

2020-2021 Wisconsin Statewide Waste Characterization Study

EXECUTIVE SUMMARY

The Wisconsin Department of Natural Resources (WDNR) contracted with SCS Engineers (SCS) in 2020 to update Wisconsin's statewide waste characterization Study (2020-2021 Study or Study). This Study continued WDNR's long history of tracking the types and quantities of waste disposed in Wisconsin. The 2020-2021 Study was designed to conform to previous statewide waste characterization studies to facilitate the comparison and tracking of waste disposal trends. This Study provides meaningful data to help WDNR and local governments document the impact of existing diversion initiatives, make program and policy decisions to expand waste reduction and recycling goals, strengthen economic development efforts, understand where additional education may be needed, and improve overall quality of life in communities and throughout the state.

The 15 host facilities where waste sampling and sorting activities took place represent the diversity of solid waste facilities in the State of Wisconsin with respect to geography and size. Sampling and sorting activities took place at facilities that dispose of larger quantities of waste. This facilitated the collection of representative data as it provided a greater cross-section of waste to sample. Multiple facilities in each of WDNR's five regions participated in the Study.

State law assesses fees on several types of solid waste disposed in Wisconsin landfills. The Study focused on two categories of waste:

- Category 1 - Municipal solid waste (MSW)
- Category 25 - Construction and demolition debris (CDD)

The overall objectives of the Study were as follows:

1. Use field collection methods that statistically measure waste composition data for WDNR Category 1 municipal solid waste (MSW) generated in Wisconsin and disposed at permitted solid waste facilities in the state. SCS used the methods in ASTM International Standard D 5231 - 92 (Revised 2016) *Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste* to complete this Study.
2. Develop statewide waste composition data by weight for MSW disposed by the single family residential, multi-family, and institutional/commercial/industrial (ICI) generating sectors individually and overall for the State of Wisconsin and each region individually for 85 different material components.
3. Perform standard statistical analyses of the waste composition data by calculating standard deviations and the 90 percent confidence intervals for each material component.
4. Visually estimate and calculate the composition of WDNR Category 25 construction and demolition debris (CDD) disposed at permitted solid waste facilities in each region.
5. Design the Study so that it can be compared to previous waste characterization studies to identify waste disposal changes and trends and for ease of replication in future studies that may be commissioned.

This Study provides waste composition data for each WDNR region and overall for the State of Wisconsin for the following waste generating sectors:

- **Single Family Residential** – Encompasses MSW generated from single family homes and multi-unit properties with no more than four units.
- **Multi-Family** – Includes MSW generated at properties with five or more Single family residential units.
- **Institutional/Commercial/Industrial (ICI)** – Includes MSW generated at commercial, institutional, and industrial facilities.
- **Construction and Demolition Debris (CDD)** – Includes construction and demolition waste from home and/or commercial construction or demolition job sites.

Regional waste characterization data is an aggregation of the data collected from each host facility in each particular region. The overall statewide data is an aggregation of regional data collected.

The 2020-2021 Study was conducted over two time periods as follows:

- Season 1 – September – November 2020
- Season 2 – March – April 2021

Exhibit 1 summarizes the overall Category 1 MSW composition for waste materials disposed in Wisconsin. **Table 1** provides a more detailed breakdown of the MSW characterization results for all material components measured. **Appendix E** includes acronyms for material abbreviations in the tables. The data presented is aggregated from the single family residential, multi-family, and ICI waste generating sectors and represents the overall MSW waste stream. **Exhibit 2, Exhibit 3, and Exhibit 4** summarize the overall MSW composition data for the Single family residential, multi-family, and ICI waste streams, respectively. Detailed waste composition profiles for these individual generating sectors are provided in the results section of this report.

