

**WISCONSIN WASTE  
CHARACTERIZATION & MANAGEMENT  
STUDY UPDATE 2000**

**Prepared for**

**State of Wisconsin  
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**By**

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## CHAPTER 1

### SOLID WASTE GENERATION

#### INTRODUCTION

This chapter presents estimated solid waste generation in Wisconsin for 2000. Included for comparison, are the 1990 and 1995 estimates from two previous reports prepared for the Wisconsin Department of Natural Resources<sup>1</sup>. Some estimates from the 1995 study have been revised where more recent data and/or improved estimated techniques were available.

As before, estimates of municipal solid waste (MSW) were based largely on the use of production data (by weight) for the materials and products that are ultimately discarded as wastes. Information on the geographic flow of these materials and products was used along with economic and demographic data to estimate quantities of various MSW components in Wisconsin. The MSW definition used in this report is consistent with that used in the annual Environmental Protection Agency MSW characterization reports<sup>2</sup>. This allows Wisconsin to compare local MSW management practices with national management practices.

This MSW measurement approach assumes that products are purchased, used and become part of the solid waste stream. Generation refers to these products before recovery or disposal. Products are assumed as generated solid wastes at the end of their useful life. The measure of useful life varies among materials and products. Packaging materials are assumed as wastes in the same year as produced whereas appliances are assigned various years of life depending on industry information from 1980 to 1999 for each type of appliance.

Where Wisconsin specific production data were not available, national production data were adjusted by economic or demographic indicators specific to Wisconsin. For example, the quantity of disposable diapers sold in the U.S. is known but is not available for individual states. To estimate the portion of disposable diapers generated by Wisconsin, Census Bureau statistics available for both the U.S. and Wisconsin were used. These statistics included the number of "live births" in 1998 and 1999. Wisconsin's percentage of the total U.S. was the same for both of these data points. Since it was assumed that Wisconsin's per child usage of disposal diapers was typical of the U.S., this percentage was applied to national generation of disposable diapers to estimate Wisconsin generation.

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<sup>1</sup> *Wisconsin Waste Generation and Composition Study Waste Management Study*. Franklin Associates, Ltd. September 1992. *Wisconsin Waste Characterization & Management Study Update*. Franklin Associates, Ltd. February 1998.

<sup>2</sup> *Municipal Solid Waste In The United States: 1999 Facts and Figures*. July 2001. EPA530-R-01-014. And previous editions.

Other types of information were used to estimate MSW components not related to economic production. For example, yard trimmings were estimated using WI DNR data. Additionally, estimated generation of a few non-MSW components were developed based on data provided by WI DNR.

The sections below contain descriptions of the methodologies used to estimate Wisconsin-generated solid wastes (including non-MSW waste streams) along with the estimates developed.

### DEFINITION OF TERMS USED IN THIS REPORT

**Municipal solid waste (MSW)** includes durable goods (excluding vehicles and other moving equipment), nondurable goods, containers and packaging, food scraps, yard trimmings and miscellaneous inorganic wastes from **residential** (single- and multi-family households) and **non-residential** (commercial, institutional and industrial) sources. MSW does not include construction and demolition debris, vehicle bodies, municipal sludges, combustion ash, industrial process wastes, and trees and brush from parks, streets or power line trimmings that might also be disposed in municipal waste landfills or incinerators.

**Source reduction** activities reduce the amount or toxicity of wastes at the source of production or first use before they enter the municipal solid waste management system. Reuse of products such as refillable glass bottles, reusable plastic food storage containers, or refurbished wood pallets are examples of source reduction. Management of yard trimmings on-site is another example that has a substantial effect on reducing the amount of municipal solid waste generated.

**Generation** refers to the amount of materials and products that enter the waste stream before recycling, composting at central facilities, landfilling or combustion takes place. Generation figures do not include source reduction estimates.

**Recovery** of materials, as referred to in this report, means removing certain materials/products from the waste stream for the purpose of **recycling** (including composting at centralized facilities).

**Diversion** of materials from disposal may be accomplished through source reduction, reuse, and recycling (including composting at centralized facilities).

**Discards** include the solid wastes remaining after recycling and composting at centralized facilities. In this report, mathematically, discards equal generation minus recycling and composting. These discards are usually combusted with or without energy recovery or disposed of in landfills, although some solid waste is littered, stored, or disposed on site, particularly in rural areas.

## **MUNICIPAL SOLID WASTE**

### **Methodology**

**Old Newspaper (ONP).** Old newspapers, as defined here, include all newsprint distributed with daily and weekly newspapers, newsprint type inserts, inserts printed on papers other than newsprint (i.e., ground wood, supercalendered and glossy or coated stock), suburban newspapers, shoppers, free distributions, etc.

ONP generation in Wisconsin was based on the Wisconsin publishers report to the WI DNR and published data on the circulation and weights of daily newspapers produced in Wisconsin as well as those entering Wisconsin from out-of-state<sup>3</sup>. Adjustments were made for daily newspapers leaving the state. Smaller weekly newspaper circulation figures were added to the total ONP estimate for the state. Newspaper production generates pressroom scrap, which is considered a preconsumer waste and not part of MSW. The ONP generation estimates are finished product weights and do not include the material lost as scrap.

**Old Corrugated Containers.** Generation of OCC was based on the application of corrugated container consumption data by different economic sectors—as provided by the Fibre Box Association<sup>4</sup>. Statewide employment data for Wisconsin (from County Business Patterns) were used in conjunction with estimated rates of OCC generation by economic sector<sup>5</sup> to estimate statewide OCC.

**Old Magazines.** Data on the circulation in Wisconsin of the top 25 U.S. magazines were used in estimating this category<sup>6</sup>. Wisconsin circulation, as a percentage of national circulation of the same 25 magazines, was multiplied by the national quantity of total magazines generated by weight. Glossy catalogues are included in the category.

**High Grade Office Paper.** High grade office paper includes white ledger paper, copy paper and computer printout. Estimates of Wisconsin generation of high grade office paper was based on application of established generation rates to Wisconsin government and office employment and population data<sup>5</sup>. Allowances were made for diversion of office papers into storage and for papers coming out of storage and entering the waste stream.

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<sup>3</sup> Newsprint consumption by individual newspapers - Editor & Publisher. Wisconsin specific subscriptions - SRDS *Circulation 2001*.

<sup>4</sup> Fibre Box Association. 2001.

<sup>5</sup> Franklin Associates, Ltd.

<sup>6</sup> SRDS *Circulation 2001*.

**Mixed Waste Paper.** This category includes books, third class mail, directories, commercial printing, tissue paper and paper towels, paper plates and cups, other nonpackaging paper, milk cartons, folding cartons, other paperboard packaging, paper bags and sacks, wrapping papers and other packaging paper. Wisconsin generation was based on national per capita generation rates for these paper grades applied to Wisconsin population estimates.

Since third class mail comprises approximately 26 percent of mixed waste paper by weight, the U.S. Postal Service was contacted in an attempt to find regional or state data for the generation of third class mail in Wisconsin. However, according to the national and regional representatives, neither regional nor state level data are available for the distribution of third class mail. Thus, third class mail generation for Wisconsin was calculated by adjusting the U.S. generation of third class mail to Wisconsin's population.

**Metal Containers.** The generation of beverage containers is a function of beverage consumption and the mix of container types used. Data on soft drink consumption is available by regions of the U.S. and beer consumption is available for each state<sup>7</sup>. The mix of containers used for beer is also available by state whereas only national data is available for determining the mix of containers used for soft drinks. This information was used to estimate aluminum and steel beverage cans in Wisconsin. Other metal cans—mostly steel food cans—were estimated from national per capita values. Wisconsin's steel food can consumption was assumed to be typical of U.S. consumption.

**Plastics.** Plastic beverage containers were determined by the same methodology as described for metal beverage cans except for the addition of data on milk, bottled water, sports drinks, teas, etc. packaged in plastic. Regional milk consumption and packaging data was used along with regional data on bottled water, sports drinks and teas<sup>8</sup>. The regional milk consumption and packaging data included information on the use of plastic containers and container weight whereas plastic container use for sports drinks, fruit juice and fruit drinks, and ready to drink (RTD) teas was developed through examination of the mix of containers in stores. Bottled water packaging mix and container weight were available on a national basis.

Generation of other plastic containers, packaging and nondurable goods was based on the assumption that Wisconsin consumption patterns are similar to the national average. Published data on resin sales by major market or by patterns of consumption were used and allocated to Wisconsin based on population.

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<sup>7</sup> *Beverage World*. The Beer Institute.

<sup>8</sup> U.S. Department of Agriculture Dairy Division. *Beverage World*.

**Glass Containers.** Glass beverage containers were determined by using the same data sources and methodology used for metal and plastic beverage containers. Other glass containers, however, were based on using national generation rates. Non-container glass in MSW is found in durable goods including major appliances, furniture and furnishings, and miscellaneous durables.

**Yard Trimmings.** Generation of yard trimmings in 2000 was based on quantities reported by WI DNR, as collected for composting or other recovered use. The WI DNR data was supplemented with data received from the recycling survey conducted as part of this report. Since yard trimmings were banned from landfilling in 1993, much greater on-site management of yard trimmings occurred in 1995 and 2000 than in 1990. Yard trimmings managed on-site were not included as generation in this report.

**Food Waste.** Food waste in MSW includes that from households, commercial establishments, institutional establishments such as schools and hospitals, and industrial sources such as factory lunchrooms, but excludes food processing waste. Commercial food waste generation in Wisconsin was based partly on per capita generation rates of employees at hospitals, nursing homes, restaurants, public schools, and universities and colleges. The estimated per employee generation rates<sup>9</sup>, were multiplied by the number of employees in the corresponding sectors. These generation factors were supplemented with similar factors for prisons and grocery stores<sup>10</sup>. Employment statistics were found in the 1999 County Business Patterns, published by the U.S. Census Bureau. The number of prisoners in Wisconsin was provided by the Wisconsin Department of Corrections. Residential food waste generation was estimated by applying a per capita rate to Wisconsin population<sup>10</sup>.

The method described above estimates a higher generation of food waste than previously used methods. This methodology was applied to 1995 employment statistics to provide a revised estimate for the 1995 data year. The revised 1995 value is 591,000 tons of food waste. Wisconsin's total generation of food waste in 2000 is an estimated 663,900 tons.

**Disposable Diapers.** Generation of diapers was based on the percentage of children born in Wisconsin. The percentage of U.S. children born in Wisconsin was 1.71 percent in 1998 and 1.72 percent in 1999. Since approximately 1.9 percent of the U.S. population lives in Wisconsin, the estimated quantity of diapers generated in Wisconsin is lower than total population might suggest. The percentage of births in Wisconsin was multiplied by the estimated national generation of diapers to estimate diaper generation.

**Vehicle Batteries.** The number of vehicles registered in Wisconsin was used as the basis for allocating from the national consumption estimates for vehicle batteries.

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<sup>9</sup> Center for Biomass Programs and FORA.

<sup>10</sup> Franklin Associates, Ltd.

