1997. "Comparison of waste composition in a continuing-care retirement community." *J. Am. Diet. Assoc.* 97, 396-400.

King County Department of Natural Resources and Parks, Solid Waste Division. *2003 King County Residential Food Scrap Collection Final Report*. May 2004.

Kroger. *2010 Sustainability Report.* June 2010. http://www.thekrogerco.com/documents/KrogerSustainReport2010.pdf

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

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

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

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

Michaels, Karen. "Mapping the Density of Food Residuals Generation." *BioCycle.* June 2003.

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

North Carolina, Orange County. *Solid Waste Management Department.* FY2010 food waste collection data received July, 2010.

Personal communication with Andrew Shakman President and Co-Founder. LeanPath, Inc. August 2010.

Personal communication with Brian Mathews Senior Program Manager StopWaste.org. Alameda County, CA. January 2008.

Personal communication with Bruce Bowers Environmental Manager. Harley-Davidson Motor Company Operations, LLC. August 2010.

Personal communication with Jeff Senne Director of Performance, Sustainability and CSR. Sodexo, Inc. August 2010.

Personal communication with Jennifer Erickson. Metro Regional Government Resource Conservation & Recycling. Portland, Oregon. August 2010.

Personal communication with Mike Geller PSA Sustainability Coordinator. Providence Health & Services. Portland, OR. August 2010

Personal communication with Nicole Chardoul Resource Recycling Systems. August 2010. www.recycle.com

Personal communication with Rachel Warner Marketing Director. National Association of College and Universities Food Services. August 2010.

Personal communication with Rick Robson Environmental Chemist - Sustainability. Hallmark Cards, Inc. August 2010.

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

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

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

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

Tufts University. *Wind and Waste Diversifying Boston's Renewable Energies.* Prepared by graduate students from the Tufts University Department of Urban and Environmental Policy and Planning. 2009. http://ase.tufts.edu/UEP/Degrees/field_project_reports/2009/Team_2_Final_Report.pdf

U.S. Census Bureau. *American Fact Finder.* "Characteristics of the Group Quarters Population by Group quarters Type. 2006-2008 American Community Survey 3-Year Estimates." S2601B. http://factfinder.census.gov/servlet/STSelectServlet?_ts=298394730199

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

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

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

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

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

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

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

U.S. Department of Education. *National Center For Educational Statistics.* "Table 167. Minimum amount of instructional time per year and policy on textbook selection, by state: 2000, 2006, and 2008." http://nces.ed.gov/programs/digest/d09/tables/xls/tabn167.xls

U.S. Department of Labor. Bureau of Labor Statistics. *Occupational Employment Statistics database.* May 2009 http://data.bls.gov:8080/oes/search.jsp?data_tool=OES

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

University of North Carolina Health Care System 2009 Annual Report. *Financials and Statistics.* Chapel Hill, North Carolina. http://www.unchealthcare.org/site/aboutus/annualreport2009.pdf

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

Virginia Department of Environmental Quality (DEQ).*Composting Feasibility Study for the Randolph-Macon College Dining Facility.* Fall 2008. http://www.deq.virginia.gov/export/sites/default/recycle/pdf/CompostingStudyRMC2009.pdf

Walmart. *Integrated Organic Diversion Program.* Bobby Fanning, Sr. Manager, Solid Waste and Recycling. Presentation from Resource Conservation Challenge (RCC) 2010 Workshop. March 2010. http://www.epa.gov/epawaste/rcc/resources/meetings/rcc-2010/fanning.pdf

WRAP. United Kingdom. *Food Waste Report The Food We Waste*. April 2008. http://wrap.s3.amazonaws.com/the-food-we-waste.pdf

FURNITURE AND FURNISHINGS

Consumer Product Safety Commission. "Status Report: Peer Reviewed CPSC Staff Research Reports on Upholstered Furniture Flammability." December 2006. http://www.cpsc.gov/LIBRARY/FOIA/foia07/brief/ufurn1.pdf

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

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

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

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. "Average Weight and Width of Broadwoven Fabrics (Gray)." MQ313T various years.

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

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

U.S. Department of Commerce. U.S. International Trade Commission (USITC). Tariff and trade online database. http://dataweb.usitc.gov/scripts/user_set.asp

GLASS CONTAINERS

Arkansas Department of Environmental Quality. "State of Recycling in Arkansas 2007-2008." January 2009. http://www.adeq.state.ar.us/solwaste/branch_recycling/default.htm

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

Brewers Almanac. Various years.

Cal Recycle. Department of Resources Recycling and Recovery. "Biannual Report of Beverage Container Sales, Returns, Redemption, and Recycling Rates." May 10, 2010. http://www.calrecycle.ca.gov/BevContainer/Rates/BiannualRpt/default.htm

California Department of Conservation. *Biannual Report of Beverage Container Sales, Returns, Redemption, and Recycling Rates*. May 9, 2008 http://www.conservation.ca.gov/dor/Notices/Documents/Biannual.pdf

Colorado Department of Public Health and Environment. Division of Hazardous Materials and Waste Management. "2009 Annual Report to the Colorado General Assembly On the Status of the Solid Waste and Material Management Program In Colorado." February 1, 2010. http://www.cdphe.state.co.us/hm/recycle/data.htm

Connecticut Department of Environmental Protection. Bureau of Materials Management & Compliance Assurance. "Estimates of Connecticut Municipal Solid Waste Generated (MSW), Disposed, and Recycled FY2008." http://www.ct.gov/dep/lib/dep/reduce_reuse_recycle/data/average_state_msw_statistics_fy2008.pdf

Delaware Department of Natural Resources and Environmental Control. The Recycling Public Advisory Council. "The Eighth Annual Report of the Recycling Public Advisory Council." November 2009. http://www.awm.delaware.gov/Recycling/Documents/The%20Eighth%20Annual%20Report%20RPAC%20Nov2009.pdf

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

Florida Department of Environmental Protection. "Solid Waste Management in Florida 2008 Annual Report." Appendix B: Recycling and Waste Reduction. Table 3-B. http://www.dep.state.fl.us/waste/categories/recycling/SWreportdata/08_data.htm

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

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

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

Glass Packaging Institute. "Glass Bottles Reaching 50% Recycled Content." Joe Cattaneo presentation at Virginia Recycling Association Annual Conference, Virginia Beach, VA. May 18, 2010. http://www.vrarecycles.org/LinkClick.aspx?fileticket=jP3bJ0xHPuo%3D&tabid=58

Glass Packaging Institute. "Glass Container Recycling Market Trends." Bryan Vickers presentation at Iowa Recycling & Solid Waste Management Conference Waterloo, IA October 6, 2009.

Glass Packaging Institute. *U.S. Glass Container Shipment and Production Report*. 2009 and 2010.

Hawaii Department of Health. "Report to the Twenty-Fifth Legislature State of Hawaii 2009." November 2008. http://hawaii.gov/health/environmental/waste/sw/hi5/support/2009ReportToLeg.pdf

Maine State Planning Office. "Solid Waste Generation & Disposal Capacity Report for Calendar Year 2008." March 2010. http://www.state.me.us/spo/recycle/docs/gencapdraft040110final.pdf

Massachusetts Department of Environmental Protection. "2008 Solid Waste Data Update on the Beyond 2000 Solid Waste Master Plan." April 2010. Table 4 and Figure 2. http://www.mass.gov/dep/recycle/priorities/08swdata.pdf

Minnesota Pollution Control Agency. "Recycling in Minnesota, The SCORE Report. Recycling and solid waste data." 2008. http://www.pca.state.mn.us/index.php/topics/environmental-data/score/recycling-and-solid-waste-data.html

Nevada. Division of Environmental Protection. 2009 Recycling Rate in Nevada http://nevadarecycles.gov/doc/nvrate09.pdf

New Jersey Department of Environmental Protection. Joe Davis, Recycling & Planning.

New Mexico Environment Department. Solid Waste Bureau. Connie Pasteris. Personal communication. July 2010.

New York State Department of Environmental Conservation. "Beverage Container Deposit and Redemption Statistics October 1, 2005 - September 30, 2006." http://www.dec.ny.gov/docs/materials_minerals_pdf/0506rcarpt.pdf

North Carolina. Department of Environment and Natural Resources. Solid Waste Management Annual Report. July 1, 2007 – June 30, 2008
http://wastenot.enr.state.nc.us/swhome/AR07_08/AR07_08.pdf

North Carolina, Orange County. Solid Waste Management Department. 2007-2008 Statistics.
http://www.co.orange.nc.us/recycling/index.asp

Ohio Environmental Protection Agency. Division of Solid and Infectious Waste Management. "State Solid Waste Management Plan 2009." March 3, 2010. Table 2-3.
http://www.epa.ohio.gov/LinkClick.aspx?fileticket=7dqcFOrOZg0%3d&tabid=2613

Oregon Department of Environmental Quality. "2008 Oregon Material Recovery and Waste Generation Rates Report. Land Quality Division." September 2009.
http://www.deq.state.or.us/lq/pubs/docs/sw/2008MRWGRatesReport.pdf

Owens Corning. "OI NA Cullet Report on Market Conditions". Paul J Smith Sourcing Manager – Cullet presentation to Federation of New York Solid Waste Associations. May 6, 2009.
http://www.nyfederation.org/pdf2009/73smithpaul.pdf

Pennsylvania Department of Environmental Protection. Lawrence Holley, Division Chief, Waste Minimization and Planning. Telephone call July 7, 2010.

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

Personal communication with representative of Glass Packaging Institute. July 2010.

Personal communication with a representative of Strategic Materials. 2000 and 2005.

Personal communication with a representative of Waste Management. July 2007.

Resource Recycling, *Container Recycling Update.* Various issues.