Exhibit 1. Overall Category 1 MSW Statewide Waste Composition

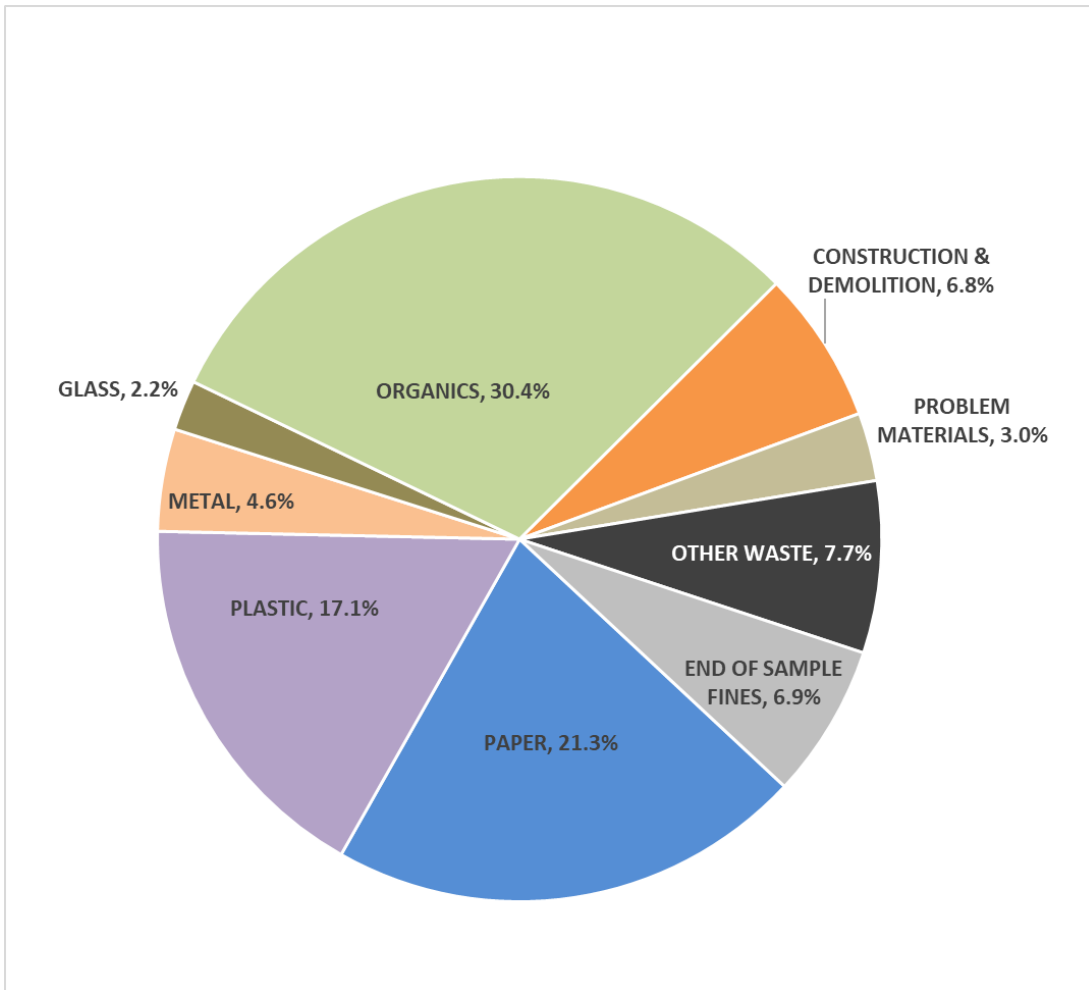


Table 1. Overall Category 1 MSW Statewide Waste Composition – Detailed
(refer to Appendices B and E for descriptions of waste types and acronyms)

Material Components	2020 Tons	Mean Composition	Standard Deviation	90% Confidence Limits	
				Lower	Upper
PAPER					
1 Newsprint (ONP)	39,200	0.9%	2.5%	0.7%	1.1%
2 High Grade Office Paper	61,800	1.4%	2.3%	1.2%	1.6%
3 Magazines/Catalogs	32,800	0.8%	1.3%	0.6%	0.9%
4 Uncoated OCC - Recyclable	138,700	3.2%	7.1%	2.6%	3.8%
5 Coated OCC	4,700	0.1%	0.6%	<0.1%	0.2%
6 Boxboard	54,800	1.3%	1.1%	1.2%	1.4%
7 Cartons - Aseptic/Gable Top Containers	16,900	0.4%	1.2%	0.3%	0.5%
8 Mixed Paper - Recyclable	223,300	5.1%	7.9%	4.5%	5.8%
9 Compostable Paper	232,000	5.3%	3.8%	5.0%	5.6%
10 Other Paper	120,700	2.8%	4.2%	2.4%	3.1%
Total Paper	924,900	21.3%			
PLASTIC					
11 PET (#1) Bottles	67,500	1.6%	3.0%	1.3%	1.8%
12 Natural HDPE (#2) Bottles	12,300	0.3%	0.5%	0.2%	0.3%
13 Colored HDPE (#2) Bottles	18,600	0.4%	0.6%	0.4%	0.5%
14 PP (#5) Bottles	800	<0.1%	0.1%	<0.1%	<0.1%
15 Other (#3, #4, #6, and #7) Bottles	500	<0.1%	<0.1%	<0.1%	<0.1%
16 PET(#1) Non-Bottle Rigid Containers & Packaging	17,600	0.4%	0.5%	0.4%	0.4%
17 HDPE (#2) Non-Bottle Rigid Containers & Packaging	6,100	0.1%	0.5%	<0.1%	0.2%
18 PP(#5) Non-Bottle Rigid Containers & Packaging	50,000	1.1%	1.1%	1.1%	1.2%
19 PS(#6) Non-Foam, Bottle Rigid Containers & Packaging	12,200	0.3%	0.4%	0.2%	0.3%
20 Other (#7)/Unidentifiable Non-Bottle Rigid Containers & Packaging	23,200	0.5%	0.7%	0.5%	0.6%
21 Rigid Non-Packaging	68,400	1.6%	2.3%	1.4%	1.8%
22 Bulky Rigid Plastics	32,500	0.7%	1.9%	0.6%	0.9%
23 PE Recyclable Film	38,600	0.9%	0.9%	0.8%	1.0%
24 Agricultural Film	8,000	0.2%	0.7%	0.1%	0.2%
25 Pouches	2,800	<0.1%	0.3%	<0.1%	<0.1%
26 Other Flexible Films	311,200	7.2%	4.8%	6.8%	7.6%
27 PS Foam (#6)	34,100	0.8%	0.8%	0.7%	0.8%
28 Compostable Plastics	1,200	<0.1%	0.3%	<0.1%	<0.1%
29 Other Plastics	40,000	0.9%	1.7%	0.8%	1.1%
Total Plastic	745,600	17.1%			
METAL					
30 Aluminum Beverage Containers	29,100	0.7%	0.7%	0.6%	0.7%
31 Other Aluminum	19,700	0.5%	1.5%	0.3%	0.6%
32 Ferrous ("Tin") Cans	24,400	0.6%	0.6%	0.5%	0.6%
33 Other Ferrous Scrap	57,800	1.3%	3.2%	1.1%	1.6%
34 Other Non-Ferrous Scrap	3,000	<0.1%	0.4%	<0.1%	0.1%
35 Other Metal	64,500	1.5%	3.3%	1.2%	1.8%
Total Metals	198,500	4.6%			