**Tires.** An estimated 97,300 tons of tires were introduced to Wisconsin's MSW stream in 2000. This value was estimated by comparing the total miles of vehicle travel in Wisconsin (a statistic published in Ward's Motor Vehicle Facts and Figures) with the same statistic on a national basis. The Wisconsin average per person miles driven is higher than the U.S. average. This factor was applied to the total U.S. generation of tires in 2000. The 1990 and 1995 estimates of tires generated in Wisconsin were revised to reflect the methodology used in this study update. The U.S. generation of tires is based on the number of car and truck tires removed from service (adjusted for retreads) times a weighted average tire weight. The *weighted* average tire weight (based on number of car *and* truck tires removed from service) was assumed to be 32.5 pounds per unit.

**Major Appliances.** The national database used to determine major appliance generation in Wisconsin includes industry data from 1980 to the present. The data detail the composition, quantity, and life of individual appliance types.

To determine the applicability of this database to Wisconsin generation of major appliances, a 1994 Census Bureau survey (the latest data available for Wisconsin) of households in Milwaukee was reviewed. This survey lists the number of occupied households in Milwaukee with various appliances.

A comparison of the Milwaukee statistics with the same U.S. statistics shows that the Milwaukee metropolitan area is similar to the U.S. in percentage of occupied households with refrigerators, ranges, ovens, washing machines and dryers. The percentage of households in Milwaukee was lower (81% of U.S.) for dishwashers but higher (135% of U.S.) for window air conditioners.

The factor used to estimate Wisconsin's generation of major appliances was based on government and industry data on appliance sales. Census bureau data on Wisconsin sales (in dollars) of major appliances in 1982, 1987 and 1992 and AHAM<sup>11</sup> Wisconsin sales data for 1995 and 1997 were used to estimate this component of Wisconsin's waste stream. Dollar sales of major appliances in Wisconsin were ratioed with corresponding national sales and applied to national generation to estimate major appliances in the 2000 Wisconsin waste stream.

**Furniture and Furnishings.** The approach to estimate furniture and furnishings for Wisconsin was the same as for major appliances. Census bureau furniture store sales data for 1982 through 1998 were used to estimate Wisconsin generation of furniture and furnishings in 2000 from the national estimate. The 1995 estimate of furniture and furnishings was revised to include more data points than the previous methodology.

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<sup>11</sup> Association of Home Appliance Manufacturers.

**Wood Pallets.** A primary use for wood pallets is shipping goods, usually goods that are packaged in corrugated boxes. Since Wisconsin's estimated generation of corrugated boxes was above national average, wood pallet generation was assumed to be higher than national average. Estimated generation of wood pallets in Wisconsin was determined by applying the ratio of generation of corrugated boxes in Wisconsin to the U.S. generation of corrugated boxes multiplied by the U.S. generation of pallets. The 1995 estimate of wood pallets was revised based on this methodology.

**Other MSW Components.** MSW components not listed above were estimated for Wisconsin based upon national per capita estimates for 2000<sup>12</sup>. These included textiles, rubber, leather, carpets and rugs, miscellaneous packaging, miscellaneous durables and miscellaneous inorganics. Consumer electronic generation, a subset of miscellaneous durables generation, was estimated for 2000. This delineation is not available for previous years.

Consumer electronic products, as defined for this report, include video and audio equipment and information age products. Video products are products such as standard televisions (TV), projection TV, high density TV, VCR decks, camcorders and laserdisc players. Audio products include rack audio systems, compact audio systems, portable compact discs, portable headset audio, total CD players and home radios. Information products include cordless/corded telephones, wireless telephones, telephone answering machines, fax machines, word processors, personal computers, computer printers, monitors and modems.

## **Generation**

**Total MSW Generation.** Total MSW generation from the state of Wisconsin is estimated at 3,890,000 tons for 1995 and 4,366,500 tons for 2000. (Table 1-1).

The 1995 total generation is revised from that shown in the 1998 report and is five percent higher than before. Generation estimates were increased for plastic containers, other plastic packaging, other plastic nondurable goods, food waste, tires and furniture and furnishings. Foam polystyrene and wood pallet generation estimates decreased. The changes reflect revised methodology from the 1998 report and, in the case of wood pallets, a revised national generation estimate. Tire generation is the only estimate revised from the 1990 estimates. The other 1990 category estimates were not revised because the necessary indicator data could not be found.

Total MSW generation in Wisconsin increased 12 percent between 1995 and 2000. Overall, most categories of MSW increased in generation. Those declining include magazines, steel cans, foam polystyrene packaging, and glass containers.

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<sup>12</sup> Franklin Associates, Ltd. internal working data.

Of the 11,960 tons per day of MSW generated in Wisconsin in 2000, approximately 55 percent was estimated to be from residential/household sources and 45 percent was estimated to be from non-residential sources.

**Per Capita MSW Generation.** Based on the revised estimate of total MSW generation in 1995, the corresponding average per capita generation rate for MSW in Wisconsin was estimated at 4.16 pounds per person per day (ppd). The average per capita MSW estimate for 2000 in the state is 4.46 ppd or seven percent higher.

Wisconsin's per capita MSW rate in 2000 was lower than the national rate estimated at 4.64 ppd in 1999. Wisconsin's landfill ban of yard waste is responsible for most of the reduced per capita rate.

Generation estimates are provided for 27 component categories of MSW in Table 1-1. Added detail on plastic and glass containers—two of the categories shown in Table 1-1—is provided below.

**Plastic Container Generation.** Generation of plastic containers in Wisconsin, estimated by HDPE, PET and other plastic resins, is shown for 1995 and 2000 in Table 1-2. The total quantity of plastic containers was higher in 2000 than in 1995. Compared with 1995, a lower volume of milk was consumed in 2000, which resulted in a lower generation of milk packaging. Other HDPE containers and PET containers were estimated at higher levels in 2000 than in 1995. Other plastic containers decreased in 2000. Over 80 percent of the plastic container generation was estimated to be from the residential sector.

**Glass Container Generation.** Generation of glass containers is shown to have decreased by 4 percent since 1995. A breakdown of glass containers by different uses is shown for both 1995 and 2000 in Table 1-3. Glass used for beer and non-beverage foods comprised 77 percent of the total quantity of glass containers shown for 2000. Seventy-nine percent of total glass containers were estimated from residences. A comparison between 1995 and 2000 shows trends in glass packaging. There has been a shift to plastic packaging from glass packaging, especially for soft drinks and food products.

**MSW Generation by Source.** The MSW generation estimates shown in Table 1-1 are divided between residential and non-residential sources. The residential estimates are further divided between single-family (up to four household per building) and multi-family (five or more households per building) sources in Table 1-4. The multi-family estimates were partly based on quantity data from Milwaukee multi-family households extrapolated to the population in multi-family households statewide. These materials include newspaper, corrugated containers, magazines, and aluminum, steel, glass, and plastic containers. For all other MSW components, it was determined that single-family and multi-family per capita estimates should be the same.

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Table 1-1  
Estimated Municipal Solid Waste Generation  
In Wisconsin 1990, 1995 and 2000

Waste Category	1990	1995	2000	2000 Generation By Source (1)	
	<u>Generation</u> (tons/year)	<u>Generation</u> (tons/year)	<u>Generation</u> (tons/year)	<u>Residential</u> (tons/year)	<u>Non-residential</u> (tons/year)
MSW					
Newspaper	218,590	227,600	228,730	194,420	34,310
Corrugated containers	431,500	573,790	661,580	66,160	595,420
Magazines	66,800	51,540	46,970	30,530	16,440
High grade office paper	124,490	130,470	159,710	39,930	119,780
Mixed waste paper	521,300	592,520	605,760	393,740	212,020
Aluminum beverage cans	35,300	32,850	32,950	26,360	6,590
Steel cans (2)	50,300	51,490	50,280	42,740	7,540
Foam polystyrene packaging	4,090	4,680 r	4,190	3,350	840
Foam polystyrene nondurable goods	4,370	5,170	5,390	1,350	4,040
Plastic containers (3)	47,930	57,070 r	70,730	57,870	12,860
Other plastic packaging (4)	79,510	96,740 r	130,020	104,020	26,000
Other plastic nondurable goods	78,110	93,910 r	108,580	54,290	54,290
Glass containers	200,300	199,410	191,270	150,760	40,510
Yard trimmings	491,000	225,070	287,580 (5)	258,820	28,760
Food waste	382,200	591,030 r	663,860	398,320	265,540
Disposable diapers	49,160	51,970	57,450	51,710	5,740
Vehicle batteries	29,780	37,860	38,530	1,930	36,600
Tires	76,760 r	80,610 r	97,260	4,860	92,400
Textiles, rubber, & leather products (6)	93,800	112,150	137,530	82,520	55,010
Carpets & rugs	32,590	43,530	49,040	39,230	9,810
Major appliances	67,960	69,810	71,310	13,760	57,550
Furniture & furnishings (7)	127,300	129,530 r	158,800	127,040	31,760
Miscellaneous durables (7)(8)	208,360	232,270	220,700	176,560	44,140
Consumer electronics			29,870	16,730	13,140
Wood pallets	154,990	122,930 r	174,390	0	174,390
Miscellaneous packaging	15,130	14,630 r	17,360	12,150	5,210
Miscellaneous inorganic wastes	60,200	61,440	66,710	33,360	33,350
<b>Total MSW</b>	<b>3,651,820</b>	<b>3,890,070</b>	<b>4,366,550</b>	<b>2,382,510</b>	<b>1,984,040</b>
				55%	45%
<b>Wisconsin population</b>	<b>4,891,769</b>	<b>5,124,971</b>	<b>5,363,675</b>		

(1) Source: FAL estimates. Residential includes multi-family households.

(2) Steel cans include bi-metal cans and "tin" cans.

(3) See Table 1-2 for container detail.

(4) Other plastic packaging includes bags, sacks, wraps and other closures.

(5) Quantity does not include yard trimmings managed on-site (estimated at 250,800 tons).

(6) Quantities shown include rubber from sources other than tires.

(7) Quantities shown include other glass.

(8) Quantities shown exclude rubber and leather which are included in Textiles, rubber, and leather.

r = revised

Source: Franklin Associates, Ltd.

Table 1-2  
Estimated Plastic Container Generation  
In Wisconsin

	Generation		Generation By Source, 2000	
	1995 (tons/year)	2000 (tons/year)	Residential (tons/year)	Non-residential (tons/year)
Plastic Containers				
HDPE milk	10,110	8,570	8,140	430
HDPE water, sport & fruit juice, RTD	190	380	300	80
HDPE pigmented	13,653 r	22,680	18,140	4,540
PET soft drink	13,460	19,550	15,640	3,910
PET wine & liquor	210	210	170	40
PET water, sport & fruit juice, RTD	3,251 r	8,670	6,940	1,730
Other plastic containers	16,200	10,670	8,540	2,130
Total Plastic Containers	57,070	70,730	57,870	12,860
			82%	18%

RTD = ready to drink tea

Source: Franklin Associates, Ltd.