South Carolina Department of Health and Environmental Control. "South Carolina Solid Waste Management Annual Report for Fiscal Year 2009." Section 6 page 38. http://www.scdhec.gov/environment/lwm/recycle/pubs/swm09_small.pdf

Texas Department of Transportation. "Recycling Summary." Roadway Recycled Materials and Products Placed in FY09. http://www.txdot.gov/business/contractors_consultants/recycling/performance.htm

The ULS Report. "A Study of Packaging Efficiency as it Relates to Waste Prevention". February 2007. http://www.americanchemistry.com/plastics/doc.asp?CID=1593&DID=6072

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

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

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

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

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

U.S. Department of Commerce. U.S. International Trade Commission (USITC). Tariff and trade online database. http://dataweb.usitc.gov/scripts/user_set.asp

Virginia Department of Environmental Quality. "The Virginia Annual Recycling Rate Report. Calendar Year 2008 Summary." November 2009. http://www.deq.state.va.us/export/sites/default/recycle/documents/AnnualReport-RRR2008Final.pdf

Washington State Department of Ecology. "Generation, Recycling and Per Capita data (1986-2008)." http://www.ecy.wa.gov/programs/swfa/solidwastedata/recyclin.asp

Wisconsin Department of Natural Resources. "Annual Reports from Responsible Units." Table 1 Recyclable Materials Collected by Wisconsin Responsible Units (1999-2008). http://www.wnrmag.com/org/aw/wm/recycle/recycleldfrept/table1ru.pdf

LEAD-ACID BATTERIES

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

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

Battery Council International. *Lead-acid Battery Shipments 1937 – 2007.* http://www.batterycouncil.org/LeadAcidBatteries/tabid/54/Default.aspx

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

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

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

National Automobile Dealers Association. NADA *Data: Vehicles in Operation and Scrappage,* http://www.nada.org/Publications/NADADATA/ as of Dec.6, 2007.

National Automobile Dealers Association. NADA. *Data 2006. Economic Impact of America's New-Car and New-Truck Dealers.* http://www.nada.org/

National Automobile Dealers Association. NADA. *Data 2010. Dealership and Industry Review.* www.nada.org/nadadata

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

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

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

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

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

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

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

U.S. Department of Commerce. U.S. International Trade Commission (USITC). Tariff and trade online database. http://dataweb.usitc.gov/scripts/user_set.asp

U.S. Department of the Interior. U.S. Geological Survey. *USGS Minerals Yearbook: Lead.* January 2008. http://minerals.usgs.gov/minerals/pubs/commodity/lead/myb1-2006-lead.pdf

U.S. Department of Transportation. Bureau of Transportation Statistics. *National Transportation Statistics 2005*.
http://www.bts.gov/publications/national_transportation_statistics/2005/csv/table_04_54.csv

U.S. Department of Transportation. Federal Highway Administration. *Highway Statistics.* "State Motor Vehicle Registrations." Various years.
http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.cfm

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

MAJOR APPLIANCES

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

Appliance Magazine. Corcoran Communications. September 1983.

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

Appliance Manufacturer. "Market Profile." Various years.

Appliance Manufacturer. "Shipments Forecasts." Various years.

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

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

Best Buy website. www.bestbuy.com.

Canon Communications. *58th Annual Appliance Industry Forecast*. February 2010.

Canon Communications. *U.S. Appliance Industry Statistical Review: 1999 to 2008*. July 2009.

Dana Chase Publications, Inc. *Appliance Statistical Review*. Various years.

Electrical Merchandising. January 1951.

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

Maytag Corporation. www.amana.com.

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

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

Personal communication with a representative of Steel Recycling Institute. Various years.

Rheem Manufacturing Company. www.rheem.com.

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

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

Target Brands, Inc. www.target.com.

University of Illinois Extension. Disaster Resources. "Energy Guide Labels" web.extension.uiuc.edu/disaster/replace/energy.html

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

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

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

U.S. Geological Survey. *Mineral Commodity Summaries*. "Iron and Steel Scrap." Various years.

Wal-Mart website. www.walmart.com

PAPER AND PAPERBOARD

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

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

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

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

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

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

Personal communication with Amy Healy, Director Public Policy, of the Yellow Pages Association. February, April, June 2010.

Personal communication with Cathy Foley, Paper Division Vice President and Stan Lancey, Chief Economist, of the American Paper & Forest Association. July and August 2010.

Personal communication with Ed Klein, Executive Director, of the Carton Council. July 2010.

Personal communication with Jeff Fielkow, Vice President of Recycling, of the Carton Council. July 2010.

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

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

PLASTICS

Alliance of Foam Packaging Recyclers. *EPS Recycling Report*. Various years. www.epspackaging.org.

Alliance of Foam Packaging Recyclers. "Recycled Content in Expandable Polystyrene Foam Protective Packaging." Technical Bulletin. Fall 2001.

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

American Chemistry Council Plastics Division. *2008 National Postconsumer Recycled Plastic Bag and Film Report.* http://www.americanchemistry.com/s_plastics/index.asp

American Chemistry Council Plastics Division. *2006 National Post-Consumer Recycled Plastic Bag and Film Report*. http://www.plasticbagrecycling.org/08.0/2006Report.pdf

American Chemistry Council Plastics Division. *2008 National Postconsumer Report on Non-Bottle Rigid Plastic Recycling.* http://www.americanchemistry.com/s_plastics/index.asp

American Chemistry Council Plastics Division. *2008 United States National Postconsumer Plastics Bottle Recycling Report.* http://www.americanchemistry.com/s_plastics/index.asp

American Chemistry Council Plastics Division. Plastic Packaging Resins. March 2007.

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

Association of Postconsumer Plastic Recyclers and the American Chemistry Council. *United States National Postconsumer Plastics Bottle Recycling Report.* 2006 http://www.americanchemistry.com/s_plastics/sec_content.asp?CID=1593&did=7094

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

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

Patty Moore, Moore Recycling Associates, Inc. Presentation to the Association of Oregon Recyclers June 22, 2007. http://www.aorr.org/Docs/2007_Conference_Presentations/Markets%20Panel%20Plastics.pdf

Personal communication with Patty Moore, Moore Recycling Associates, Inc. August 2009 and September 2010.

Personal communication with various industry representatives. August 2006, August 2007, August 2008, and September 2009.

Plastics Recycling Update. January 2004.

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

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

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

U.S. Department of Commerce. U.S. International Trade Commission (USITC). International Trade Statistics. Various years.

U.S. Department of Commerce. U.S. International Trade Commission (USITC). Online database. http://dataweb.usitc.gov/scripts/user_set.asp

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

RUBBER

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

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

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

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

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

Modern Tire Dealer. "Retail Tire Distribution." January 2008.

Modern Tire Dealer. "Tip-top shape America's largest retreaders continue to expand. Just look at Snider Tire." Bob Ulrich and Mike Manges. 2009. http://www.moderntiredealer.com/Stats/

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

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

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

Retreader's Journal. April 1987.

Rubber Manufacturers Association. Newsroom. *Year 2009 Press Releases.* "2009 Tire Shipments Revised to Drop Sixteen Percent." November 2, 2009. http://www.rma.org/newsroom/

Rubber Manufacturers Association. Newsroom. *Year 2010 Press Releases.* "2010 Tire Shipments to Increase Three Percent." (Article contains 2009 data.) March 12, 2010. http://www.rma.org/newsroom/

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

Rubber Manufacturers Association. *Scrap Tire Markets in the United States* Various years.

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

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

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

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

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

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

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

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

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

U.S. Department of Commerce. U.S. International Trade Commission (USITC). Online database. http://dataweb.usitc.gov/scripts/user_set.asp

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

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

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

SMALL APPLIANCES

58th Annual Appliance Industry Forecasts. "Appliance Market Research Report." February 2010.

Best Buy website. www.bestbuy.com.

Dana Chase Publications, Inc. *Appliance Statistical Review*. Various years.

Environmental Product Declaration (EPD): Floor Vacuum Cleaner ETA 1450 Proximo. March 2005. www.environdec.com/reg/epde26e.pdf

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

Swedish Environmental Management Council. "Composition Vacuum Cleaners: Environmental Product Declaration (EPD): Floor Vacuum Cleaner ETA 1450 Proximo." www.environdec.com/reg/epde26e.pdf

U.S. Appliance Industry Statistical Review: 1999-2008. "Appliance Market Research Report." July 2009.

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports*. "Electric Housewares and Fans MA36E and MA335E." Various years.

U.S. Department of Commerce. U.S. International Trade Commission. *Tariff and Trade Data.* "U.S. Imports, Annual Data." 2009 and earlier years."

U.S. Department of Commerce, International Trade Commission. *Tariff and Trade Data.* "U.S. Domestic Exports, Annual Data." 2009 and earlier years.

U.S. Department of Commerce. U.S. International Trade Commission (USITC). Online database. http://dataweb.usitc.gov/scripts/user_set.asp

Wal-Mart website. www.walmart.com

STEEL CONTAINERS AND PACKAGING

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

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

Personal communication with a representative of the Association of Container Reconditioning. June 1994, July 2006, and July 2008.

Personal communication with a representative of the Reusable Industrial Packaging Association. September 2004 and July 2008.

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

Resource Recycling. Container Recycling Report. Various issues.

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

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

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

TEXTILES AND FOOTWEAR

American Apparel and Footwear Association. *Shoe Stats.* 2008 and earlier years. http://www.apparelandfootwear.org/Statistics.asp

American Apparel and Footwear Association. *Trends: An Annual Compilation of Statistical Information on the U.S. Apparel & Footwear Industries. 2005 Edition. June 2006.* www.apparelandfootwear.org.

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

Global Clothing Industries, LLC website. *The Atlanta Journal-Constitution.* "Your cast-offs their profits. Items donated to Goodwill and Salvation Army often end up as part of a $1 billion-a-year used-clothing business." December, 24, 2006. http://www.gciatl.com/media.html

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

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

Nike Reuse-A-Shoe website. August 2010. http://www.nikereuseashoe.com/faqs.

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

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports.* "Apparel." MA23A, MA23E, MA23G, MQ315A, MQ315D, MA315Q. Various years.

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

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

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

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports.* "Textiles: Sheets, Towels, and Pillowcases. MA313Q. 2009.

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

U.S. Department of Commerce. U.S. International Trade Commission (USITC). Data Bank. Various years.

U.S. Department of Commerce. U.S. International Trade Commission. *Tariff and Trade Data.* "U.S. Domestic Exports, Annual Data, 2009 and earlier years."

U.S. Department of Commerce. U.S. International Trade Commission. *Tariff and Trade Data.* "U.S. Imports, Annual Data, 2009."