Table 1. Overall Category 1 MSW Statewide Waste Composition – Detailed
(continued)
(refer to Appendices B and E for descriptions of waste types and acronyms)

Material Components	2020 Tons	Mean Composition	Standard Deviation	90% Confidence Limits	
				Lower	Upper
GLASS					
36 Clear Containers - Beverage	27,300	0.6%	1.5%	0.5%	0.8%
37 Colored Containers - Beverage	21,700	0.5%	0.8%	0.4%	0.6%
38 Glass Food Containers	16,900	0.4%	0.6%	0.3%	0.4%
39 Other Glass	31,700	0.7%	2.5%	0.5%	0.9%
Total Glass	97,600	2.2%			
ORGANICS					
40 Yard Materials - <6"	80,000	1.8%	4.5%	1.5%	2.2%
41 Yard Materials - >6"	8,400	0.2%	1.3%	<0.1%	0.3%
42 Food Scraps (Not Traditionally Edible)	238,500	5.5%	5.5%	5.0%	5.9%
43 Wasted Food	615,500	14.1%	10.6%	13.3%	15.0%
44 Diapers	154,400	3.5%	3.7%	3.2%	3.9%
45 Animal Waste/Kitty Litter	103,400	2.4%	4.3%	2.0%	2.7%
46 Bottom Fines/Dirt	33,100	0.8%	2.8%	0.5%	1.0%
47 Other Organic Material	88,900	2.0%	3.0%	1.8%	2.3%
Total Organics	1,322,200	30.4%			
CONSTRUCTION & DEMOLITION					
48 Treated Wood	19,600	0.4%	1.6%	0.3%	0.6%
49 Untreated Clean Dimensional Lumber	58,200	1.3%	4.9%	0.9%	1.7%
50 Unpainted Engineered Wood	44,500	1.0%	4.7%	0.6%	1.4%
51 Painted/Stained Wood	43,600	1.0%	5.1%	0.6%	1.4%
52 Other Recyclable Wood	13,500	0.3%	3.7%	<0.1%	0.6%
53 Rock, Concrete, Brick	6,300	0.1%	0.7%	<0.1%	0.2%
54 Gypsum Wallboard - Demo	33,900	0.8%	4.2%	0.4%	1.1%
55 Gypsum Wallboard - Clean Scrap	8,000	0.2%	3.1%	<0.1%	0.4%
56 Roofing Shingles	3,500	<0.1%	0.7%	<0.1%	0.1%
57 PVC	2,600	<0.1%	0.3%	<0.1%	<0.1%
58 Ceramics/Porcelain Fixtures	6,800	0.2%	0.8%	<0.1%	0.2%
59 Other CDD	56,100	1.3%	3.3%	1.0%	1.6%
Total Construction & Demolition	296,600	6.8%			

Table 1. Overall Category 1 MSW Statewide Waste Composition – Detailed
(continued)
(refer to Appendices B and E for descriptions of waste types and acronyms)