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Total MSW generation from multi-family households (Table 1-4) was estimated at 11 percent of total residential MSW generation—slightly below the 11.9 percent of Wisconsin’s population estimated to be living in multi-family households. This is mainly due to less yard waste generation in multi-family households.

On a per capita rate, old newspapers are estimated at a higher rate in multi-family households. Since newspapers are sold on a household basis and, statistically, the number of people in multi-family households is lower than single-family households, the per capita rate is higher for old newspaper (ONP). Other products, such as steel food cans, are related to the number of individuals.

Table 1-3  
Estimated Glass Container Generation  
In Wisconsin

	Generation		Generation By Source, 2000	
	1995 (tons/year)	2000 (tons/year)	Residential (tons/year)	Non-residential (tons/year)
Glass Containers				
Beer	75,370	95,930	71,950	23,980
Soft drink	8,300	1,250	1,000	250
Wine and liquor	25,690	30,070	24,060	6,010
Other Beverage Glass (clear)	15,740	13,360	10,690	2,670
Other food glass (mostly clear)	74,310	50,660	43,060	7,600
Total Glass Containers	199,410	191,270	150,760	40,510
			79%	21%

Source: Franklin Associates, Ltd.

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Table 1-4  
Estimated Residential Municipal Solid Waste Generation  
In Wisconsin 2000

Waste Category	2000 Generation By Source		
	Residential (tons/year)	Single-Family (tons/year)	Multi-Family (tons/year)
<b>MSW</b>			
Newspaper	194,420	167,090	27,330
Corrugated containers	66,160	58,660	7,500
Magazines	30,530	25,940	4,590
High grade office paper	39,930	35,180	4,750
Mixed waste paper	393,740	346,900	46,840
Aluminum beverage cans	26,360	24,110	2,250
Steel cans	42,740	37,290	5,450
Foam polystyrene packaging	3,350	2,950	400
Foam polystyrene nondurable goods	1,350	1,190	160
Plastic containers	57,870	50,180	7,690
Other plastic packaging	104,020	91,650	12,370
Other plastic nondurable goods	54,290	47,830	6,460
Glass containers	150,760	131,180	19,580
Yard trimmings	258,820	257,000	1,820
Food waste	398,320	350,940	47,380
Disposable diapers	51,710	45,560	6,150
Vehicle batteries	1,930	1,700	230
Tires	4,860	4,280	580
Textiles, rubber, & leather products	82,520	72,700	9,820
Carpets & rugs	39,230	34,560	4,670
Major appliances	13,760	12,120	1,640
Furniture & furnishings	127,040	111,930	15,110
Miscellaneous durables	176,560	155,560	21,000
Consumer electronics	16,730	14,740	1,990
Miscellaneous packaging	12,150	10,700	1,450
Miscellaneous inorganic wastes	33,360	29,390	3,970
<b>Total MSW</b>	<b>2,382,510</b>	<b>2,121,330</b>	<b>261,180</b>
		89%	11%

Source: Franklin Associates, Ltd.

## NON-MUNICIPAL SOLID WASTE

### Methodology

**Scrap Vehicles.** Data on vehicles retired in 2000, including the number and their average age and weight, were used in estimating this waste stream. The number of vehicles estimated as retired in Wisconsin in 2000 (approximately 246,000 vehicles) was multiplied by an average vehicle weight to obtain a total quantity. The average vehicle weight used in the calculations was that reported for vehicles manufactured from 1990 to 1997. The Steel Recycling Institute provided additional data. Average vehicle weights ranged from 3,141 pounds in 1990 to 3,248 in 1997 with an average of 3,190 pounds.

An estimated 393,000 tons of scrap vehicles were generated in Wisconsin in 2000. This value was calculated by multiplying the estimated number of vehicles retired from use in 2000 by the average weight of a typical family car.

**Used Oil.** Automotive used oil estimated for Wisconsin was based upon reported gasoline and automotive oil consumption in the U.S. and gasoline consumption in Wisconsin. Automotive oil consumption in Wisconsin was assumed proportional to gasoline consumption. The percentage of U.S. gasoline use attributable to Wisconsin was multiplied by reported automotive oil consumption in the U.S. to estimate automotive oil consumed in Wisconsin. Automotive used oil generation in the state was then calculated by allowing for oil burned or otherwise lost in use.

Estimating used oil from industrial uses in Wisconsin was also based upon apportioning industrial oil consumption at the national level to the state level. Employment reported in industrial sectors where oil use was judged to be high<sup>13</sup> was compared for Wisconsin and the U.S. The Wisconsin employment in these sectors, as a percentage of corresponding U.S. employment, was used to estimate industrial oil consumption in the state. As with automotive oil, adjustments were made for oil lost in industrial processing in order to estimate the generation of industrial used oil in the state.

Estimated used oil filter generation was provided by the Used Oil Filter Subcommittee for the Council on Recycling. The subcommittee estimated 9 million oil filters were generated in Wisconsin in 1998<sup>14</sup>.

**Pulp/Paper Mill Waste.** The 1990 estimate of pulp and paper mill waste was based on the reported national generation rate multiplied by the reported pulp and paper mill employees in the state. The estimate for 1995 was based on figures from WI DNR and the University of Wisconsin's Solid and Hazardous Waste Education Center. The 2000 pulp/paper mill waste was estimated from three WI DNR data sources: (1) "Beneficial Use of Industrial Byproducts. 1999 Usage Summary" (2) WI DNR 2000 Landfill Tonnage-Capacity Report and (3) WI DNR combustion data.

**Coal Ash and Foundry Waste.** The 2000 estimates of coal ash and foundry waste generated in Wisconsin in 2000 were from the WI DNR publication "Beneficial Use of Industrial Byproducts. 1999 Usage Summary".

**Pottery Cull.** Changes in employment in the stone, glass and clay industries between 1995 and 2000, applied to the 1995 estimate, were used to estimate Wisconsin generation of pottery cull in 2000.

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<sup>13</sup> Certain manufacturing sectors, mining and construction employment.

<sup>14</sup> "Recommendations Concerning the Effectiveness of Voluntary and Nonvoluntary Measures to Increase the Recycling of Used Oil Filters in Wisconsin." 1999.

**Municipal Wastewater Treatment Sludge.** Estimated Wisconsin generation of municipal wastewater treatment sludge in 2000 was based on adjusting the earlier estimate for 1995 in proportion to the change in state population.

**Construction and Demolition Debris.** Construction and demolition debris generation in 2000 was based on the national generation factor of 2.8 pounds per person per day. Construction and demolition debris, as defined by this study, does not include debris from road construction or demolition. The national factor is based on an analysis of composition studies from several locations in the U.S.<sup>15</sup>

## **Generation**

**Total Non-MSW Generation.** Total Wisconsin generation of the non-MSW categories of solid wastes examined for inclusion in this report was estimated at 9,143,700 tons in 2000 (Table 1-5). The estimates for the solid waste categories shown in Table 1-5 remain the same for 1995 as in the previous report except for the scrap vehicles estimate that have been revised based on updated information.

The higher total quantity shown in 2000 for the non-MSW waste streams in Table 1-5 is due to increases shown for all of the waste streams except pulp and paper mill waste.

Ranked by size, construction and demolition debris was the largest non-MSW waste at 2.7 million tons in 2000. Generation of pulp and paper mill waste was estimated to be at over 1.8 million tons. Coal ash, foundry waste and municipal wastewater treatment sludge were generated at more than one million tons each in 2000. A substantial quantity of scrap vehicles (393,000 tons) was generated as well.

**Per capita Non-MSW Generation.** Total per capita non-MSW generation was estimated to be the same in 2000 as it was in 1995. The estimated total per capita generation of the non-MSW categories included in Table 1-5 is 9.3 ppd for 2000—much higher than the per capita rate for MSW.

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<sup>15</sup> Characterization of Building-Related Construction and Demolition Debris in the United States. U.S. Environmental Protection Agency. 1998.

Table 1-5  
Estimated Generation of Selected Non-Municipal Solid Waste  
In Wisconsin

Waste Category	Generation		
	1990 (tons/year)	1995 (tons/year)	2000 (tons/year)
Scrap vehicles	331,400	336,900 r	393,000
Used oil (1)			
Automotive	54,800	58,400	61,200
Industrial	42,600	50,200	60,700
Oil filters (2)			4,500
Pulp/paper mill waste	1,873,000 (3)	2,090,500 (4)	1,854,900 (5)
Coal ash (6)	1,154,900	1,357,000	1,595,600
Foundry waste (6)	715,000	964,000	1,102,600
Pottery cull (7)	12,700	14,500	14,600
Municipal wastewater treatment sludge (8)	1,200,000	1,257,200	1,315,800
Construction and Demolition Debris (9)	2,499,700	2,600,000	2,740,800
<b>Total</b>	<b>7,884,100</b>	<b>8,728,700</b>	<b>9,143,700</b>
Wisconsin population	4,891,769	5,124,971	5,363,675

- (1) Includes unrecoverable oil and industrial oil managed on-site (estimated at 28,600 tons). Assumed 7.5 pounds per gallon; ASTM Standards.
- (2) Council on Recycling. Used Oil Filter Subcommittee. "Recommendations Concerning the Effectiveness of Voluntary and Nonvoluntary Measures to Increase the Recycling of Used Oil Filters in Wisconsin."
- (3) Estimate based on national generation value applied to employment in the pulp/paper mill industry.
- (4) John Katers. Solid and Hazardous Waste Education Center; Dennis Mack. WI DNR.
- (5) Wisconsin DNR "Beneficial Use of Industrial Byproducts. 1999 Usage Summary." Wisconsin DNR 2000 Landfill Tonnage-Capacity Report. June 15, 2001. and additional data provided by John Meier WI DNR.
- (6) Wisconsin DNR "Beneficial Use of Industrial Byproducts. 1999 Usage Summary."
- (7) Increased from 1995 based on 1999 stone, clay and glass sector employment.
- (8) Increased from 1995 based on total population increase. Assumes wet weight bases at 14% solids content.
- (9) Construction and demolition debris generation estimated based on Franklin Associates' national estimate of 2.8 pounds per capita per day.

Source: Franklin Associates, Ltd.

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## **CHAPTER 2**

### **SOLID WASTE DISPOSITION**

The estimated disposition in 2000 of the Wisconsin-generated solid wastes estimated in Chapter 1 is presented in this chapter. Quantities recovered for recycling (including composting at centralized facilities), combusted and landfilled are shown. MSW recovered for recycling is divided between that from residential and non-residential sources. Disposition, in this report, refers to the management of products at the end of their useful life (after reuse). The reuse of products (the second, third, or more times) is not estimated separately in this report. Reuse has been accounted for in the generation methodology in Chapter 1.

Difficulty was encountered in developing estimates of MSW recovery—particularly from non-residential sources for which there was little data. A survey of both materials recovery facilities (MRFs) and other recyclables processors in Wisconsin was conducted. Of the 215 recyclables processors surveyed, responses were received from 110—a 51 percent response rate. Over 230 calls were logged in an effort to receive as high a response rate as possible. In addition, telephone contacts were made with brokers, paper mills and other end users for added data. WI DNR provided residential recovery data supplied by “responsible units” as required by law. The WI DNR data covered single-family residential (i.e., up to four household living quarters) but was not designed to include multi-family households in building of five households or more.