Spiegel Catalog. Fall/winter 1997.

WOOD PACKAGING

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

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

Buchlmann U, Araman PA, Bush RJ. "Pallet Re-Use and Recycling Saves High Value Material from Landfills." *Engagement Matters*, Virginia Cooperative Extension Journal, Virgina Tech and Virginia State University. Volume 2, Issue 1: January/February 2010.

Bush RJ, Araman PA. "Material Use and Production Changes in the U.S. Wood Pallet and Container Industry: 1992 to 2006." *Pallet Enterprise*. June 2009.

Bush RJ, Araman PA. "Pallet Recovery, Repair and Remanufacturing in a Changing Industry: 1992 to 2006." *Pallet Enterprise.* August 2009. http://www.palletenterprise.com/articledatabase/view.asp?articleID=2906

Bush, Robert, Phillip Araman, and E. Brad Hager. "Recovery, Reuse and Recycling by the United States Wood Packaging Industry: 1993 to 2006." Environmental Planning, Management, and Sustainability Studies. February 26, 2007. www.srs4702.forprod.vt.edu/pubsubj/pdf/07t5.pdf

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

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

Hardwood Market Report. February 28, 1998.

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

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

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

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

RPM Technologies, Inc. - Plastic Pallets. "Annual Report 2006." http://www.rpmplasticpallets.com/investor-relations.htm.

The Freedonia Group/IBIS Market Research Report. "Pallets – US Industry Study with Forecasts for 2012 & 2017." June 2008.

The Freedonia Group. Market Research Abstracts. "Freedonia Focus on Pallets." June 1, 2008.

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

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

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

YARD TRIMMINGS

Arkansas Department of Environmental Quality. "State of Recycling in Arkansas 2007-2008." January 2009. http://www.adeq.state.ar.us/solwaste/branch_recycling/pdfs/report_state_of_recycling_2007_2008.pdf

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

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

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

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

City & County of Honolulu's Department of Environmental Services. "Recycling and Landfill Diversion." Oahu Recycling 2009. http://www.opala.org/solid_waste/archive/facts2.html

City of Mesa, Arizona. "Solid Waste Management Department Annual Report FY 2008/2009." http://www.mesaaz.gov/waste/pdf/sw_annual_report_08_09.pdf

Colorado Department of Public Health and Environment. Division of Hazardous Materials and Waste Management. "2009 Annual Report to the Colorado General Assembly on the Status of the Solid Waste and Material Management Program in Colorado." February 1, 2010. http://www.cdphe.state.co.us/hm/sw/100201legrpt.pdf

Commonwealth of Virginia Department of Environmental Quality. "Solid Waste Managed in Virginia During Calendar Year 2008." June 2009. http://www.deq.state.va.us/export/sites/default/waste/pdf/swreport2008.pdf

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

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

Connecticut Department of Environmental Protection. Bureau of Materials Management & Compliance Assurance. "Estimates of Connecticut MSW Generated, Disposed, and Recycled FY 2008." http://www.ct.gov/dep/lib/dep/reduce_reuse_recycle/data/average_state_msw_statistics_fy2008.pdf

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

County of Hawai'i. "Integrated Resources and Solid Waste Management Plan The Path to Zero Waste. Section 2. Waste Stream Assessment." December 2009. http://www.hawaii-county.com/env_mng/swm/iswmp/Final/Section2WasteStreamAssessment.pdf

Delaware Department of Natural Resources and Environmental Control. "The Eighth Annual Report of the Recycling Public Advisory Council." November 2009. http://www.awm.delaware.gov/Recycling/Documents/The%20Eighth%20Annual%20Report%20RPAC%20Nov2009.pdf

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

Florida Department of Environmental Protection. "Solid Waste Annual Report Data." 2008 and earlier years. http://www.dep.state.fl.us/waste/categories/recycling/SWreportdata/08_data.htm

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

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

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

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

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

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

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

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

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

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

Illinois Environmental Protection Agency. "Nonhazardous Solid Waste Management and Landfill Capacity in Illinois: 2008." December 2009. http://www.epa.state.il.us/land/landfill-capacity/2008/report.pdf

Indiana Department of Environmental Management. Michelle Weddle, Senior Environmental Manager.

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

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

Kentucky Energy and Environment Cabinet. "Statewide Solid Waste Management Report - 2008 Update." http://waste.ky.gov/RLA/Documents/2008SolidWasteSummaryReport.pdf

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

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

Maine State Planning Office. "Solid Waste Generation & Disposal Capacity Report for Calendar Year 2008." March 2010. http://www.state.me.us/spo/recycle/docs/gencapdraft040110final.pdf

Maryland Department of the Environment. "County Recyclables by Commodity in Tons for Calendar Year 2008". http://www.mde.maryland.gov/assets/document/recycling_chart.pdf

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

Michigan Department of Natural Resources and Environment. Matt Flechter, Recycling/Composting Coordinator.

Minnesota Pollution Control Agency. Lisa Mojsiej, EIT.

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

Montana Department of Environmental Quality. "Compost Business in Montana." November 2009. www.deq.mt.gov/Recycle/pdf/MontanaComposters.pdf

Nevada. Division of Environmental Protection. "2009 Recycling Rate in Nevada." 2009. http://nevadarecycles.gov/doc/nvrate09.pdf

New Hampshire Department of Environmental Services. "Solid Waste Report to the Legislature 2007." October 2008. http://des.nh.gov/organization/commissioner/pip/publications/wmd/documents/r-wmd-08-3.pdf

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

New Jersey Department of Environmental Protection. Joseph Davis, Bureau of Recycling and Planning.

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

New Mexico Environment Department Solid Waste Bureau. Connie Pasteris, Outreach Section. "Solid Waste Facility Annual Report." 2009 and earlier years. http://www.nmenv.state.nm.us/swb/AnnualReportsandForms.htm

"New York State Department of Environmental Conservation. Part 360 Permitted Composting Facilities." June 10, 2009. http://www.dec.ny.gov/docs/materials_minerals_pdf/compweb.pdf

North Carolina Department of Environment and Natural Resources. Scott Mouw. "North Carolina Solid Waste Management Annual Report FY 2008-2009. Local Government Yard Waste Management FY08 and FY09." http://wastenot.enr.state.nc.us/swhome/AR08_09/AR08_09.pdf

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

Ohio Environmental Protection Agency. Division of Solid and Infectious Waste Management. "State Solid Waste Management Plan 2009." March 3, 2010. http://www.epa.ohio.gov/LinkClick.aspx?fileticket=7dqcFOrOZg0%3d&tabid=2613

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

Oregon Department of Environmental Quality. "Oregon Material Recovery and Waste Generation Rates Report." Various years. http://www.deq.state.or.us/lq/sw/recovery/materialrecovery.htm

Pennsylvania Department of Environmental Protection. Lawrence Holley, Division Chief, Waste Minimization and Planning. July 7, 2010.

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

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

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

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

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

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

South Carolina Department of Health and Environmental Control. "South Carolina Solid Waste Management Annual Report, Fiscal Year 2009." March 15, 2010. http://www.scdhec.gov/environment/lwm/recycle/pubs/swm09_small.pdf

St. Charles County Division of Environmental Services. "Recycling Facts." www.scchealth.org/docs/es/docs/recycle/**recycling_facts**.html

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

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

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

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

Utah Department of Environmental Quality. "2010 Utah Compost Facility Inventory (Calendar 2009 Data)." http://www.hazardouswaste.utah.gov/Solid_Waste_Section/Adobe/SolidWaste/Compost_List.pdf

Vermont Department of Environmental Conservation. "Solid Waste Management Annual Solid Waste Diversion & Disposal Reports." http://www.anr.state.vt.us/dec/wastediv/solid/pubs/DiversionDisposalReportTable2.pdf

Virginia Department of Environmental Quality. "The Virginia Annual Recycling Rate Report. Calendar Year 2008 Summary." November 2009. http://www.deq.virginia.gov/export/sites/default/recycle/documents/AnnualReport-RRR2008Final.pdf

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

Washington Department of Ecology. "Generation, Recycling and Per Capita data (1986-2008)." 2009. http://www.ecy.wa.gov/programs/swfa/solidwastedata/recyclin.asp

West Virginia Department of Environmental Protection. Sudhir Patel, Division of Water & Waste Management.

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

Wisconsin Department of Natural Resources. "Annual Reports from Responsible Units." Table 1 Recyclable Materials Collected by Wisconsin Responsible Units (1999-2008). http://www.wnrmag.com/org/aw/wm/recycle/recycleldfrept/index.html

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

CHAPTER 3

MANAGEMENT OF MUNICIPAL SOLID WASTE

INTRODUCTION

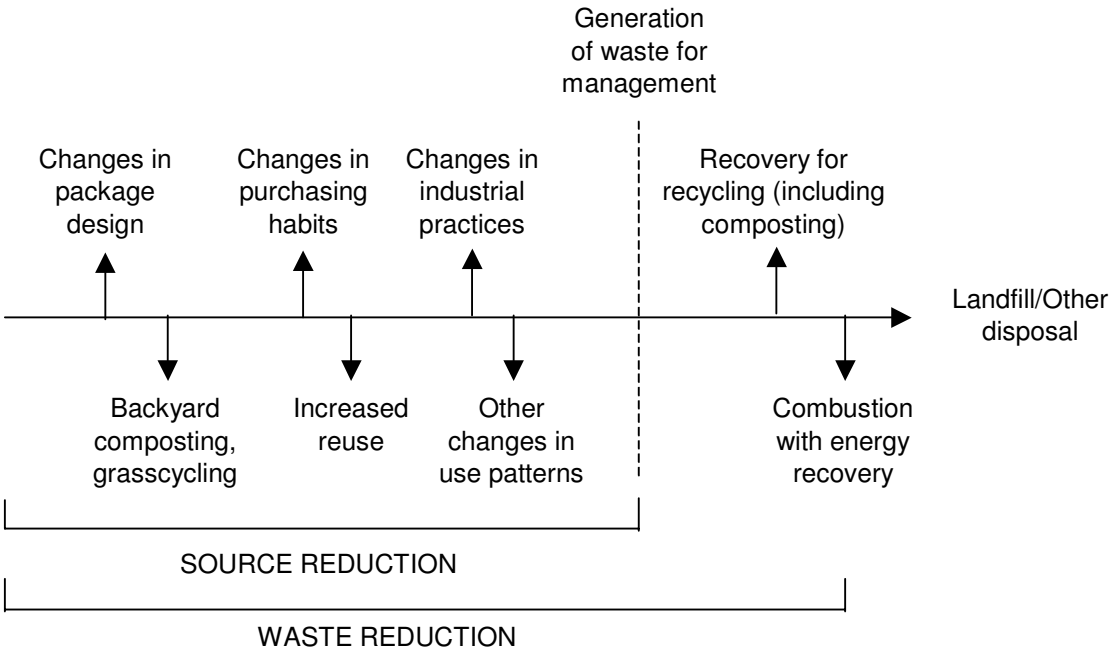
EPA's tiered integrated waste management strategy includes the following components:

- 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 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

Since 1960, the amount of waste each person creates has increased from 2.68 to 4.34 pounds per day. An 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.