Material Components	2020 Tons	Mean Composition	Standard Deviation	90% Confidence Limits	
				Lower	Upper
PROBLEM MATERIALS					
60 Televisions - CRT	2,800	<0.1%	1.1%	<0.1%	0.2%
61 Televisions - Non-CRT	500	<0.1%	0.2%	<0.1%	<0.1%
62 Other Banned Electronic Equipment	16,200	0.4%	1.4%	0.3%	0.5%
63 Non-Banned Electronic Equipment	14,800	0.3%	1.0%	0.3%	0.4%
64 Small Electrical Appliances	28,400	0.7%	1.9%	0.5%	0.8%
65 White Goods - Refrigerated	2,100	<0.1%	0.7%	<0.1%	0.1%
66 White Goods - Non-Refrigerated	2,000	<0.1%	0.9%	<0.1%	0.1%
67 Lead Acid Batteries	1,000	<0.1%	0.4%	<0.1%	<0.1%
68 Other Batteries	4,700	0.1%	0.2%	<0.1%	0.1%
69 Fluorescent Light Tubes	100	<0.1%	<0.1%	<0.1%	<0.1%
70 Compact Fluorescent Light Bulbs	700	<0.1%	<0.1%	<0.1%	<0.1%
71 Tires	8,200	0.2%	1.7%	<0.1%	0.3%
72 Paint	7,100	0.2%	1.3%	<0.1%	0.3%
73 Automotive Used Oil/Filters	2,000	<0.1%	0.3%	<0.1%	<0.1%
74 Household Hazardous Waste	2,100	<0.1%	0.4%	<0.1%	<0.1%
75 Sharps, Needles, Lancets	2,200	<0.1%	0.3%	<0.1%	<0.1%
76 Other Problem Materials	37,300	0.9%	3.4%	0.6%	1.1%
Total Problem Materials	132,200	3.0%			
OTHER WASTE					
77 Textiles	240,700	5.5%	6.4%	5.0%	6.1%
78 Carpet	44,300	1.0%	3.9%	0.7%	1.3%
79 Carpet Padding	5,800	0.1%	0.8%	<0.1%	0.2%
80 Wood Pallets	8,900	0.2%	2.0%	<0.1%	0.4%
81 Bulky Items	1,900	<0.1%	0.8%	<0.1%	0.1%
82 Mattresses and Box Springs	100	<0.1%	<0.1%	<0.1%	<0.1%
83 Wood Furniture	23,000	0.5%	2.9%	0.3%	0.8%
84 Aerosol Cans	7,900	0.2%	0.3%	0.2%	0.2%
85 Compressed Gas Containers	1,300	<0.1%	0.3%	<0.1%	<0.1%
Total Other Waste	333,900	7.7%			
END OF SAMPLE FINES					
Other Paper	30,300	0.7%	1.1%	0.6%	0.8%
Other Plastic	23,900	0.5%	1.0%	0.5%	0.6%
Other Glass	1,100	<0.1%	0.5%	<0.1%	<0.1%
Bottom Fines/Dirt	122,900	2.8%	3.8%	2.5%	3.1%
Food Scraps	23,600	0.5%	1.1%	0.5%	0.6%
Wasted Food	16,600	0.4%	0.9%	0.3%	0.5%
Other Organics	80,100	1.8%	2.6%	1.6%	2.1%
TOTALS	298,600	6.9%			
TOTALS	4,350,100	100.0%			

Note: Composition based on 398 samples

Exhibit 2. Overall Category 1 MSW Single Family Residential Statewide Waste Composition