Solid wastes remaining after recovery for recycling were assumed to have been disposed by combustion (with and without energy recovery), landfilling or landspreading. Records provided on these disposal activities were used in developing estimates of each. It must be noted, however, that some MSW is littered, stored, burned or otherwise disposed on site without permitting. These practices are presumed to be quite small.

### **MUNICIPAL SOLID WASTE**

#### **Methodology**

The major task in estimating the disposition of Wisconsin MSW in 2000 was determining levels of recovery for recycling. This was accomplished through the following:

- a survey of MRFs and other facilities processing recyclables,
- numerous industry contacts,
- review of relevant Wisconsin reports,
- data from WI DNR and other state agency officials, and
- professional judgement.

The methodologies used in developing the residential and non-residential recovery estimates are described below.

**Residential Estimates.** Data on recovery from single-family households (including up to four households per building) was supplied to WI DNR by governmental units (called “responsible units”) in Wisconsin as required by law. This data served as a starting point for estimating recovery of MSW for recycling from residential sources.

It was necessary to adjust the single-family recovery data for undercounting of some MSW components and for including certain wastes not included in MSW. Review of the WI DNR MSW recovery data revealed some of the reported quantities shown were not MSW. Although some of the recovered scrap metal was presumably from household construction/remodeling projects, most was from non-residential, non-MSW sources. In addition, used oil recovery was included in the reported recovery although not part of MSW either. A substantial quantity of tires was shown recovered even though most were processed for energy recovery.

Single-family recovery of aluminum cans was increased to an assumed 80 percent recovery level from the 30 percent reported. The low reported recovery of aluminum cans reflects separate collection of these cans for sale at buyback centers.

In all, the single-family MSW recovery for recycling estimated for 2000 was reduced about 7 percent from that reported. This revised single-family recovery estimate was added to a separate quantity estimated from multi-family households to obtain total residential recovery.

The multi-family recovery estimate was based on generated quantities of recyclables from multi-family households (Table 1-4) multiplied by estimated recovery rates. Assuming an 80 percent building compliance rate and a multi-family monthly participation rate of 72 percent, the amount of recyclables available for recovery was assumed to be 58 percent (80% x 72%). The building compliance percentage is based on WI DNR estimates. The multi-family monthly participation rate is similar to the one used in the 1998 update report<sup>16</sup>.

A final factor affecting the rate of recovery of each recyclable was the assumed capture rate—i.e., the percentage of a generated recyclable that a participating household separates for recovery. The capture rate is important to include because a participating household is unlikely to place 100 percent of their recyclable materials in the recycling bin. The capture rates used in the analysis varied from 90 percent for steel cans to 33 percent for commingled plastic containers. Generation times compliance rate times participation rate times capture rate equals recovered quantity. Recovered quantity divided into generation quantity equals recovery rate.

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<sup>16</sup> *Wisconsin Waste Characterization & Management Study Update*. Franklin Associates, Ltd. February 1998.

**Non-Residential Estimates.** Data obtained from recyclable materials collectors and processors, supplemented with industry data, were used to estimate non-residential recovery in Wisconsin in 2000. Paper grades have long been the dominant material category recovered from non-residential sources. Recovery of all paper grades from non-residential sources was estimated at 51 percent statewide in 2000. Non-residential newspaper and OCC recovery rates were estimated at 75 percent and 55 percent respectively. A few recyclers felt that recovery of OCC was down in 2000 from 1995 levels due to depressed market prices. A review of Chicago OCC market prices<sup>17</sup> reflects this decrease in market prices. In 1995, OCC averaged \$111 per ton (range of \$20 to \$195 per ton) compared to an averaged market price of \$70 per ton in 2000 (range of \$30 to \$115 per ton).

Data from the recyclables collectors and processors suggested comparatively high recovery of beverage containers from non-residential sources. This resulted in an estimated 58 percent recovery of non-residential glass containers and a 51 percent recovery of non-residential plastic containers and steel cans.

All yard trimmings, vehicle batteries and major appliances generated from non-residential sources were assumed recovered because of the difficulty of avoiding the landfill ban on these items. Recovery of tires for recycling was estimated, from data obtained through the survey, at about six percent of generation; the remaining tires were recovered for fuel or placed into storage.

Consumer electronic recovery, a new subcategory in this report, was estimated from data provided by processors. The non-residential consumer electronics recovery was estimated at 11 percent of generation. Due to a lack of data, estimated non-residential recovery of textiles, rubber & leather products and wood pallets was assumed the same as the national rate.

## **Recovery for Recycling**

Recovery of Wisconsin-generated MSW for recycling (including composting at central facilities) in 2000 is estimated in Table 2-1. Recovery from both residential and non-residential sources is presented and residential recovery is divided between single family and multi-family sources.

Total recovery of MSW for recycling in the state is shown at about 1.44 million tons in 2000, which is 33 percent of the estimated generation that year. This compares to a revised estimate of 33.7 percent in 1995<sup>18</sup>. The most notable decline is the estimated OCC recovery rate. The 2000 recovery rate of 55.7 percent is considerably lower than the 78 percent estimated in 1995. This decline is most probably due to improvement in non-residential data collection. A declining market value for recovered OCC in 2000 may have also contributed to a lower recovery level.

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<sup>17</sup> Official Board Markets The Yellow Sheet. Advanstar Publications. Monthly editions 1995 and 2000.

<sup>18</sup> Some 1995 generation and recovery estimates were revised to reflect methodology changes from the 1995 data year to the 2000 data year analysis. The original 1995 recycling rate was 36 percent.

Fifty percent of the total recovery is shown from residential sources. Over 36 percent of MSW generated from non-residential sources and 30 percent of residential MSW was estimated as recovered. Twenty-six percent of the total MSW recovery shown in Table 2-1 is OCC, which was mostly from non-residential establishments. Other paper grades accounted for 29 percent of total recovery. Yard trimmings collected for composting is the next largest recovered category at 20 percent followed by glass containers; both of these recovered wastes were largely from the residential sector.

Recovery of ONP is shown at 77 percent of generation. Estimated recovery of all paper grades is 46 percent of generation. Plastic and glass container recovery is estimated at 41 and 57 percent. Virtually all collected yard trimmings were estimated as composted.

Table 2-1  
Estimated Recovery for Recycling of MSW  
In Wisconsin 2000

Waste Category	Total Generation (tons/year)	Residential Recovery			Non- Residential Recovery (tons/year)	Total Recovery	
		Single-Family (tons/year)	Multi-Family (tons/year)	Residential (tons/year)		Quantity (tons/year)	% of Generation (%)
<b>MSW</b>							
Newspaper	228,730	137,270	13,380	150,650	25,730	176,380	77.1%
Corrugated containers	661,580	37,650	3,240	40,890	327,660	368,550	55.7%
Magazines	46,970	18,460	1,980	20,440	2,680	23,120	49.2%
High grade office paper	159,710	240	140	380	44,030	44,410	27.8%
Mixed waste paper	605,760	73,430	1,350	74,780	97,480	172,260	28.4%
Subtotal paper/paperboard	1,702,750	267,050	20,090	287,140	497,580	784,720	46.1%
Aluminum beverage cans	32,950	20,080	910	20,990	5,370	26,360	80.0%
Steel cans	50,280	23,430	2,830	26,260	5,590	31,850	63.3%
Foam polystyrene packaging	4,190	30	0	30	20	50	1.2%
Foam polystyrene nondurable goods	5,390	0	0	0	0	0	0.0%
Plastic containers	70,730	22,720	1,460	24,180	5,070	29,250	41.4%
Other plastic packaging	130,020	0	0	0	1,730	1,730	1.3%
Other plastic nondurable goods	108,580	0	0	0	0	0	0.0%
Glass containers	191,270	78,040	7,890	85,930	23,540	109,470	57.2%
Yard trimmings	287,580	257,000	1,820	258,820	28,760	287,580	100.0%
Food waste	663,860	0	0	0	6,500	6,500	1.0%
Disposable diapers	57,450	0	0	0	0	0	0.0%
Vehicle batteries	38,530	540	0	540	36,800	37,340	96.9%
Tires	97,260	150	0	150	6,000	6,150	6.3%
Textiles, rubber, & leather products	137,530	250	0	250	22,420	22,670	16.5%
Carpets & rugs	49,040	0	0	0	50	50	0.1%
Major appliances	71,310	12,120	1,640	13,760	57,550	71,310	100.0%
Furniture & furnishings	158,800	0	0	0	0	0	0.0%
Miscellaneous durables	220,700	0	0	0	11,700	11,700	5.3%
Consumer electronics	29,870	40	10	50	1,460	1,510	5.1%
Wood pallets	174,390	0	0	0	10,640	10,640	6.1%
Miscellaneous packaging	17,360	0	0	0	0	0	0.0%
Miscellaneous inorganic wastes	66,710	0	0	0	0	0	0.0%
<b>Total MSW</b>	<b>4,366,550</b>	<b>681,450</b>	<b>36,650</b>	<b>718,100</b>	<b>720,780</b>	<b>1,438,880</b>	<b>33.0%</b>

Quantities do not include yard trimmings managed on-site (estimated at 250,800 tons).

Recovery estimates do not include non-MSW materials recovery.

Source: Franklin Associates, Ltd.

Recovery from the residential sector was largely from single-family households. Although multi-family households made up nearly 12 percent of the state's population in 2000, these households contributed only 5 percent of the estimated residential MSW recovery. However, without yard trimmings—of which very little is generated in multi-family households—the per capita recovery rate from multi-family households is shown to be nearly 67 percent as high as from single-family residences.

Table 2-2  
Estimated Disposition of Wisconsin MSW in 2000

Waste Category	Generation (1) (tons/year)	Recovered for Recycling (2) (tons/year)	Combusted with Energy Recovery (3) (tons/year)	Burn Barrels (4) (tons/year)	Landfilled (tons/year)	Stored/ Shipped Out-of-state (tons/year)
MSW						
Newspaper	228,730	176,380	1,400	3,380	47,570	
Corrugated containers	661,580	368,550	8,370	1,950	282,710	
Magazines	46,970	23,120	640	780	22,430	
High grade office paper	159,710	44,410	3,080	3,050	109,170	
Mixed waste paper	605,760	172,260	11,560	24,630	397,310	
Aluminum beverage cans	32,950	26,360	180	410	6,000	
Other Al. cans & foil	0	0	0		0	
Steel cans	50,280	31,850	490	1,140	16,801	
Foam polystyrene packaging	4,190	50	110	260	3,770	
Foam polystyrene nondurable goods	5,390	0	140	100	5,150	
Plastic containers	70,730	29,250	1,120	2,620	37,740	
Other plastic packaging	130,020	1,730	3,420	7,980	116,890	
Other plastic nondurable goods	108,580	0	2,900	4,560	101,120	
Glass containers	191,270	109,470	2,810	5,010	73,980	
Yard trimmings	287,580	287,580	0	0	0	
Food waste	663,860	6,500	17,540	30,510	609,310	
Disposable diapers	57,450	0	1,530	3,990	51,930	
Vehicle batteries	38,530	37,340	30	0	1,160	
Tires	97,260	6,150	50,000	0	0	41,110
Textiles, rubber, & leather products	137,530	22,670	3,060	6,380	105,420	
Carpets & rugs	49,040	50	1,310	0	47,680	
Major appliances	71,310	71,310	0	0	0	
Furniture & furnishings	158,800	0	4,240	0	154,560	
Miscellaneous durables	220,700	11,700	5,580	13,670	189,750	
Consumer electronics	29,870	1,510	760	0	27,600	
Wood pallets	174,390	10,640	4,370	0	159,380	
Miscellaneous packaging	17,360	0	460	910	15,990	
Miscellaneous inorganic wastes	66,710	0	1,780	2,620	62,310	
<b>Total MSW</b>	<b>4,366,550</b>	<b>1,438,880</b>	<b>126,880</b>	<b>113,950</b>	<b>2,645,730</b>	<b>41,110</b>
<b>Percent of Total Generation</b>		<b>33%</b>	<b>3%</b>	<b>3%</b>	<b>61%</b>	<b>1%</b>

(1) Table 1-1. Yard trimmings generation does not include quantity managed on-site (estimated at 250,800 tons).