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 • Container lightweighting	• 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

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. An example of materials reduction is the lightweighting of aluminum beverage cans. In 2009, an aluminum beverage can weighs 0.0291 pounds; down from 0.0341 pounds per can in 1996 (close to a 15 percent reduction in weight).

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 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 9 million tons of wood pallets were refurbished and returned to service in 2009. 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 28 percent of MSW generation in 2009, 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 2009, 23 states (amounting to about 50 percent of the nation's population) had legislation discouraging the disposal of yard trimmings. In addition, some local and regional jurisdictions regulate 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 2009, more than 9,000 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 commonly 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 2009, over 70 percent of the U.S. population had access to curbside recyclables collection programs (based on data from states representing 48 percent of the U.S. population and shown in Table 25). In comparison, a 2009 American Beverage Association study estimated that 74 percent of the U.S. population had access to curbside recycling programs.[5] The Northeast region had the largest population served – 47 million persons. In the Northeast, 85 percent of the population had access to curbside recyclables collection, while in the West 68 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, 2009

Region	Number of Programs	Population* (in thousands)	Population Served (in thousands)	Population Served Percent**
NORTHEAST	3,619	55,284	47,120	85%
SOUTH	1,157	26,936	17,870	66%
MIDWEST	3,286	37,768	20,720	55%
WEST	1,004	27,307	18,650	68%
Total	9,066	147,296	104,360	71%
Total U.S. Population		307,007		

* Population in states reporting population served data.

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

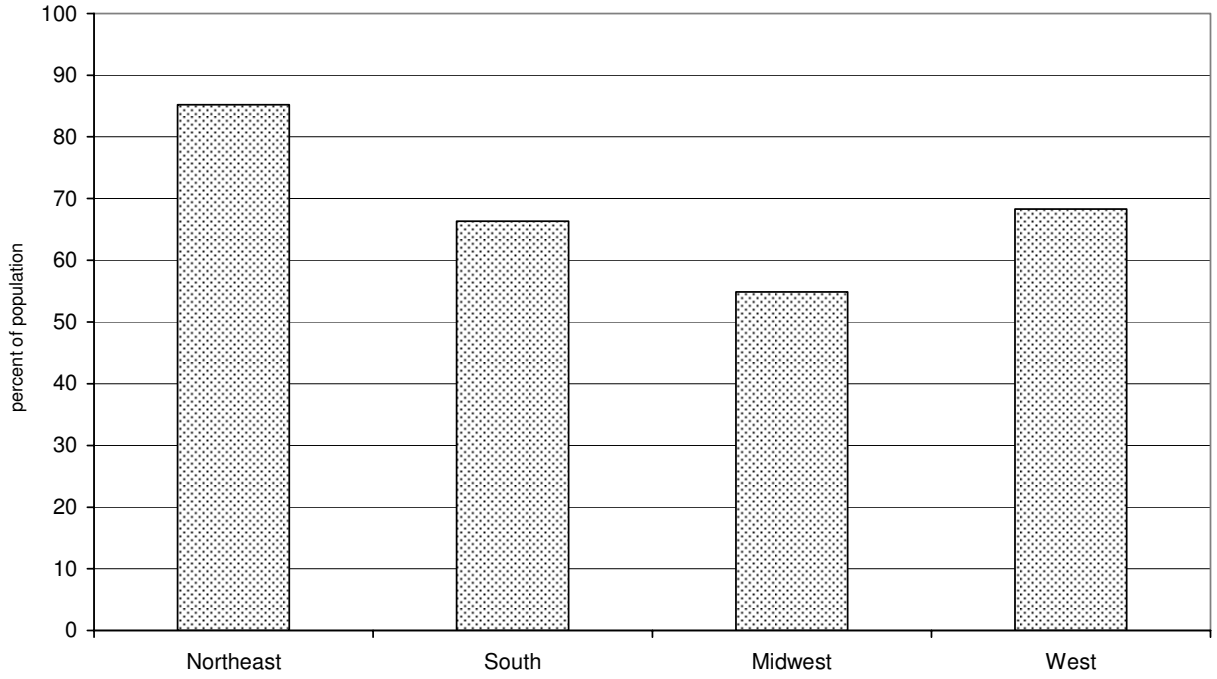
Sources:

U.S. Census Bureau, *BioCycle* preliminary State of Garbage data received August 2010, *BioCycle* The State of Garbage in America. April 2006, and data from the following websites Connecticut Department of Enviornmental Protection, Delaware Solid Waste Management Authority, Georgia Department of Community Affairs, Maine State Planning Office, North Dakota Department of Health Division of Waste Mangaement, Oregon Department of Environmental Quality, and 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.

[5] American Beverage Association. "2008 ABA Community Survey. Final Report. September 2009.

Figure 18. Population served by curbside recycling, 2009



U.S. Census Bureau, BioCycle preliminary State of Garbage data received August 2010, BioCycle The State of Garbage in America. April 2006, and data from the following websites Connecticut Department of Enviornmental Protection, Delaware Solid Waste Management Authority, Georgia Department of Community Affairs, Maine State Planning Office, North Dakota Department of Health Division of Waste Mangaement, Oregon Department of Environmental Quality, and 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. The 2009 American Beverage Association study estimated 83 percent of the U.S. population has access to drop-off collection programs. Both of these studies stated that many communities have access to both curbside and drop-off 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.

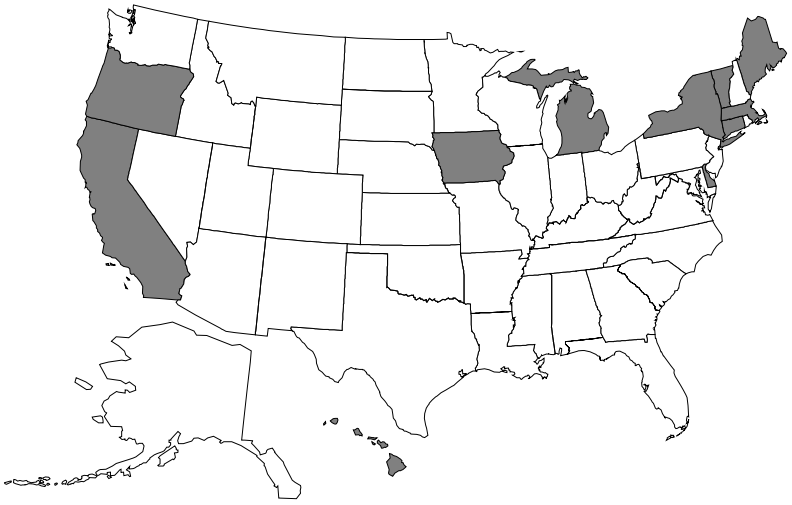
Buy-Back Centers. A buy-back center is typically a commercial operation that pays individuals for recovered materials. This could include scrap metal dealers, aluminum can centers, waste haulers, or paper dealers. Materials are collected by individuals, small businesses, and charitable organizations.

Deposit Systems. Eleven states have container deposit systems: California, Connecticut, Delaware[6], 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, which account for about 5 percent of total MSW generation (dairy products are typically excluded). The 2007 version of this report series 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.)

[6] Delaware deposit legislation was repealed by Senate Bill 234. Deposit collection will cease on December 1, 2010. http://www.bottlebill.org/legislation/usa/delaware.htm

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 2009, 578 MRFs were operating in the United States, with an estimated total daily throughput of over 86,000 tons per day (Table 26). The most extensive recyclables processing throughput occurs in the Northeast and Midwest (Figure 20).

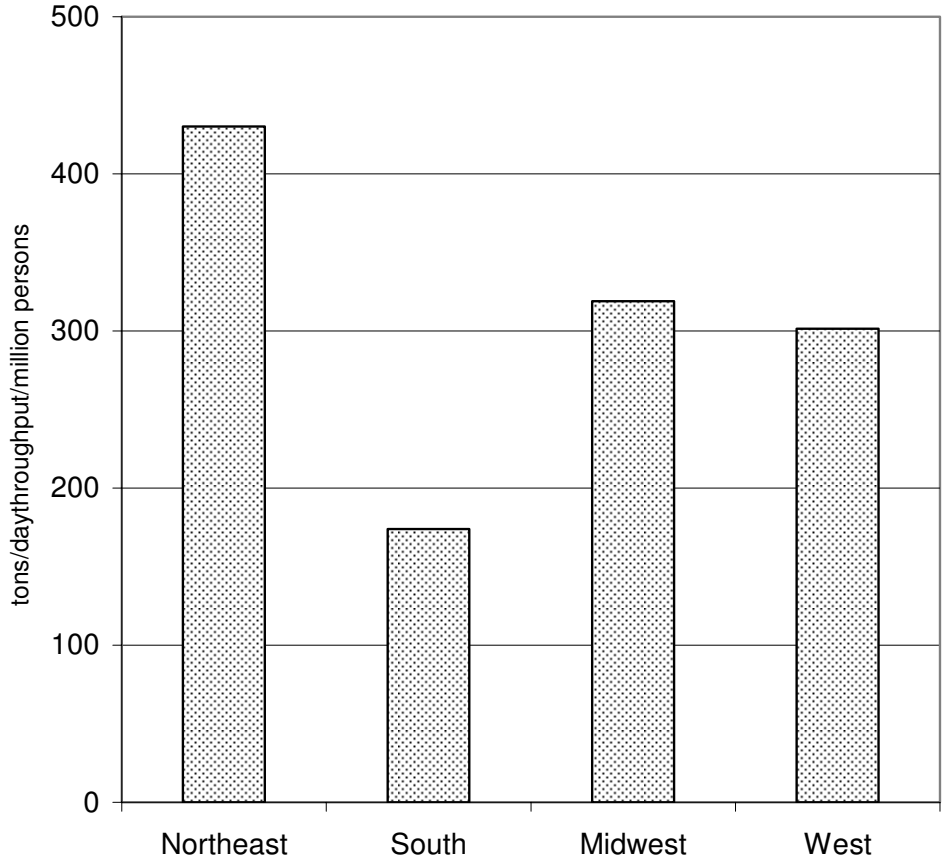
Table 26

MATERIALS RECOVERY FACILITIES, 2009

Region	Number	Estimated Throughput (tpd)
NORTHEAST	147	23,769
SOUTH	161	19,699
MIDWEST	144	21,320
WEST	126	21,565
U.S. Total	**578**	**86,353**

Source: Governmental Advisory Associates, Inc.