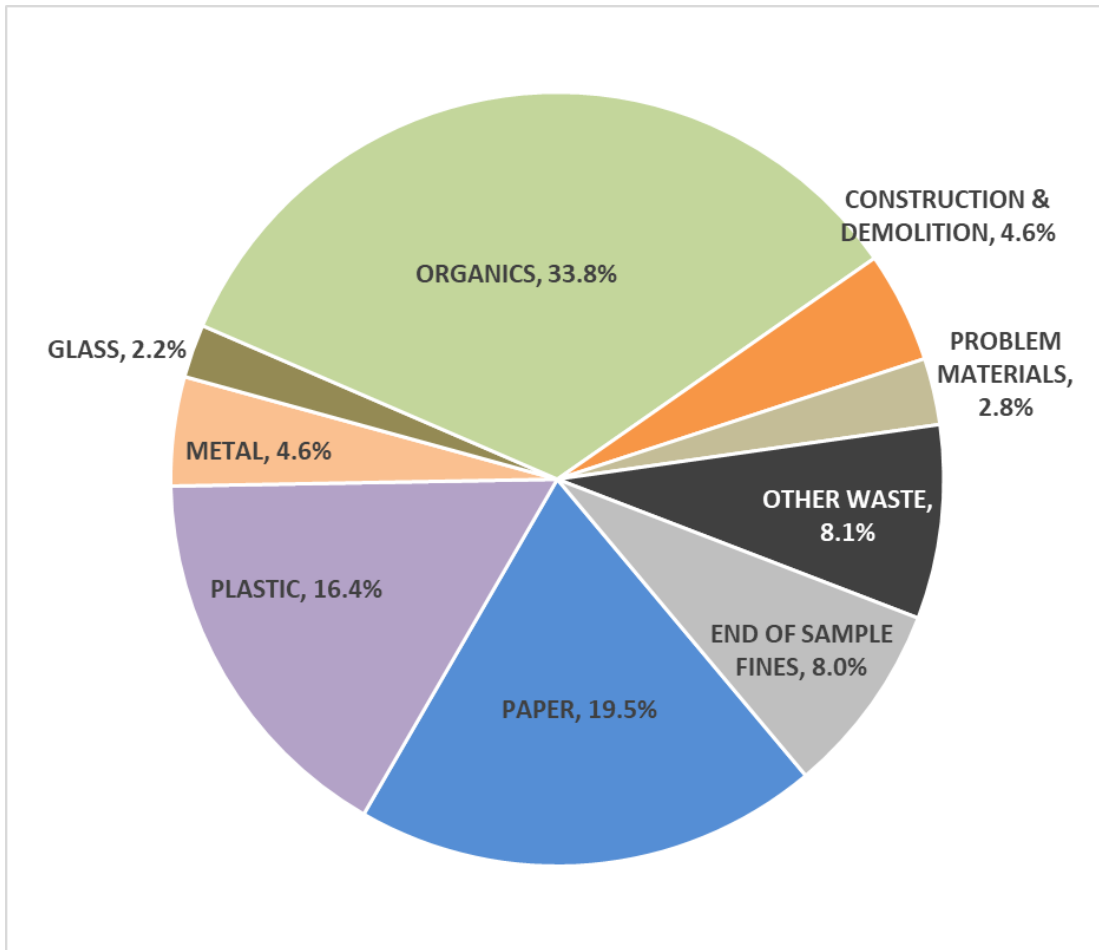


Exhibit 3. Overall Category 1 MSW Multi-Family Statewide Waste Composition

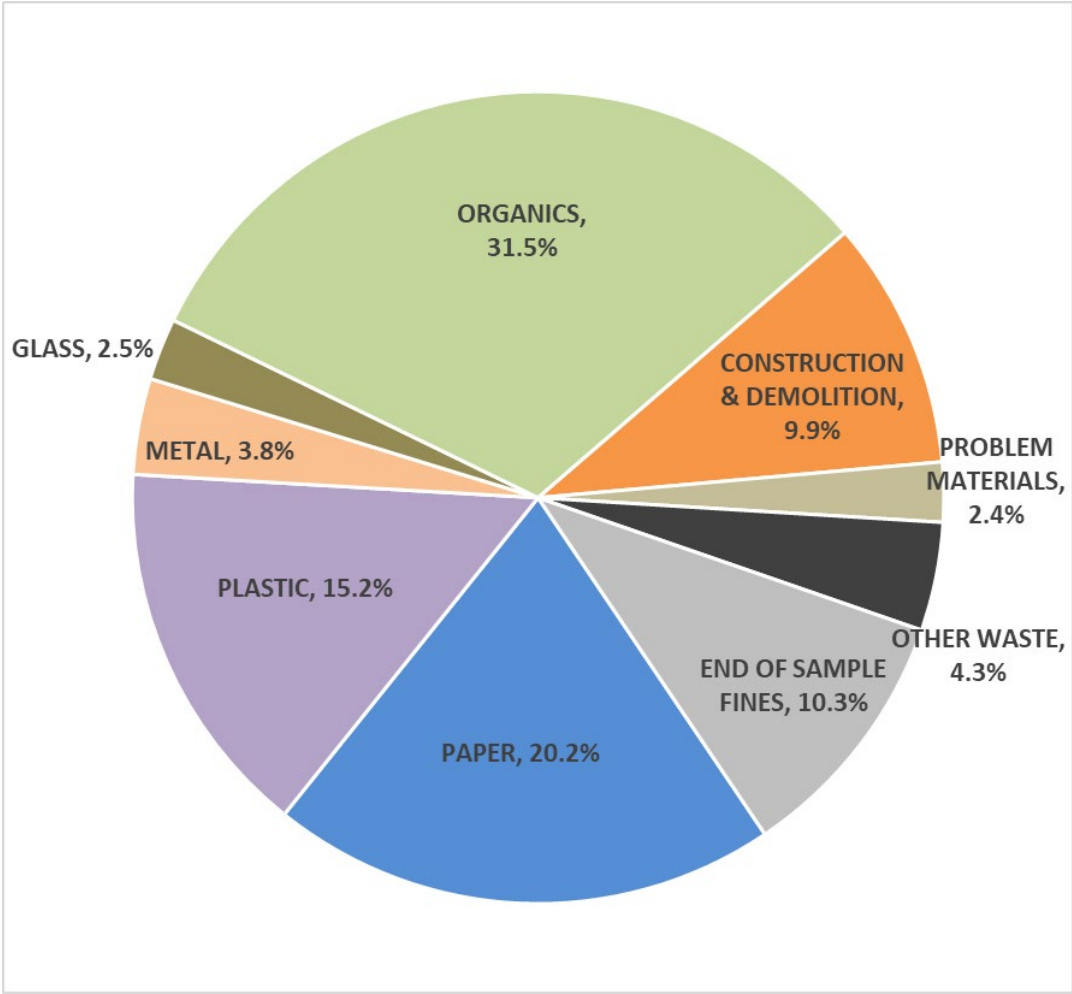


Exhibit 4. Overall Category 1 MSW ICI Statewide Waste Composition

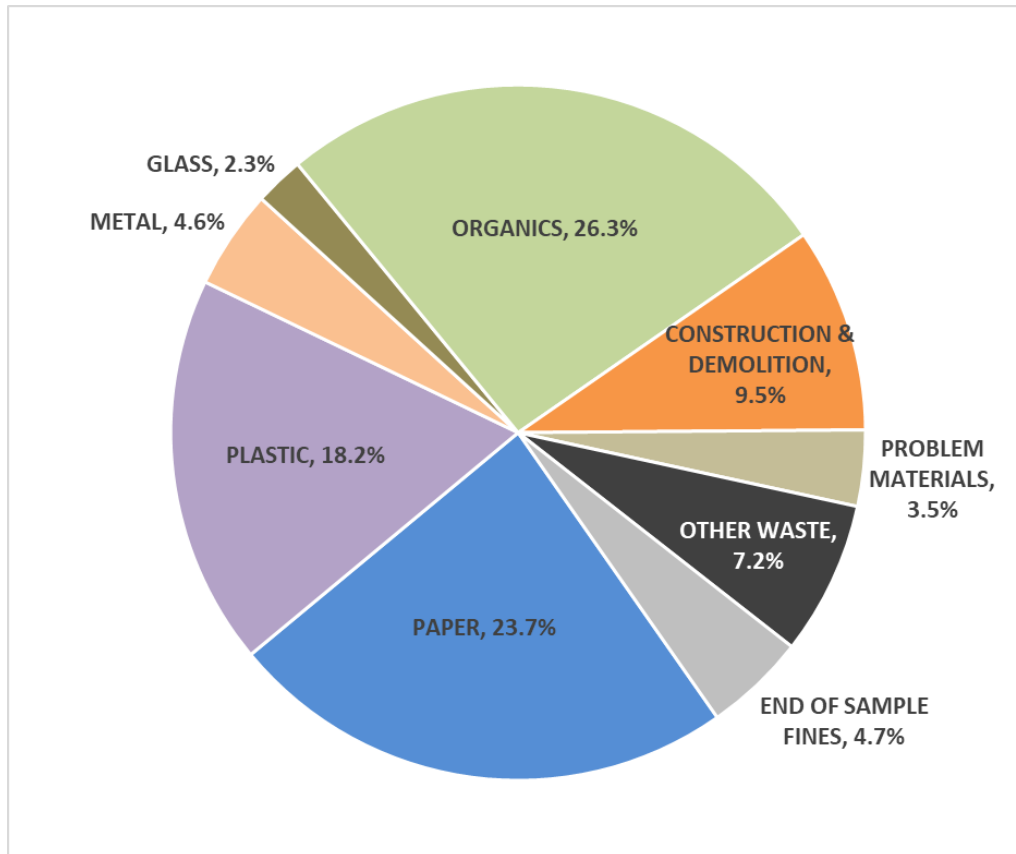


Table 2 summarizes the top 10 materials components that comprise the largest portions of the overall Category 1 MSW waste stream along with the comparison to the top ten materials from the 2009 Study. **Table 3** summarizes the top 10 materials components that comprise the largest portions of the overall Category 25 CDD waste stream along with the comparison to the top ten materials from the 2009 Study. **Table 4** summarizes the top 10 materials components from each generating sector from the 2021 Study.