(2) Table 2-1.

(3) Includes ash generated from combustion process. Estimated at 25%.

(4) Combusted without energy recovery. Includes ash generated from combustion process. Estimated at 35%.

Source: Franklin Associates, Ltd.

## Disposal

MSW generated in Wisconsin in 2000 that was not recovered for recycling was collected for combustion (with or without energy recovery) or was landfilled. Some tires are also stored or shipped out-of-state. The estimated disposition of Wisconsin MSW in 2000 is shown in Table 2-2. A breakdown of quantities recovered for recycling, combusted, landfilled and stored/shipped out-of-state is shown.

Only 3 percent of generated MSW was found to be combusted for energy recovery. Nearly 50,000 tons of this were tires, which were used as fuel in several industrial and power utility boilers. Remaining MSW combustion occurred in an RDF facility in LaCrosse and at the Barron County MSW mass burn facility. Between them, these two facilities recovered the energy from approximately 76,900 tons of MSW in 2000. The quantity of MSW burned by individuals was estimated to be 3 percent of MSW generated. This estimate was developed using U.S. Census data<sup>19</sup>, WI DNR burn barrel permit activity and a survey of residents using burn barrels in Northwest Wisconsin and Northeast Minnesota<sup>20</sup>. Over 210,000 households were estimated to use burn barrels<sup>21</sup>. These residents were assumed not to burn vehicle batteries, tires, carpets and rugs, furniture and furnishings, and consumer electronics.

Over 41,000 tons of tires (approximately one percent of MSW) was estimated to be stored in licensed and unlicensed facilities in Wisconsin or shipped out-of-state to storage, energy recovery or disposal facilities. The disposition of the tires shipped out of Wisconsin was not determined. The MSW remaining was assumed to be landfilled. This amounted to about 2,645,730 tons in 2000 or 61 percent of generation.

## Diversion from Disposal

Total MSW recovery shown for Wisconsin in 2000 is estimated at 33 percent of generation. However, it should be noted that in terms of diverting MSW from disposal, even greater success has been achieved in Wisconsin.

Yard trimmings, for example, are generated at much lower levels than before the landfill ban since they must generally be collected separately and managed through composting or landspreading if taken off site. As a result, yard trimmings that would have previously been collected for off-site management (by homeowners or municipalities) are often managed on-site to avoid separate charges. Only those yard trimmings collected for off-site management are included as part of MSW generation shown in Table 1-1. Thus, the amount of MSW handled by collection systems in Wisconsin is lower than would be true without a landfill ban on yard trimmings.

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<sup>19</sup> Occupied housing units and seasonal housing units. [www.census.gov](http://www.census.gov).

<sup>20</sup> *Increased Awareness. Insight Into Public Patterns and Perceptions*. Western Lake Superior Sanitary District. January 2000.

<sup>21</sup> Seasonal household use was assumed at four weeks plus 20 weekends per year.

If the landfill ban on yard trimmings did not exist, generation of yard trimmings in Wisconsin could have been approximately 538,400 tons in 2000 instead of the 287,580 tons shown in Tables 1-1 and 2-1. (This assumes an increase from 1995 proportional to the increase in population during that time<sup>22</sup>.) The additional 250,800 tons of yard trimmings would change total MSW generation in the state in 2000 from 4,366,550 tons to 4,617,350 tons. Thus, it seems reasonable to assume that the landfill ban has resulted in an additional 250,800 tons of diversion from disposal through the reduction in amount generated

Adding this estimated reduction (250,800 tons) to the total quantity recovered for recycling (1,438,880 tons) results in an estimated diversion from disposal of 1,689,680 tons of MSW in 2000. This represents a 36.6 percent diversion of the 4,617,350 tons of MSW estimated for the state without the landfill ban on yard trimmings.

MSW disposition is shown with and without inclusion of the estimated 250,800 tons of yard trimmings that would have been collected without the ban. A detailed breakdown of the MSW diversion estimate is shown in Table 2-3. The estimated effect of the yard trimmings landfill ban on MSW generation and diversion from disposal is illustrated in Figure 2-1.

Table 2-3  
Estimated Diversion of Wisconsin MSW in 2000

	Actual Generation (tons/yr)	Potential Generation (1) (tons/yr)	Recovery for Recycling (2) (tons/yr)	Yard Trimmings Source Reduction (3) (tons/yr)	Total Diversion (4) (tons/yr)	Diversion as % of Potential Generation
Residential Sector	2,382,510	2,608,210	718,100	225,700	943,800	36.2
Non-residential Sector	<u>1,984,040</u>	<u>2,009,140</u>	<u>720,780</u>	<u>25,100</u>	<u>745,880</u>	<u>37.1</u>
Totals	4,366,550	4,617,350	1,438,880	250,800	1,689,680	36.6

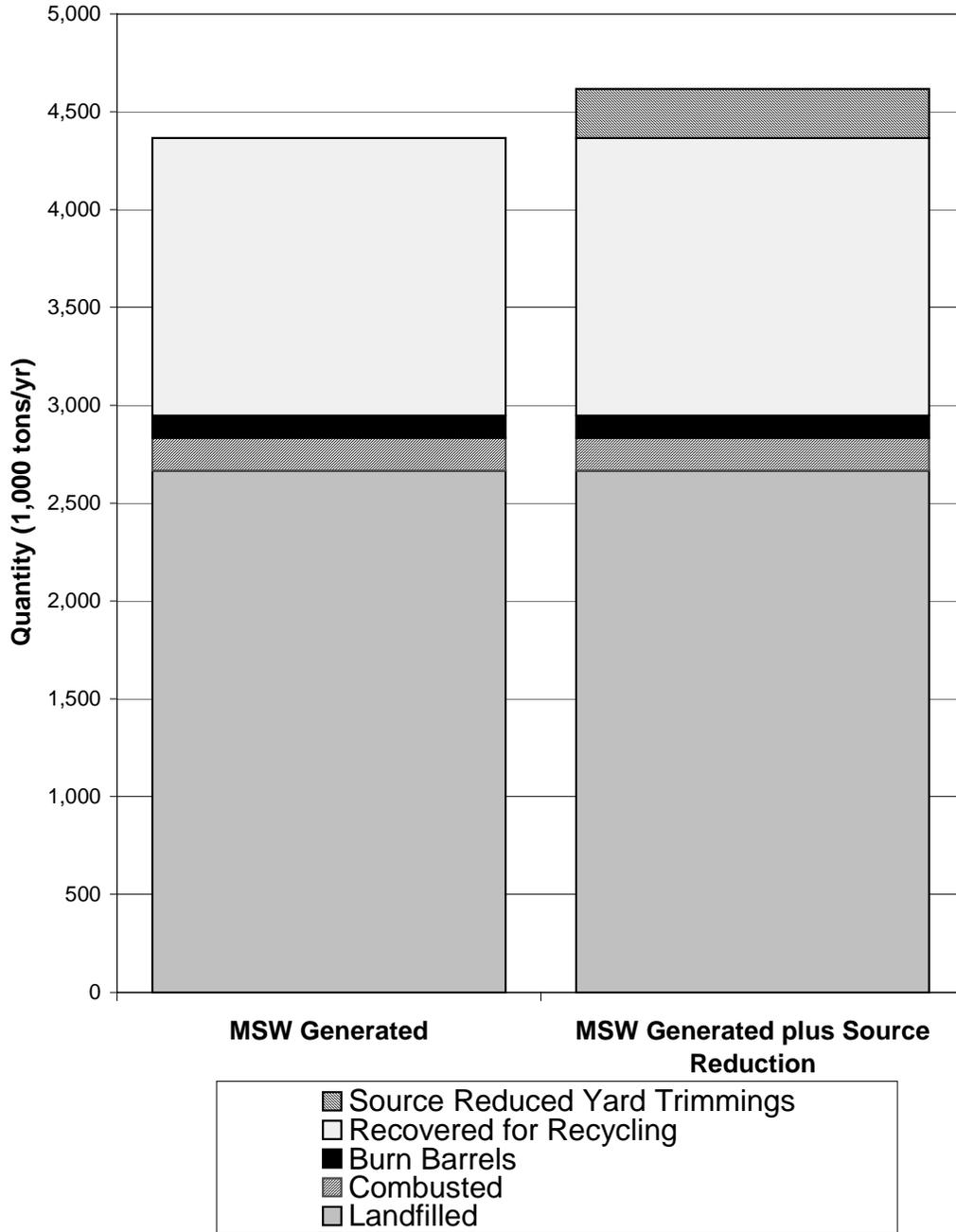
- 
- (1) Includes actual MSW generation plus yard trimmings estimated as managed on site because of the landfill ban.
  - (2) Includes materials collected for traditional recycling plus yard trimmings collected for composting.
  - (3) Yard trimmings estimated as managed on site because of landfill ban.
  - (4) Includes MSW collected for recycling plus yard trimmings managed on site because of landfill ban.

Source: Franklin Associates, Ltd.

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<sup>22</sup> The 2000 quantity of yard trimmings source reduced was estimated from the change in the number of single-family households from 1990 to 2000 and was found to differ from the population estimate by only 1.8 percent. Population change, a statistic updated annually, can be easily used to update this estimate in future years.

Figure 2-1. Estimated Disposition of Wisconsin MSW in 2000



It is probable that the landfill bans on other materials—and perhaps other source reduction measures—have resulted in a decrease in the amount of municipal solid waste generated in Wisconsin, but these are more difficult to estimate.

## **NON-MUNICIPAL SOLID WASTE**

### **Methodology**

**Scrap Vehicles.** Old vehicles that are taken out of service are usually taken to salvage yards where they provide parts for still active vehicles. Later, they are baled or shredded and sent to steel mills for metals recovery. A state of Wisconsin report noted quantities of scrap vehicle shredder fluff used as daily cover at landfills in the state in 2000. Subtracting the shredder fluff from the estimated generation of retired vehicles provided an estimated quantity recycled.