Figure 20. Estimated MRF throughput, 2009
(Tons per day per million persons)

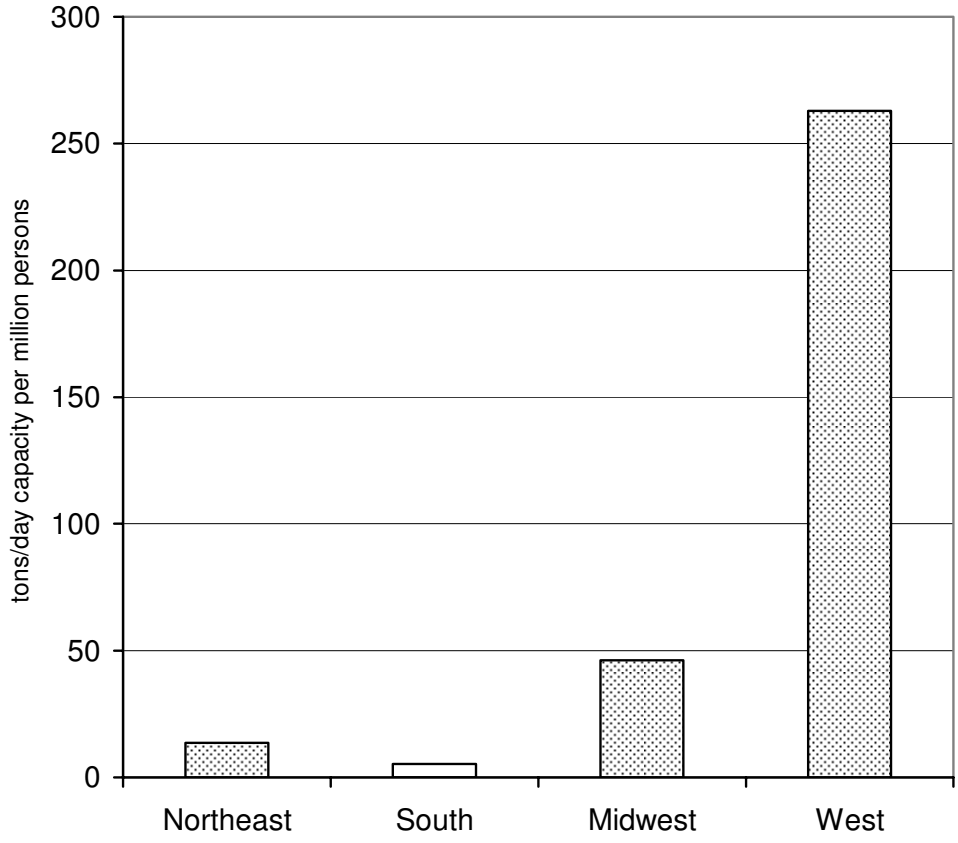


Source: U.S. Census Bureau, Governmental Advisory Associates, Inc.

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 some 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 2009, there were reported 25 mixed waste processing facilities in the U.S., handling about 23,000 tons of waste per day. The Western region has the largest concentration of these processing facilities (representing over 80 percent of the daily throughput).

Figure 21. Mixed waste processing estimated throughput 2009 (tons per day per million persons)

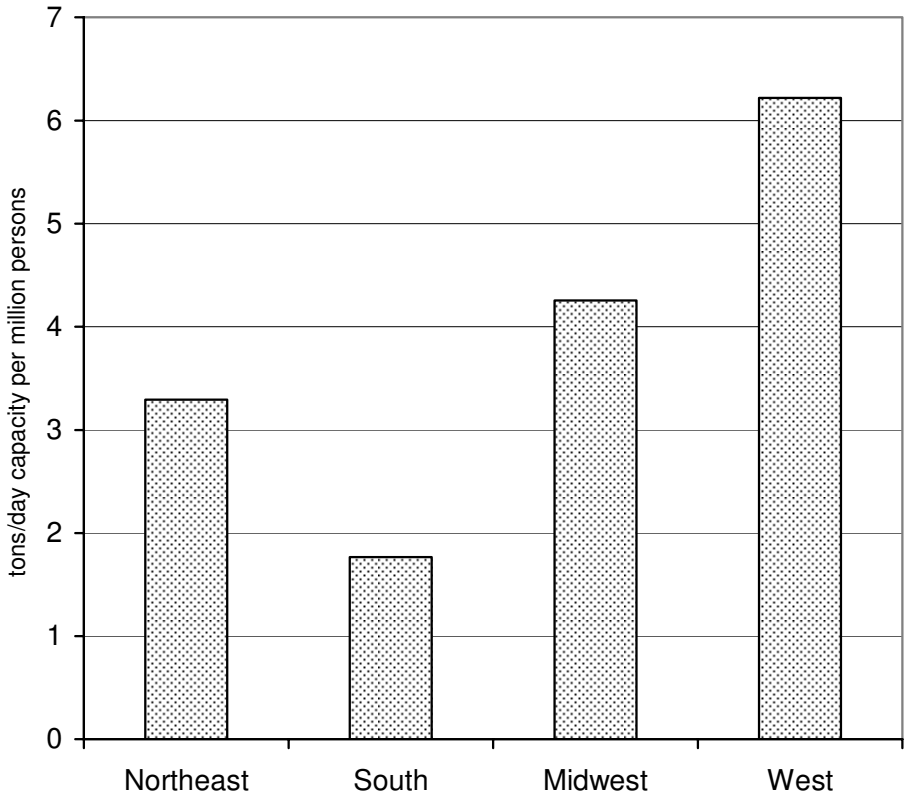


Source: U.S. Census Bureau; Governmental Advisory Associates, Inc.

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 2009, there were 12 mixed waste composting facilities, four less than was reported in 2007.

Nationally, mixed waste composting facilities handled about 1,100 tons per day in 2009, down from 1,500 tons per day in 2007. In 2009, the highest processing capacity per million persons was found in the West and Midwest, as shown in Figure 22.

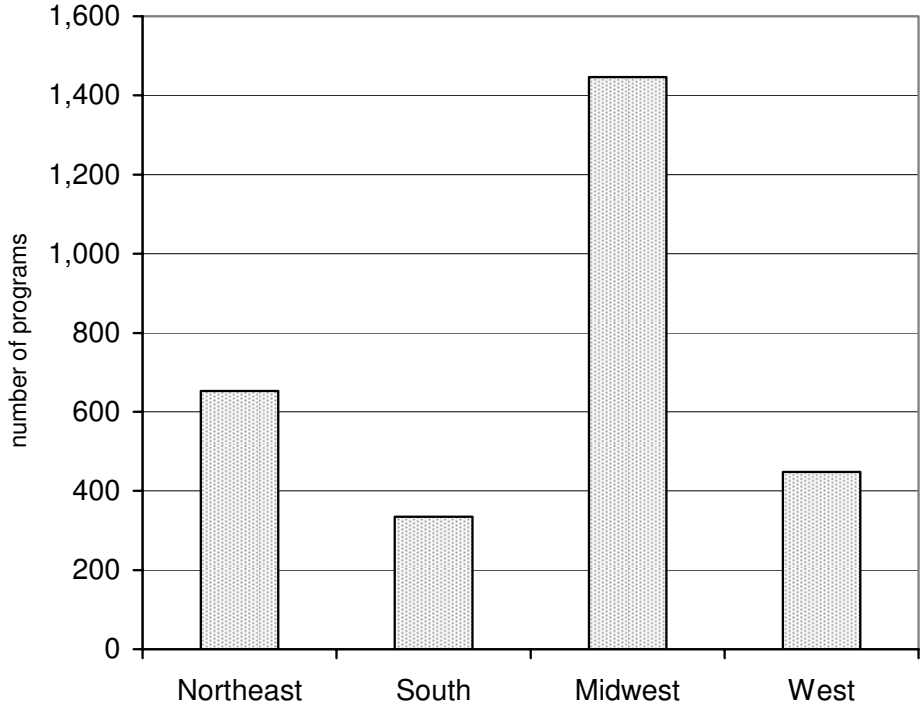
Figure 22. MSW composting capacity, 2009
(Capacity in tons per day per million persons)



Source: U.S. Census Bureau; *BioCycle,* November 2009.

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 2009, about 2,900 yard trimmings composting programs were documented from a search of state environmental websites. In 2009, about 50 percent of these programs were in the Midwest region, as shown in Figure 23. Based on 19.9 million tons of yard trimmings recovered for composting in the United States (Table 2, Chapter 2), yard trimmings composting facilities handled approximately 54,500 tons per day in 2009.

Figure 23. Yard trimmings composting programs, 2009 (In number of programs)



Source: Internet search: includes data cited by 41 state environmental websites.

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 2009 design capacity of 94,721 tons per day. There were 87 WTE facilities in 2009 (Table 27), down from 102 in 2000. In tons of capacity per million persons, the Northeast region had the most MSW combustion capacity in 2009 (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 2009, with tires contributing a majority of the total.