Table 2. Comparison of the Top 10 Category 1 MSW Material Components from 2009 and 2020-2021

2020-2021 Study Results		2009 Study Results ¹	
Material Component	Percent Composition	Material Component	Percent Composition
Wasted Food (typically edible or spoiled food that was wasted because of spoilage or discarded before being eaten; not a result of food preparation or scraps)	14.5%	Food Scraps ² (typically edible or spoiled food that was wasted because of spoilage or discarded before being eaten, including food waste resulting of food preparation and food scraps)	10.6%
Other Flexible Films (non-PE film and non-film flexibles)	7.2%	Roofing Shingles (asphalt shingles tarpaper; also tarpaper from built-up roofing)	5.8%
Food Scraps (not traditionally edible)	6.0%	Compostable Paper (tissues and paper including OCC that are soiled with food, such as paper plates, paper cups, pizza boxes, popcorn bags and paper towels)	5.0%
Textiles (clothing, bedding, curtains, blankets, stuffed animals, cotton diapers, other cloth material and leather goods)	5.5%	Painted/Stained Wood (wood that has had an external coating applied, such as paint or varnish)	4.4%
Compostable Paper (plastic lined paper products meeting ASTM D-6868, food contaminated paper (including OCC) and low-grade paper that does not fit into the Mixed Paper-Recyclable category)	5.3%	Other Plastic Film (flexible plastic film regardless of resin type, not including plastic film shopping bags or plastic film industrial packaging)	4.3%
Mixed Paper - Recyclable (paper that would be included in residential "mixed mail" or commercial "office pack" recycling programs, not including newsprint, high grade office paper, magazines/catalogs, uncoated and coated OCC, boxboard or cartons)	5.1%	Uncoated OCC - Recyclable (uncoated cardboard with a wavy core and not contaminated with other materials such as wax or plastic coating)	3.9%
Bottom Fines/Dirt (small fragments, typically less than 2 inches, and miscellaneous fines and dirt)	3.6%	Yard Materials - <6" (leaves, grass clippings, yard and garden debris and brush, including clean woody vegetative material no greater than 6 inches in diameter)	3.8%
Diapers (infant and adult disposable diapers)	3.5%	Composite/Other Plastic (all items that were plastic but combined with metal, wood or glass)	3.6%
Other Paper (all paper that doesn't fit in the other paper categories and items that are primarily paper but include other materials such as plastic or metal)	3.5%	Bottom Fines/Dirt (small fragments that pass through the 1/4" sort screen, and miscellaneous fines and dirt)	3.6%
Uncoated OCC - Recyclable (uncoated cardboard with a wavy core and not contaminated with other materials such as wax or plastic coating)	3.2%	Other Paper (all paper that doesn't fit in the other paper categories and items that are primarily paper but include other materials such as plastic or metal)	3.5%
TOTAL	57.5%	TOTAL	48.5%

Table 3. Comparison of the Top 10 Category 25 CDD Material Components from 2009 and 2020-2021

2020-2021 Study Results		2009 Study Results ¹	
Material Component	Percent Composition	Material Component	Percent Composition
Other C&D (any other material used in home construction, not including wood, rock, brick, concrete, gypsum wallboard, shingles, PVC or ceramics/porcelain fixtures)	25.0%	Roofing Shingles (asphalt shingles tarpaper; also tarpaper from built-up roofing)	29.5%
Untreated Clean Dimensional Lumber (unpainted, untreated new or demolition dimensional lumber such as 2x4s, 2x6s, etc.; may contain nails or other trace contaminants)	11.5%	Rock, Concrete, Bricks (rock gravel, Portland cement mixtures (set or unset), fire-clay bricks, asphalt pavement)	13.2%
Roofing Shingles (asphalt shingles tarpaper; also tarpaper from built-up roofing)	10.0%	Painted/Stained Wood (wood that has had an external coating applied, such as paint or varnish in more than small amounts)	10.1%
Unpainted Engineered Wood (unpainted new or demolition scrap from sheet goods such as plywood, particle board, wafer board, oriented strand board and other residual materials used for sheathing and related construction uses)	8.7%	Clean Dimensional Lumber (unpainted, untreated new or demolition dimensional lumber such as 2x4s, 2x6s, etc.; may contain nails or other trace contaminants)	8.8%
Gypsum Wallboard - Demo (used gypsum drywall typically with paint, wallpaper or other finish coating)	6.5%	Other C & D (any other material used in home construction, not including wood, rock, brick, concrete, gypsum wallboard, shingles, PVC or ceramics/porcelain fixtures)	5.8%
Wood Pallets (wood pallets and crating materials commonly used for industrial and commercial packaging and shipping)	5.3%	Other Ferrous Scrap (ferrous and alloyed ferrous metal scrap to which a magnet is attached, includes household, commercial and industrial materials)	4.8%
Boxboard (chipboard boxes not coated with wax, plastic or metal)	4.9%	Clean Engineered Wood (unpainted new or demolition scrap from sheet goods such as plywood, particle board, wafer board, oriented strand board and other residual materials used for sheathing and related construction uses; may contain nails or other trace contaminants)	4.7%
Rock, Concrete, Brick (rock gravel, Portland cement mixtures (set or unset), fire-clay bricks, asphalt pavement)	4.3%	Drywall - Clean Scraps (unpainted gypsum drywall construction cutoffs and scrap)	3.5%
Painted/Stained Wood (wood that has had an external coating applied, such as paint or varnish in more than small amounts)	3.5%	Bottom Fines/Dirt (small fragments that pass through the 1/4" sort screen, and miscellaneous fines and dirt)	3.0%
Uncoated OCC - Recyclable (uncoated cardboard with a wavy core and not contaminated with other materials such as wax or plastic coating)	3.4%	Treated Wood (lumber that is either green or brown treated)	1.9%
TOTAL	83.1%	TOTAL	85.3%