**Used Oil.** Disposition of used oil was based on both local and national data. Collection of automotive oil for recycling was available from “responsible units” and was added to an estimate of industrial oil recovered for recycling based on a telephone survey of used oil processors. Used oil processor data combined with WI DNR data also provided the estimate for used oil combusted. Landfilled oil was based on quantities judged as remaining in oil filters and national estimates of those changing oil at home. Some industrial oil, estimated at 28,600 tons is managed on-site by the generator. The disposition of this on-site managed industrial oil (whether reused, collected for energy recovery, or disposed) was not estimated.

**Coal Ash and Foundry Waste.** Management of these waste streams was based on data from two WI DNR reports: the 2000 Landfill Tonnage-Capacity Report and Beneficial Use of Industrial Byproducts.

**Pulp/Paper Mill Waste and Municipal Wastewater Treatment Sludge.** Quantities landfilled and combusted were provided from state data for both of these waste streams. The quantity of municipal wastewater treatment sludge remaining after the estimated quantities landfilled and combusted was assumed as landspread.

**Construction & Demolition Debris.** The quantity of construction & demolition debris landfilled was based on work done by Camp, Dresser and McKee for the Wisconsin Market Development Board. Some construction & demolition debris was estimated to be managed on-site, burned, or otherwise unaccounted for and is listed under landspread/other on Table 2-4.

**Pottery Cull.** It was assumed that all of the pottery cull generated was landfilled.

## Recovery for Recycling and Beneficial Use

Non-MSW disposition in Wisconsin in 2000 is estimated in Table 2-4. Of the 9.1 million tons of non-MSW shown as generated in the state, an estimated 1.4 million tons (or over 15 percent) is shown as recovered for recycling. Beneficial use accounts for another 31 percent.

**Scrap Vehicles.** The quantity of old vehicles shown as recovered resulted from subtracting vehicle shredder fluff reported as used for daily cover from estimated scrap vehicles generation. Thus, the 74 percent recovery level reflects an estimate of materials from vehicles actually recycled.

**Used Oil.** The total quantity of used oil generated in Wisconsin in 2000 is not accounted for in the disposition estimates shown in Table 2-4. The difference can be attributed to industrial oil managed on site, for which no estimates of disposition were made. Over 10 percent of the used oil generation shown was estimated as recovered for recycling, which is defined here as recovery for re-refining into a new lubricating oil product.

Table 2-4  
Estimated Disposition of Selected Non-Municipal Solid Waste  
In Wisconsin 2000

Waste Category	Generation (1) (tons/year)	Recovered for Recycling (tons/year)	Beneficial Use (tons/year)	Combustion (2) (tons/year)	Landfilled (tons/year)	Landspread/ Other (tons/year)
Scrap vehicles 3,4)	393,000	291,300	101,700			
Used oil (5,6,7)	121,900	13,000		64,600	8,300	7,400
Used oil filters (8)	4,500	700			3,800	
Pulp/paper mill waste (3,9,10)	1,854,900		1,150,000	73,700	631,200	
Coal ash (10)	1,595,600		1,155,200		440,400	
Foundry waste (3,10)	1,102,600		446,900		655,700	
Pottery cull	14,600				14,600	
Municipal wastewater treatment sludge (3,9)	1,315,800			72,900	75,600	1,167,300
C&D Debris (11)	2,740,800	1,096,300			959,300	685,200
<b>Total Selected Waste</b>	<b>9,143,700</b>	<b>1,401,300</b>	<b>2,853,800</b>	<b>211,200</b>	<b>2,788,900</b>	<b>1,859,900</b>
		15%	31%	2%	31%	20%

- (1) Table 1-5.
- (2) Waste oil is combusted with energy recovery. Some pulp/paper mill waste and municipal wastewater treatment sludge facilities combust with energy recovery and some do not recover energy.
- (3) Wisconsin DNR 2000 Landfill Tonnage-Capacity Report. June 15, 2001.
- (4) Dennis Mack. Wisconsin DNR October 15, 2001.
- (5) Recovery estimates: Wisconsin Annual Recycling Reports, 2001 survey and Used Oil Annual Reports.
- (6) Combustion estimates: Used Oil Annual Reports, Dave Parsons WI DNR.
- (7) Oil landfilled is oil estimated to be from do-it-yourselfers and oil left in oil filters. Oil landspread is from do-it-yourselfers. Industrial on-site managed used oil (estimated at 28,600 tons) not included in the disposition estimates.
- (8) Council on Recycling. Used Oil Filter Subcommittee. "Recommendations Concerning the Effectiveness of Voluntary and Nonvoluntary Measures to Increase the Recycling of Used Oil Filters in Wisconsin."
- (9) Combustion estimates: John Meier WI DNR. Pulp/paper mill waste estimate does not include 17,260 tons of paper pellets combusted.
- (10) Beneficial Use of Industrial Byproducts. 1999 Usage Summary. Wisconsin DNR.
- (11) Recovered for recycling estimate assumed at 40 percent of generation.  
Landfilled C&D estimate assumed at 35 percent of generation.  
Landspread/Other C&D estimate reflects the quantity remaining after estimates of landfilling and recovery.

Source: Franklin Associates, Ltd.

**Coal Ash.** Beneficial use of coal ash represents the largest recovered quantity of non-MSW shown in Table 2-4. Approximately 72 percent of generated coal ash in Wisconsin was estimated as recovered for beneficial use in 2000. Uses of coal ash include concrete additives, flowable fill material, aggregate for subbase on roads and stabilization under roads.

**Foundry Waste.** A little more than 40 percent of foundry waste was estimated as recovered for beneficial use in 2000. Foundry sand can be used as geotechnical fill material in construction projects.

**Pulp/Paper Mill Waste.** An estimated 62 percent of the pulp/paper mill waste generated in 2000 was collected for beneficial use. Beneficial uses include soil additive, aggregate production and combustion with energy recovery<sup>23</sup>.

**Construction and Demolition Debris.** Recovery of C&D debris, an estimated 40 percent of generation, was based on the 1995 recovery rate<sup>1</sup>. It was assumed that Wisconsin was typical of the few states (Florida, Vermont, Oregon, South Carolina, and Massachusetts) that have reported C&D recovery levels.

## Disposal

Combustion with and without energy recovery, landfilling and landspreading were used to dispose of Wisconsin non-MSW not recovered for recycling or beneficial use. Over 53 percent of the non-MSW estimated in Table 2-4 was disposed including all of the pottery cull and municipal wastewater treatment sludge. This compares to over 75 percent in 1995. Thirty-one percent of the generated non-MSW is shown as landfilled, about 20 percent landspread and 2 percent combusted. Most of the municipal wastewater treatment sludge was landspread but smaller quantities were landfilled and combusted.

## OTHER LANDFILLED WASTE STREAMS

The WI DNR 2000 Landfill Tonnage-Capacity Report includes waste streams not reviewed in this report. Examples of these are high volume industrial waste and contaminated soils—both used for daily cover. Other wastes that may be categorized as MSW by landfill gate attendants fall outside the definition of MSW used in this report. Examples of these are: street cleaning debris, non-targeted non-hazardous industrial process waste, and construction and demolition debris. By the definition used in this report, liquid wastes, such as liquid household hazardous waste and used oil, are not considered municipal solid waste (MSW)<sup>24</sup>.

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<sup>23</sup> Total beneficial use estimate was reported; the quantity combusted with energy recovery could not be separated from the other uses.

<sup>24</sup> Wisconsin's regulatory definition of *solid waste* is much broader than the definition of *MSW* used in this report. Solid waste is defined as garbage, refuse, sludge from a waste treatment plant, water supply treatment plant or air pollution control facility and other discarded or salvageable materials, including solid, liquid, semisolid, or contained gaseous materials resulting from industrial, commercial, mining and agricultural operations, and from community activities (289.01(33)).

Residues from the collection and processing of recyclable materials and ash remaining after combustion in burn barrels are considered MSW in this report, but the quantities are shown in the “Recovery for Recycling” and “Burn barrel” estimates (not in the “Landfilled” estimate). Residual from the Xcel RDF facility, also considered MSW, is accounted for in the “Combustion” estimate.

Additionally, the landfill quantity shown in Table 2-2 only contains the moisture inherent in the MSW materials. Moisture added by rain, snow or liquid wastes is not estimated. For every one percent increase in moisture, the weight of the total landfilled MSW increases by approximately 27,000 tons.

Recent MSW characterizations studies from other states were reviewed for the waste streams mentioned above. Specifically, reports that sampled MSW collection trucks or MSW landfills were targeted. Due to lack of detailed data, not all studies are usable. For example, a study that presents data only as percentages cannot be applied to the Wisconsin waste stream. Weight data is necessary when comparing characterization studies. Without it, one cannot be sure the denominators of the waste streams being compared are equal. Characterization data from the following areas were determined to be usable for this analysis.

- Florida – internal sampling data from residential refuse collection trucks
- Minnesota – statewide characterization report
- Missouri – statewide characterization report
- Oregon – statewide characterization data
- Washington – statewide characterization data
- Seattle – city characterization data
- King County – county characterization report (excluding Seattle).

The 2000 Landfill Tonnage-Capacity Report (adjusted for out-of-state waste) lists the quantity of disposed MSW, Category 1, at 4.6 million tons. The difference between this quantity and the amount shown as disposed on Table 2-2 is approximately 1.9 million tons. Adding rough estimates of the omitted wastes streams to the landfilled quantities shown in Table 2-2 results in a total Category 1 landfilling estimate that is 95 percent of that reported by the WI DNR landfill records. The estimates in Table 2-5 were developed from a variety of sources including:

- State, city and county characterization data
- University of Wisconsin Extension-Environmental Resources Center
- Wisconsin DNR data
- Wisconsin landfill operators
- *Handbook of Solid Waste Properties.*

The average, as well as the range of values, are shown in Table 2-5. The unidentified quantity, calculated by difference, represents approximately 5 percent of the Category 1, MSW, landfilled. This quantity might include some yard trimmings being disposed instead of recovered for composting. Although yard trimmings are banned from disposal in Wisconsin, data from other states suggest that there is less than 100 percent compliance with landfill bans on yard trimmings. Data from Florida and Minnesota would suggest that landfilled yard trimmings in Wisconsin could range from 75,000 tons to 150,000 (1.6 percent to 3.3 percent). A county in Georgia estimated yard trimmings at 2.2 percent of MSW disposed. The differences in reported landfilling versus the quantities shown in this report are largely explained by differences in waste definitions and wastes not included in this study.