Table 27

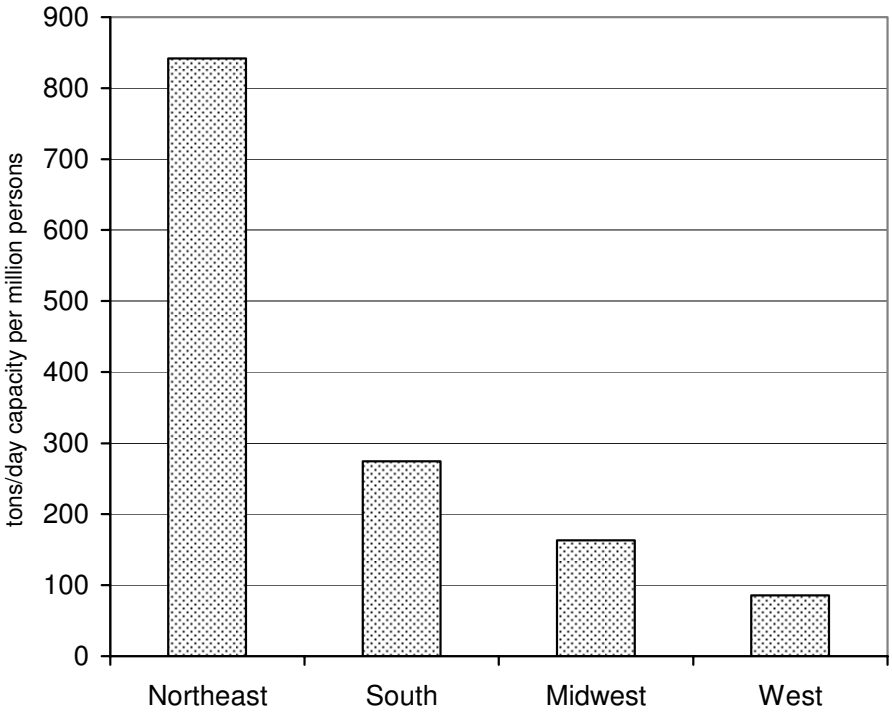
MUNICIPAL WASTE-TO-ENERGY PROJECTS, 2009

Region	Number Operational	Design Capacity (tpd)
NORTHEAST	40	46,537
SOUTH	23	31,131
MIDWEST	16	10,912
WEST	8	6,141
U.S. Total*	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. Latest report available.

Figure 24. Municipal waste-to-energy capacity, 2009 (Capacity in tons per million persons)



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

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 separately[7]. (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 2009, there were 1,908 municipal solid waste landfills reported in the United States. 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 West, 35 percent in the South, and 21 percent in the Midwest. Less than 7 percent are located in the Northeast.

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

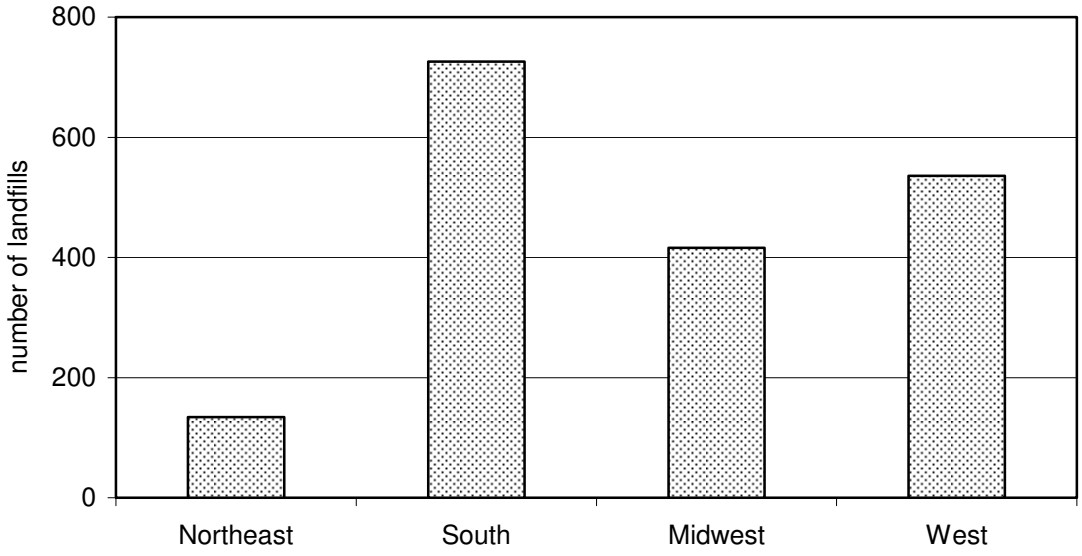
Table 28

LANDFILL FACILITIES, 2009

Region	Number of Landfills
NORTHEAST	128
SOUTH	668
MIDWEST	394
WEST	718
U.S. Total	1,908

Source: *BioCycle* October 2010.

Figure 25. Number of landfills in the U.S., 2009



Source: *BioCycle* October 2010.

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.

Historically, municipal solid waste generation has grown steadily (from 88 million tons in 1960 to 243 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.

Table 29

GENERATION, MATERIALS RECOVERY, COMPOSTING, COMBUSTION, AND DISCARDS OF MUNICIPAL SOLID WASTE, 1960 TO 2009
(In thousands of tons and percent of total generation)

	Thousands of Tons								
	1960	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Generation	88,120	121,060	151,640	208,270	242,540	252,380	254,980	251,020	242,960
Recovery for recycling	5,610	8,020	14,520	29,040	53,010	59,310	63,090	61,750	61,270
Recovery for composting*	Neg.	Neg.	Neg.	4,200	16,450	20,550	21,710	22,100	20,750
Total Materials Recovery	5,610	8,020	14,520	33,240	69,460	79,860	84,800	83,850	82,020
Discards after recovery	82,510	113,040	137,120	175,030	173,080	172,520	170,180	167,170	160,940
Combustion with energy recovery**	0	400	2,700	29,700	33,730	31,620	31,970	31,550	29,010
Discards to landfill, other disposal†	82,510	112,640	134,420	145,330	139,350	140,900	138,210	135,620	131,930

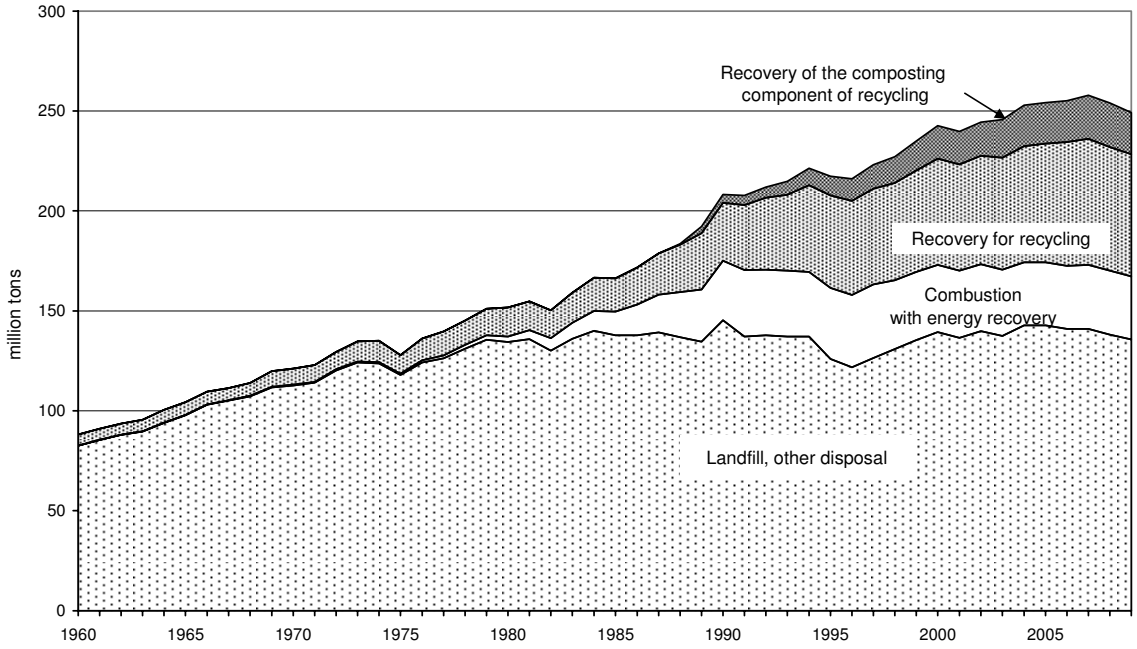
	Pounds per Person per Day								
	1960	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
Generation	2.68	3.25	3.66	4.57	4.72	4.67	4.63	4.52	4.34
Recovery for recycling	0.17	0.22	0.35	0.64	1.03	1.10	1.15	1.11	1.09
Recovery for composting*	Neg.	Neg.	Neg.	0.09	0.32	0.38	0.39	0.40	0.37
Total Materials Recovery	0.17	0.22	0.35	0.73	1.35	1.48	1.54	1.51	1.46
Discards after recovery	2.51	3.03	3.31	3.84	3.37	3.19	3.09	3.01	2.88
Combustion with energy recovery**	0.00	0.01	0.07	0.65	0.66	0.58	0.58	0.57	0.52
Discards to landfill, other disposal†	2.51	3.02	3.24	3.19	2.71	2.61	2.51	2.44	2.36
Population (thousands)	179,979	203,984	227,255	249,907	281,422	296,410	301,621	304,060	307,007

	Percent of Total Generation								
	1960	**1970**	**1980**	**1990**	**2000**	**2005**	**2007**	**2008**	**2009**
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%	14.0%	21.9%	23.5%	24.8%	24.6%	25.2%
Recovery for composting*	Neg.	Neg.	Neg.	2.0%	6.7%	8.1%	8.5%	8.8%	8.6%
Total Materials Recovery	6.4%	6.6%	9.6%	16.0%	28.6%	31.6%	33.3%	33.4%	33.8%
Discards after recovery	93.6%	93.4%	90.4%	84.0%	71.4%	68.4%	66.7%	66.6%	66.2%
Combustion with energy recovery**	0.0%	0.3%	1.8%	14.2%	13.9%	12.5%	12.5%	12.6%	11.9%
Discards to landfill, other disposal†	93.6%	93.1%	88.6%	69.8%	57.5%	55.9%	54.2%	54.0%	54.3%

* Composting of yard trimmings, food scraps and other MSW organic material. Does not include backyard composting.
** Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets and tire-derived fuel). 2009 includes 25,930 MSW, 520 wood, and 2,560 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

Figure 26. Municipal solid waste management, 1960 to 2009



Source: Franklin Associates, A Division of ERG

Recovery has increased steadily. Combustion with energy recovery, as a percentage of generation, has been declining (11.9 percent of generation in 2009). MSW discards to landfills rose to about 141 million tons in 2005, and then declined to 132 million tons in 2009. As a percentage of total MSW generation, discards to landfills or other disposal has consistently decreased–from 89 percent of generation in 1980 to about 54 percent in 2009.