¹ 2009 Wisconsin Statewide Waste Characterization Study, Table 3-12, Page 3-21, June 30, 2010

Table 4. Comparison of Top 10 MSW Components by Generating Sector (2020-2021)

Residential		Multi-Family		ICI	
Material	% Composition	Material	% Composition	Material	% Composition
Wasted Food (typically edible or spoiled food that was wasted because of spoilage or discarded before being eaten; not a result of food preparation or scraps)	14.8%	Wasted Food (typically edible or spoiled food that was wasted because of spoilage or discarded before being eaten; not a result of food preparation or scraps)	13.5%	Wasted Food (typically edible or spoiled food that was wasted because of spoilage or discarded before being eaten; not a result of food preparation or scraps)	14.6%
		Mixed Paper - Recyclable (paper that would be included in residential "mixed mail" or commercial "office pack" recycling programs, not including newsprint, high grade office paper, magazines/catalogs, uncoated and coated OCC, boxboard or cartons)	6.5%		8.3%
Food Scraps (not traditionally edible)	7.1%			Other Flexible Films (non-PE film and non-film flexibles)	
				Mixed Paper - Recyclable (paper that would be included in residential "mixed mail" or commercial "office pack" recycling programs, not including newsprint, high grade office paper, magazines/catalogs, uncoated and coated OCC, boxboard or cartons)	6.6%
Other Flexible Films (non-PE film and non-film flexibles)	6.4%	Food Scraps (not traditionally edible)	5.9%		
				Compostable Paper (plastic lined paper products meeting ASTM D-6868, food contaminated paper (including OCC) and low-grade paper that does not fit into the Mixed Paper-Recyclable category)	5.1%
Textiles (clothing, bedding, curtains, blankets, stuffed animals, cotton diapers, other cloth material and leather goods)	6.3%	Gypsum Wallboard - Demo (used gypsum drywall typically with paint, wallpaper or other finish coating)	5.6%		
Compostable Paper (plastic lined paper products meeting ASTM D-6868, food contaminated paper (including OCC) and low-grade paper that does not fit into the Mixed Paper-Recyclable category)	5.6%			Uncoated OCC - Recyclable (uncoated cardboard with a wavy core and not contaminated with other materials such as wax or plastic coating)	4.9%
Mixed Paper - Recyclable (paper that would be included in residential "mixed mail" or commercial "office pack" recycling programs, not including newsprint, high grade office paper, magazines/catalogs, uncoated and coated OCC, boxboard or cartons)	5.2%	Other Flexible Films (non-PE film and non-film flexibles)	5.0%		
		Compostable Paper (plastic lined paper products meeting ASTM D-6868, food contaminated paper (including OCC) and low-grade paper that does not fit into the Mixed Paper-Recyclable category)	4.6%		4.8%
Diapers (infant and adult disposable diapers)	4.2%	Animal Waste/Kitty Litter (self defined)	4.3%	Food Scraps (not traditionally edible)	
				Textiles (clothing, bedding, curtains, blankets, stuffed animals, cotton diapers, other cloth material and leather goods)	4.5%
Animal Waste/Kitty Litter (self defined)	2.9%	Diapers (infant and adult disposable diapers)	4.1%	Other Paper (all paper that doesn't fit in the other paper categories and items that are primarily paper but include other materials such as plastic or metal)	2.9%
Other Paper (all paper that doesn't fit in the other paper categories and items that are primarily paper but include other materials such as plastic or metal)	2.7%	Textiles (clothing, bedding, curtains, blankets, stuffed animals, cotton diapers, other cloth material and leather goods)	3.7%		
Yard Materials - <4" (leaves, grass clippings, yard and garden debris and brush, including clean woody vegetative material no greater than 6 inches in diameter)	2.7%	Uncoated OCC - Recyclable (uncoated cardboard with a wavy core and not contaminated with other materials such as wax or plastic coating)	3.0%	Diapers (infant and adult disposable diapers)	2.5%
				Untreated Clean Dimensional Lumber (unpainted, untreated new or demolition lumber such as 2x4s, 2x5s, etc.; may contain nails or other trace contaminants)	2.3%
Total	57.9%	Total	56.22%	Total	56.45%