Table 2-5  
Other Estimated Wisconsin Landfilled Waste Streams

	2000 (tons)	Range		
		Average (tons/yr)	Low (tons/yr)	High (tons/yr)
DNR reported MSW landfilled (1)	4,568,500			
Franklin Associates estimated MSW landfilled (2)	2,645,730			
Difference	1,922,770			
C&D landfilled with MSW (3)	414,120	414,120	96,550	890,860
Non-tire non-MSW rubber (4)	23,870	23,870	12,880	38,520
Other non-MSW metals (4)	138,840	138,840	83,700	225,500
Non-pallet wood waste (excludes yard waste) (4)	216,990	216,990	56,130	344,640
Inerts, Soil & dirt (includes urban street sweepings)	303,720	303,720	86,440	382,510
Household hazardous waste (5)	51,550	51,550	21,690	60,740
Used oil (6)	8,300	8,300	8,300	8,300
Recycling residue @ 7.3% of 2000 banned materials (7)	73,620	73,620	73,620	73,620
Residual from the Xcel RDF facility (8)	27,030	27,030	27,030	27,030
Added moisture @ 1% of estimated disposal quantity (9)	26,460	26,460	26,460	26,460
Ash from burn barrels (10)	39,880	39,880	39,880	39,880
Industrial Scrap (11)	382,890	382,890	141,750	593,910
Unidentified (12)	215,500	215,500	674,430	2,711,970
	1,922,770	1,922,770	674,430	2,711,970

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- (1) DNR landfill tonnage report (WI minus out-of-state MSW).
  - (2) Table 2-2.
  - (3) Does not include estimated quantities of C&D disposed in landfills or special cells. Estimates ranged from 2% of MSW landfilled to 19.5%. Average represents 9% of MSW landfilled.
  - (4) Does not include C&D rubber, metal or wood.
  - (5) University of Wisconsin Extension-Environmental Resources Center. Periodic Wisconsin Household Hazardous Waste Collections Summary. July 23,2001.
  - (6) Table 2-4.
  - (7) *Analysis of Franklin Associates' & Wisconsin DNR's 1995 Solid Waste Data*. DNR staff. June 1998.
  - (8) Residual and rejects reported landfilled at Lacrosse Landfill. Leland Archiquette, DNR. Not listed separately on the DNR landfill tonnage report.
  - (9) Franklin Associates estimate.
  - (10) Ash from residential MSW assumed 35%. *Handbook of Solid Waste Properties*. CalRecovery, Inc. Table 11.
  - (11) Industrial waste reported in MSW landfills ranged from 3% of MSW landfilled to 13%. Average represents 8%.
  - (12) Calculated by difference. Equals 5% of MSW landfilled.

Source: Franklin Associates, Ltd.

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## CHAPTER 3

### PROJECTED SOLID WASTE GENERATION AND RECOVERY

In this chapter, projections of solid waste generation and recovery in Wisconsin are provided for years 2005 and 2010. The projections are shown for MSW and non-MSW by waste category. The MSW generation projections in this report are also provided by residential and non-residential sources.

#### MUNICIPAL SOLID WASTE

##### Projected Generation Methodology

Projections of MSW were developed for 28 component categories. The projections were based on applying projected Wisconsin population (Table 3-1) to new per capita estimates for each component. For most products, the per capita estimates for years 2005 and 2010 were based on adjusting the 2000 per capita figures by the percentage changes in the corresponding national per capita estimates. The national per capita changes projected for 2005 and 2010 are based on trends in product and materials usage reflecting 40 years of data developed for the U.S. Environmental Protection Agency.

It must be emphasized that projections based on patterns and trends are not necessarily accurate predictions of the future. Changes in the economy, new innovations and new products are factors that affect the amounts and types of MSW, but their occurrence and impacts are difficult to forecast. For example, the appearance of single-serving PET bottles for soft drinks is affecting the use of aluminum cans—an unforeseen development only a few years ago and unidentifiable from trend analysis.

Table 3-1  
Population Projections

	<u>2000</u>	<u>2005</u>	<u>2010</u>
State of Wisconsin	5,363,675	5,409,536	5,512,313
Percent change		0.9%	1.9%

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Source: Wisconsin Department of Administration projections.

## Projected Generation

**Total MSW Projected.** Projections of Wisconsin MSW generation in 2000 and 2005 are found in Table 3-2. Total MSW is projected to grow at an average rate of about 1.2 per cent per year between 2000 and 2005 and about 1.0 percent per year from 2005 to 2010. This will result in over 4.6 million tons of MSW from the state in 2005 or about 6 percent more than estimated for 2000. The per capita rate in 2005 based on the projected population would be about 4.7 pounds per person per day.

Table 3-2  
Estimated and Projected Generation of MSW in Wisconsin

	2000 <u>Generation</u> (tons/year)	2005 <u>Generation</u> (tons/year)	2010 <u>Generation</u> (tons/year)
MSW			
Newspaper	228,730	246,820	257,510
Corrugated containers	661,580	703,870	758,060
Magazines	46,970	49,070	50,110
High grade office paper	159,710	174,100	186,630
Mixed waste paper	<u>605,760</u>	<u>622,190</u>	<u>631,120</u>
Subtotal paper/paperboard	1,702,750	1,796,050	1,883,430
Aluminum beverage cans	32,950	32,800	32,700
Steel cans	50,280	50,100	50,090
Plastic containers			
PET soft drink	19,550	22,830	25,510
HDPE milk and water	8,950	9,620	10,280
Other plastic containers	42,230	52,400	62,100
Other plastic packaging	134,210	150,830	164,060
Plastic nondurable goods	113,970	120,720	127,870
Glass containers			
Beer & soft drink bottles	97,180	103,320	104,230
Wine & liquor bottles	30,070	30,190	30,260
Food & other bottles & jars	64,020	58,410	55,270
Yard trimmings	287,580	290,250	295,820
Food waste	663,860	669,200	681,560
Disposable diapers	57,450	59,540	60,710
Vehicle batteries	38,530	40,850	42,630
Tires	97,260	109,160	120,830
Textiles, rubber, & leather nondurables	137,530	159,460	173,230
Major appliances	71,310	74,590	77,660
Furniture & furnishings	158,800	171,270	181,160
Carpets & rugs	49,040	54,730	59,960
Miscellaneous durables	250,570	288,760	325,930
Wood pallets	174,390	196,980	216,130
Miscellaneous packaging	17,360	17,530	17,660
Miscellaneous inorganic wastes	<u>66,710</u>	<u>67,290</u>	<u>68,560</u>
Total MSW	4,366,550	4,626,880	4,867,640

Source: Franklin Associates, Ltd.

**Paper Grades.** Paper grades are projected to continue as the dominant material in MSW. The paper grades were estimated at about 39 percent of MSW in Wisconsin in 2000 and about 33 percent in 2005. Generation of paper products has had a declining relationship with Gross Domestic Product over the past few years. The reasons are not fully understood, but seem to relate to increasing use of electronic communications and entertainment.

**Metal Cans.** Aluminum cans in MSW were projected to show a slow decline in generation after 2000, while accounting for less than one percent of MSW. An increase in the use of single-serving PET bottles for soft drinks attributes to this decline. Steel cans are also projected to show a slight decline in MSW in Wisconsin after 2000, while remaining at about one percent of MSW.

**Plastics.** Plastic containers and other plastic packaging accounted for between 4.0 and 5.0 percent of Wisconsin MSW in 2000 and this percentage is expected to increase in future years. Plastic nondurable goods accounted for another 2.6 percent of MSW, and this percentage is projected to stay about the same. Plastics are also contained in durable goods but are generally part of composite material items.

**Glass.** Most of the glass found in MSW is container glass but some glass is in durable goods as well. Glass containers represented an estimated 4.4 percent of Wisconsin MSW in 2000 but the percentage is expected to decline to less than 4.0 percent by 2010. Per capita generation of glass containers is also projected to decline.

Glass is assumed to remain the packaging of choice for beer, wine and liquor; but the use of glass food bottles and jars has declined significantly. Substitution of plastics for glass accounts for the projected decline in use of glass food and other containers.

**Yard Trimmings.** Yard trimmings have already been banned from landfills in Wisconsin and the quantity collected decreased over 50 percent between 1990 and 1995. Yard trimmings are projected to increase at the same rate as population between 2000 and 2010, but their percentage of MSW will decline. These projections assume the per capita rate of yard trimmings managed on-site will be the same as in 2000. This assumes that the existing yard trimmings collection programs will continue to service a growing population.

**Food Waste.** Food waste was estimated at about 15 percent of Wisconsin MSW in 2000. It is expected to decline slightly as a percentage of MSW in the future but is still expected to increase in total tonnage.

**Durable Goods.** Durable goods include vehicle batteries, rubber tires, major appliances, carpets and rugs, furniture and furnishings and miscellaneous durables such as small appliances and electronics. Durable goods in MSW are projected to increase in Wisconsin through 2010, largely due to normal population growth.

**MSW Projected Generation by Source.** Tables 3-3 and 3-4 contain breakdowns of projected MSW generation in 2005 and 2010 by generation sources. Projected MSW is divided between residential and non-residential sources in Table 3-3 and the residential projections are divided between single-family and multi-family sources in Table 3-4.

More MSW is expected to come from residential sources than non-residential sources in 2005 and 2010 as shown in Table 3-3. The percentage from residential sources – 54 percent – is expected to stay about the same.

Table 3-3  
Projected Generation of MSW in Wisconsin by Source

	<u>2005 Generation by Source</u>		<u>2010 Generation by Source</u>	
	<u>Residential</u> (tons/year)	<u>Non-residential</u> (tons/year)	<u>Residential</u> (tons/year)	<u>Non-residential</u> (tons/year)
MSW				
Newspaper	209,800	37,020	218,880	38,630
Corrugated containers	70,390	633,480	75,810	682,250
Magazines	31,900	17,170	32,570	17,540
High grade office paper	43,530	130,570	46,660	139,970
Mixed waste paper	<u>404,420</u>	<u>217,770</u>	<u>410,230</u>	<u>220,890</u>
Subtotal paper/paperboard	760,040	1,036,010	784,150	1,099,280
Aluminum beverage cans	26,240	6,560	26,160	6,540
Steel cans	42,740	7,360	42,580	7,510
Plastic containers				
PET soft drink	15,640	7,190	20,410	5,100
HDPE milk and water	8,060	1,560	9,250	1,030
Other plastic containers	33,780	18,620	49,680	12,420
Other plastic packaging	107,370	43,460	131,250	32,810
Plastic nondurable goods	56,990	63,730	63,940	63,930
Glass containers				
Beer & soft drink bottles	82,660	20,660	83,380	20,850
Wine & liquor bottles	24,150	6,040	24,210	6,050
Food & other bottles & jars	49,650	8,760	46,980	8,290
Yard trimmings	261,230	29,020	266,240	29,580
Food waste	401,520	267,680	408,940	272,620
Disposable diapers	53,590	5,950	54,640	6,070
Vehicle batteries	2,040	38,810	2,130	40,500
Tires	5,460	103,700	6,040	114,790
Textiles, rubber, & leather nondurables	95,680	63,780	103,940	69,290
Major appliances	14,170	60,420	14,760	62,900
Furniture & furnishings	137,020	34,250	144,930	36,230
Carpets & rugs	43,780	10,950	47,970	11,990
Miscellaneous durables	231,010	57,750	260,740	65,190
Wood pallets	0	196,980	0	216,130
Miscellaneous packaging	12,270	5,260	12,360	5,300
Miscellaneous inorganic wastes	<u>33,650</u>	<u>33,640</u>	<u>34,280</u>	<u>34,280</u>
Total MSW	<u>2,498,740</u>	<u>2,128,140</u>	<u>2,638,960</u>	<u>2,228,680</u>

Source: Franklin Associates, Ltd.