CHAPTER 3

REFERENCES

GENERAL

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

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

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

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

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

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

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

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

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

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2005 Facts and Figures*. EPA530-R-06-011. October 2006. http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/mswchar05.pdf.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2001 Facts and Figures*. EPA/530-R-03-011. October 2003. http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/msw2001.pdf.

U.S. Environmental Protection Agency. *Municipal Solid Waste in The United States: 2000 Facts and Figures*. EPA/530-R-02-001. June 2002. http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/report-00.pdf.

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

SOURCE REDUCTION

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

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

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

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

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

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

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

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

RECOVERY FOR RECYCLING AND COMPOSTING

Alabama Department of Environmental Management. Waste Remediation Programs. http://www.adem.state.al.us/programs/land/default.cnt

American Beverage Association. 2008 ABA Community Survey Final Report Rev. 02 September 2009. http://flrecycling.org/Resources/Downloads/American-Beverage-Association-Community-Recycling-Survey

American Forest &Paper Association 2007 Community Survey Executive Summary. http://www.paperrecycles.org/news/exec_summ.html

Arkansas Department of Environmental Quality. Arkansas Recycling Marketing Directory. www.adeq.state.ar.us/solwaste/branch_market_dev/mkt_dev.asp#Search

Arsova, Ljupka, et al. "The State of Garbage in America." *BioCycle*. December 2008

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

Businesses & Environmentalists Allied for Recycling (BEAR). *Understanding Beverage Container Recycling*. October 2001.

California Department of Resources Recycling and Recovery (CalRecycle). Solid Waste Information System (SWIS). Facility Site Listing. http://www.calrecycle.ca.gov/SWFacilities/Directory/SearchList/List?FAC=Disposal&OPSTATUS=Active&REGSTATUS=Permitted

Colorado Department of Public Health and Environment. Final Report on Inventory and Database of Colorado Diversion Activity. www.cdphe.state.co.us/oeis/p2_program/grantreports/sow3finalreport.pdf

Colorado Department of Public Health and Environment. Hazardous Materials and Waste Management Division. HSRF Year-to-Date Cubic Yards Reported 2008. http://www.cdphe.state.co.us/hm/swreport/hsrf2008.pdf

Colorado Municipal League. Municipal Residential Curbside Recycling Services. http://www.coloradocurbside.com/surveytables/curbsidecityservice.html

Connecticut Department of Environmental Protection. Active Leaf Composting Facilities. www.ct.gov/dep/cwp/view.asp?a=2718&q=325374&depNav_GID=1645

Connecticut Department of Environmental Protection. Summer 2008 CT DEP Municipal Solid Waste Management Full cost Accounting Survey. Curbside Pickup of Residential Bottles, Cans, & Paper (BCP) for Recycling. http://www.ct.gov/dep/lib/dep/reduce_reuse_recycle/muni_state_agency/muni_full_cost_acct_survey_report_2_section_2.pdf

Container Recycling Institute. 2006. www.container-recycling.org/

Container Recycling Institute. 2010. Bottle Bill Resource Guide. Bottle Bills in the USA. http://www.bottlebill.org/legislation/usa/delaware.htm

County of Maui Hawaii. http://www.co.maui.hi.us/

Delaware Department of Natural Resources and Environmental Control. Yard Waste in Delaware. http://www.dnrec.delaware.gov/yardwaste/Pages/Default.aspx

Delaware Solid Waste Management Authority. Reports. 2010 Statewide Solid Waste Management Plan. Statewide Solid Waste Management Plan for Delaware: Moving Toward Zero Waste. http://dswa.com/pdfs/Statewide%20Solid%20Waste%20Mgmt%20PlanAdopted42210.pdf

District of Columbia Department of Public Works. http://dpw.dc.gov/DC/DPW/

Florida Department of Environmental Protection. Yard Trash Processing Facilities Database. www.dep.state.fl.us/waste/categories/solid_waste/pages/yardtrash.htm

Georgia Department of Community Affairs. 2009 Solid Waste Management Annual Report. 2009 Solid Waste and Recyclable Collection. Solid Waste & Recycling Collection 2009 Update. http://www.dca.state.ga.us/development/research/programs/downloads/SWAR2009Collection.pdf

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

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

Goldstein, Nora. "The State of Garbage in America." *BioCycle.* October 2010.

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

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

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

Governmental Advisory Associates. Custom report. 2006, 2007, 2008, 2009.

Governmental Advisory Associates. Personal communication with Eileen Berenyi. 1998, 2002.

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

Idaho Department of Environmental Quality. Waste. http://www.deq.idaho.gov/waste/

Illinois Environmental Protection Agency. Annual Landfill Capacity Report. www.epa.state.il.us/land/landfill-capacity/2007/index.html

Indiana Department of Environmental Management. Recycle Indiana. Composting. www.in.gov/recycle/5725.htm

Iowa Department of Natural Resources. Organics and Composting. www.iowadnr.gov/waste/recycling/organics/index.html

Kansas Department of Health and Environment. Waste Management. http://public1.kdhe.state.ks.us/Landfills/Landfills.nsf?Opendatabase

Kentucky Department of Environmental Protection. Division of Waste Management. Recycling and Local Assistance Branch. http://waste.ky.gov/RLA/Pages/default.aspx

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

Maine Department of Environmental Protection. Bureau of Remediation & Waste Management. File Room / Reports Generated from Databases. www.maine.gov/dep/rwm/data/

Maine State Planning Office. Report: Residential Recycling Year: 2008. http://www.maine.gov/spo/recycle/docs/data/2008data/ResidentRecycling.pdf

Maryland Department of the Environment. Land Publications & Reports. Recycling. http://www.mde.state.md.us/Programs/LandPrograms/Recycling/publications/

Massachusetts Department of Environmental Protection. Landfills, Transfer Stations & Compost Sites. www.mass.gov/dep/recycle/solid/swfacil.htm

Michigan Department of Natural Resources and Environment. www.michigan.gov/documents/deq/DEQ-WHMD-List_Registered_Compost_Sites_230193_7.pdf

Minnesota Pollution Control Agency. Compost. www.pca.state.mn.us/waste/compost.html#pbrsites

Mississippi Department of Environmental Quality. Recycling Directories. www.deq.state.ms.us/MDEQ.nsf/page/Recycling_RecyclingDirectories?OpenDocument

Montana Department of Environmental Quality. http://www.deq.mt.gov/Recycle/Montana_Recyclables_new.mcpx

Municipality of Anchorage Alaska. http://www.muni.org/departments/sws/recycle/Pages/default.aspx

Nebraska Department of Environmental Quality. Integrated Waste Management. List of Permitted Facilities. www.deq.state.ne.us/IntList.nsf/Web+List?OpenView&Start=1&Count=125

Nevada Division of Environmental Protection. Nevada Solid Waste Landfills. http://ndep.nv.gov/BWM/landfill.htm#solid_nevada

New Hampshire Department of Environmental Services. Composting Facilities in New Hampshire. http://des.nh.gov/organization/divisions/waste/swrtas/composters.htm

New Jersey Department of Environmental Protection. NJDEP Approved Operating Commercial Sanitary Landfills. www.state.nj.us/dep/dshw/lrm/aocslf.htm

New Jersey. Department of Environmental Protection. Recycling Markets Directory. www.state.nj.us/dep/dshw/recycling/recymkts_directory.htm

New Mexico Recycling Coalition. http://www.recyclenewmexico.com/index.htm

New York State. Department of Environmental Conservation. List of Compost Facilities in New York State. www.dec.ny.gov/chemical/55447.html

North Carolina Department of Environment and Natural Resources. Division of Waste Management. www.wastenotnc.org/DATARPTS2003_3ColA.HTM

North Dakota Department of Health - Division of Waste Management. 2010 Curbside Pick-Up Programs. http://www.ndhealth.gov/WM/Publications/CommunityRecyclingInNorthDakota.pdf

Ohio Environmental Protection Agency. Division of Solid and Infectious Waste Management. http://www.epa.ohio.gov/Default.aspx?alias=www.epa.ohio.gov/dsiwm

Oregon Department of Environmental Quality. www.deq.state.or.us/lq/sw/disposal/permittedfacilities.htm

Oregon Department of Environmental Quality. Fact Sheet. Recycling Awareness Week: Facts and Figures. http://www.deq.state.or.us/lq/pubs/docs/sw/FactsFiguresRAW.pdf

Pennsylvania Department of Environmental Protection. Recycling Works. http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/recywrks/recywrks3.htm

Pennsylvania Recycling Markets Center. www.parmc.org/

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

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

Rhode Island Department of Environmental Management. Permitted Facilities. www.dem.ri.gov/programs/benviron/waste/pdf/swfacs.pdf

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

South Carolina Department of Health and Environmental Control. Solid Waste Annual Reports. http://www.scdhec.gov/environment/lwm/recycle/

Spencer, Robert, Rhodes Yepsen and Nora Goldstein. *BioCycle* Nationwide Survey. "Mixed MSW Composting in Transition." November 2007.