The percentage breakdown between single-family and multi-family MSW (Table 3-4) is expected to remain about constant. Nearly 90 percent of total residential MSW is expected to come from single-family households versus about 10 percent from multi-family households.

### Projected Recovery Methodology

The projections of MSW recovery for recycling in 2005 and 2010 were based on consideration of several factors: recovery levels in 2000; the potential for improvements in the recovery programs; the state's landfill bans and recycling requirements; state-provided support for local recycling programs; recycling markets; and maximum practical recovery rates.

Table 3-4  
Projected Generation of Residential MSW in Wisconsin by Source

	2005 Generation by Source			2010 Generation by Source		
	Residential (tons/year)	Single Family (tons/year)	Multi-Family (tons/year)	Residential (tons/year)	Single Family (tons/year)	Multi-Family (tons/year)
MSW						
Newspaper	209,800	180,310	29,490	218,880	188,110	30,770
Corrugated containers	70,390	62,410	7,980	75,810	67,220	8,590
Magazines	31,900	27,100	4,800	32,570	27,670	4,900
High grade office paper	43,530	38,350	5,180	46,660	41,110	5,550
Mixed waste paper	404,420	356,310	48,110	410,230	361,430	48,800
Subtotal paper/paperboard	760,040	664,480	95,560	784,150	685,540	98,610
Aluminum beverage cans	26,240	24,000	2,240	26,160	23,930	2,230
Steel cans	42,740	37,290	5,450	42,580	37,150	5,430
Plastic containers						
PET soft drink	15,640	13,290	2,350	20,410	17,350	3,060
HDPE milk and water	8,060	6,850	1,210	9,250	7,860	1,390
Other plastic containers	33,780	28,710	5,070	49,680	42,230	7,450
Other plastic packaging	107,370	94,600	12,770	131,250	115,640	15,610
Plastic nondurable goods	56,990	50,210	6,780	63,940	56,330	7,610
Glass containers						
Beer & soft drink bottles	82,660	70,260	12,400	83,380	70,870	12,510
Wine & liquor bottles	24,150	20,530	3,620	24,210	20,580	3,630
Food & other bottles & jars	49,650	42,200	7,450	46,980	39,930	7,050
Yard trimmings	261,230	259,390	1,840	266,240	264,370	1,870
Food waste	401,520	353,760	47,760	408,940	360,300	48,640
Disposable diapers	53,590	47,220	6,370	54,640	48,140	6,500
Vehicle batteries	2,040	1,800	240	2,130	1,880	250
Tires	5,460	4,810	650	6,040	5,320	720
Textiles, rubber, & leather nondurables	95,680	84,290	11,390	103,940	91,540	12,400
Major appliances	14,170	12,480	1,690	14,760	13,000	1,760
Furniture & furnishings	137,020	120,720	16,300	144,930	127,690	17,240
Carpets & rugs	43,780	38,570	5,210	47,970	42,260	5,710
Miscellaneous durables	231,010	203,530	27,480	260,740	229,730	31,010
Miscellaneous packaging	12,270	10,810	1,460	12,360	10,880	1,480
Miscellaneous inorganic wastes	33,650	29,650	4,000	34,280	30,200	4,080
<b>Total MSW</b>	<b>2,498,740</b>	<b>2,219,450</b>	<b>279,290</b>	<b>2,638,960</b>	<b>2,342,720</b>	<b>296,240</b>

Source: Franklin Associates, Ltd.

Emphasis was placed on examining both residential and commercial MSW recovery and the potential for changes. It was assumed that nearly everyone in Wisconsin would have access to some form of recovery mechanism in 2005 and 2010.

Some products, such as newspapers, vehicle batteries, and aluminum cans, were already at or near practical maximum recovery limits in 2000. Other products, such as disposable diapers and furniture, have no reasonable expectation of significant recovery before 2010. Each product category was considered separately when developing the recovery projections, keeping in mind prior experience in Wisconsin and the United States and reasonable expectations for recovering and marketing materials in Wisconsin.

### Projected Recovery

The projected MSW recovery for recycling levels in 2005 and 2010 are shown in Table 3-5. Total MSW recovery is expected to increase from 32.5 percent of generation in 2000 to 35 percent in 2005 and 38 percent in 2010. Recovered quantities are projected to increase from 1.4 million tons in 2000 to 1.6 million tons in 2005 and 1.8 million tons in 2010.

Table 3-5  
Projected Recovery for Recycling of Wisconsin MSW  
In 2005 and 2010

	2005 Projections			2010 Projections		
	Generation (tons/year)	Recovery (tons/year)	% of Material Generation	Generation (tons/year)	Recovery (tons/year)	% of Material Generation
MSW						
Newspaper	246,820	193,010	78.2%	257,510	206,010	80.0%
Corrugated containers	703,870	408,240	58.0%	758,060	492,740	65.0%
Magazines	49,070	25,520	52.0%	50,110	27,560	55.0%
High grade office paper	174,100	69,640	40.0%	186,630	93,320	50.0%
Mixed waste paper	622,190	202,210	32.5%	631,120	220,890	35.0%
Subtotal paper/paperboard	1,796,050	898,620	50.0%	1,883,430	1,040,520	55.2%
Aluminum beverage cans	32,800	26,900	82.0%	32,700	27,800	85.0%
Steel cans	50,100	33,070	66.0%	50,090	34,060	68.0%
Plastic containers	84,850	37,330	44.0%	97,890	46,990	48.0%
Other plastic packaging	150,830	3,020	2.0%	164,060	4,920	3.0%
Plastic nondurable goods	120,720	0	0.0%	127,870	0	0.0%
Glass containers	191,920	115,150	60.0%	189,760	123,340	65.0%
Yard trimmings	290,250	290,250	100.0%	295,820	295,820	100.0%
Food waste	669,200	16,730	2.5%	681,560	34,080	5.0%
Disposable diapers	59,540	0	0.0%	60,710	0	0.0%
Vehicle batteries	40,850	39,620	97.0%	42,630	41,780	98.0%
Tires	109,160	10,920	10.0%	120,830	18,120	15.0%
Textiles, rubber, & leather nondurables	159,460	28,700	18.0%	173,230	34,650	20.0%
Major appliances	74,590	74,590	100.0%	77,660	77,660	100.0%
Furniture & furnishings	171,270	0	0.0%	181,160	0	0.0%
Carpets & rugs	54,730	820	1.5%	59,960	1,800	3.0%
Miscellaneous durables	288,760	23,100	8.0%	325,930	39,110	12.0%
Wood pallets	196,980	19,700	10.0%	216,130	28,100	13.0%
Miscellaneous packaging	17,530	0	0.0%	17,530	0	0.0%
Miscellaneous inorganic wastes	67,290	0	0.0%	68,560	0	0.0%
Total MSW	4,626,880	1,618,520	35.0%	4,867,640	1,848,750	38.0%

Source: Franklin Associates, Ltd.

In terms of tonnage, corrugated containers, yard trimmings, mixed waste paper and newspapers are expected to make up two-thirds of total recovery. Newspapers are already near practical maximum recovery in Wisconsin, so increasing tonnage of other materials will be important in achieving improved recovery rates.

## **NON-MUNICIPAL SOLID WASTE**

### **Projected Generation Methodology**

**Scrap Vehicles, Coal Ash, Municipal Wastewater Treatment Sludge, Construction and Demolition Debris.** It was assumed that changes in the quantities of scrap vehicles, coal ash, municipal wastewater treatment sludge, and construction and demolition debris will be proportional to changes in Wisconsin's population. Thus, the populations projected for the state in 2005 and 2010 were multiplied by the estimated 2000 per capita rates of generation of each waste stream to arrive at future generation projections.

**Used Oil.** Used oil, as noted previously, includes that from automotive use as well as industrial use. Projected generation of automotive used oil in Wisconsin assumed that generation changes after 2000 will be proportional to population. Industrial used oil was assumed proportional to employment in industrial sectors judged as major users of oil. The employment projections used in projecting industrial used oil were based upon a review of employment in Wisconsin from 1983 through the 1990s.

**Pulp/Paper Mill Waste, Foundry Waste, Pottery Cull.** Projected Wisconsin generation of these waste streams in 2005 and 2010 also assumed that generation will be related to employment. Generation rates for 2000 were multiplied by employment projections to project each waste stream. Projections of pulp and paper mill waste were based on employment in pulp and paper mills and paperboard mills. Foundry waste projections were based on primary metals employment and pottery cull was projected from employment in the stone, clay and glass products industry. The employment projections used to project each waste stream were based upon recorded employment in the state from 1983.

### **Projected Generation**

Projected generation of non-municipal solid wastes examined in this study by each waste stream is shown in Table 3-6. Total generation of the solid wastes shown in Table 3-6 is expected to increase from about 9.1 million tons in 2000 to 9.4 million tons in 2005 and 9.7 million tons in 2010. All of the waste streams shown are expected to increase in tonnage. None of the waste streams are expected to change significantly as a percentage of non-MSW generation.

Table 3-6  
Estimated and Projected Generation Of Selected Non-MSW In Wisconsin

Waste Category	2000 <u>(tons/year)</u>	2005 <u>(tons/year)</u>	2010 <u>(tons/year)</u>
Scrap vehicles (1)	393,000	396,400	403,900
Used oil (2)	121,900	127,600	134,000
Pulp/paper mill waste (3)	1,854,900	1,934,700	2,014,500
Coal ash (1)	1,595,600	1,609,200	1,639,800
Foundry waste (3)	1,102,600	1,193,900	1,285,200
Pottery cull (3)	14,600	16,100	17,500
Municipal wastewater treatment sludge (1)	1,315,800	1,327,100	1,352,300
Construction & demolition debris (1)	<u>2,740,800</u>	<u>2,764,200</u>	<u>2,816,800</u>
	9,139,200	9,369,200	9,664,000

(1) Generation for 2005 & 2010 based on 2000 generation rate times projected WI population.

(2) Generation for 2005 & 2010 based on 2000 generation rate for used automotive oil times projected WI population plus used industrial oil generation which reflects projected manufacturing employment.

(3) Generation for 2005 & 2010 based on 2000 generation rate and adjusted for projected employment.

Source: Franklin Associates, Ltd.

It should be noted that the projections contained in Table 3-6 do not include the possibility of changes in industrial processes or other source reduction measures that might reduce waste generation. Such changes cannot be projected based upon information currently available.

**Pulp/Paper Mill Waste.** This waste stream will likely remain the next largest of the non-MSW streams in Wisconsin as the quantities continue to grow. This is consistent with an increasing number of employees in the pulp and allied products industry in Wisconsin.

**Construction and Demolition Debris.** At the currently estimated quantity, construction and demolition debris is expected to remain larger than the other non-MSW streams in Wisconsin.

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