State of Hawaii Department of Health Solid Waste Section. Landfill Database – Neighbor Islands. http://hawaii.gov/health/environmental/environmental/waste/sw/pdf/neighborlandfills.pdf

State of Hawaii Department of Health Solid Waste Section. Landfill Database Oahu. http://hawaii.gov/health/environmental/environmental/waste/sw/pdf/oahulandfills.pdf

Texas Commission on Environmental Quality. Municipal Solid Waste in Texas: A Year in Review FY 2008 Data Summary and Analysis. October 2009. www.tceq.state.tx.us/assets/public/comm_exec/pubs/as/187_09.pdf

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

U.S. Census Bureau. Population Division. Table 1. Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico. April, 2000 to July 1, 2009.

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

Utah Department of Environmental Quality. Division of Solid & Hazardous Waste. http://www.hazardouswaste.utah.gov/Solid_Waste_Section/SolidWasteSection.htm#DisposalFacilities

Virginia Department of Environmental Quality. www.deq.virginia.gov/waste/pdf/allava.pdf

Washington State Department of Ecology. www.ecy.wa.gov/pubs/0807061.pdf

West Virginia Department of Commerce. http://wvcommerce.org/energy/default.aspx

Wisconsin Department of Natural Resources. Facility Lists. http://dnr.wi.gov/org/aw/wm/faclists/WisLic_SWCompost_byCnty_withWaste.pdf

Wyoming Department of Environmental Quality. Solid & Hazardous Waste Division. http://deq.state.wy.us/shwd/Recycling/

Yepsen, Rhodes. "2009 MSW Composting Update. *BioCycle* Nationwide Survey. Mixed Waste Composting Review." *BioCycle*. November 2009.

Yepsen, Rhodes and Nora Goldstein. *Biocycle* Nationwide Survey. "Source Separated Residential Composting in the U.S." December 2007.

COMBUSTION WITH ENERGY RECOVERY

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

Arsova, Ljupka, et al. "The State of Garbage in America." BioCycle. December 2008.

Goldstein, Nora. "The State of Garbage in America." *BioCycle.* October 2010. Prepublication data.

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

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

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

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

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

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

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

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

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

Michaels, Ted. "The 2007 IWSA Directory of Waste-to-Energy Plants." Integrated Waste Services Association. October 27, 2007

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

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

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

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

APPENDIX A

MATERIALS FLOW METHODOLOGY

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

DOMESTIC PRODUCTION

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

CONVERTING SCRAP

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

ADJUSTMENTS FOR IMPORTS/EXPORTS

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

DIVERSION

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

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

ADJUSTMENTS FOR PRODUCT LIFETIME

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

RECOVERY

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

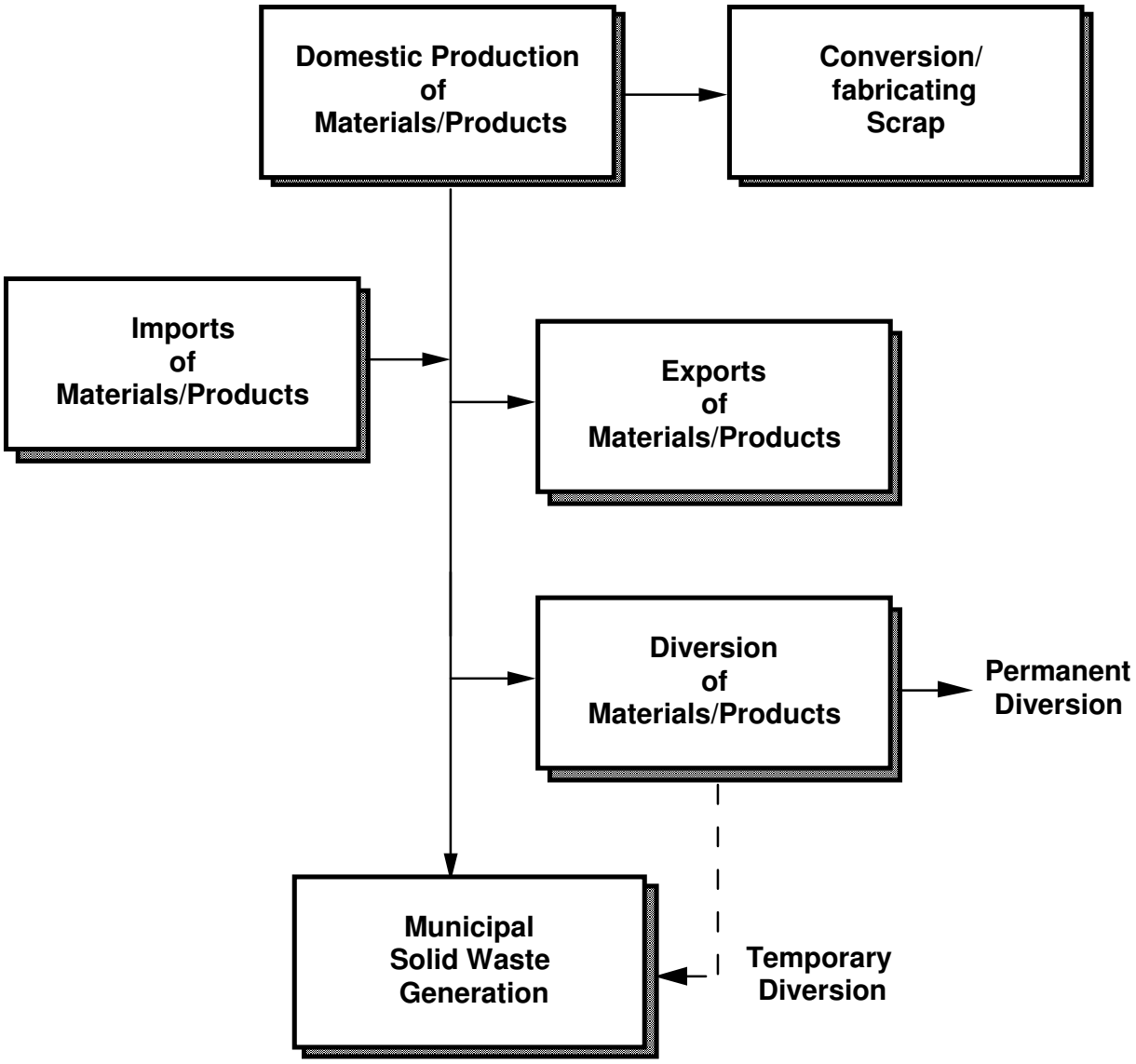


Figure A-1. Material flows methodology for estimating generation of products and materials in municipal solid waste.

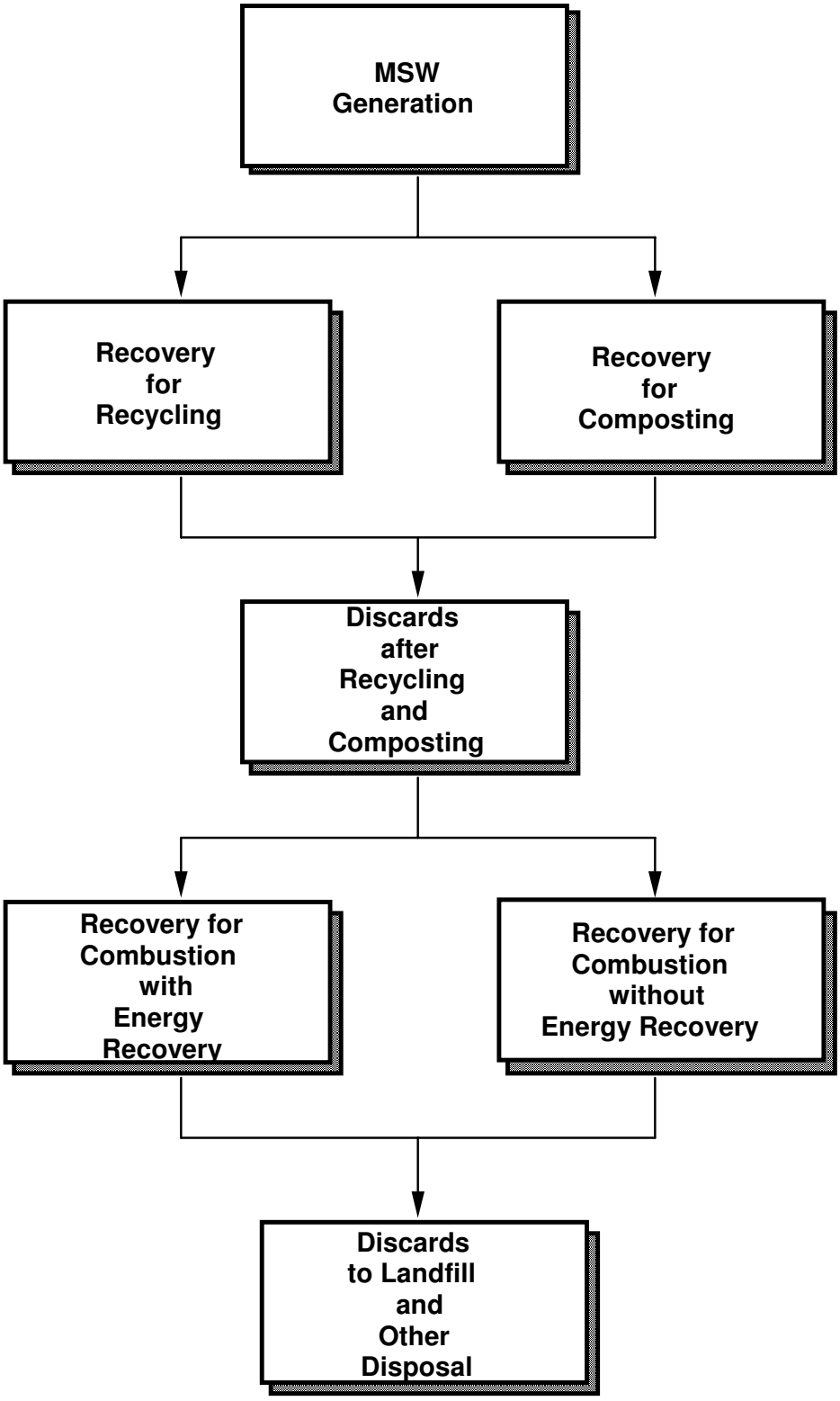


Figure A-2. Material flows methodology for estimating discards of products and materials in municipal solid waste.

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