2009 WISCONSIN STATE-WIDE WASTE CHARACTERIZATION STUDY

Prepared for:

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Final Report

June 30, 2010

RECYCLING CONNECTIONS CORPORATION

MSWCONSULTANTS

ACKNOWLEDGEMENTS

The Project Team of Recycling Connections Corporation (RCC) and MidAtlantic Solid Waste Consultants (MSW Consultants) would like to thank the management and participating operations staff of the following landfills and transfer stations that hosted field data collection events for their assistance during various stages of this project.

- BFI Waste Systems of North America, Inc. (Sarona);
- Dane County #2 Rodefeld (Madison);
- Outagamie County Solid Waste Division (Appleton);
- Veolia ES Cranberry Creek Landfill, LLC. (Wisconsin Rapids);
- Veolia ES Emerald Park Landfill, LLC. (Muskego);
- Veolia ES Glacier Ridge Landfill, LLC. (Horicon);
- Veolia ES Hickory Meadows Landfill, LLC. (Hilbert);
- Veolia ES Seven Mile Creek Landfill, LLC. (Eau Claire);
- WMWI – Deer Track Park, Inc. (Watertown);
- WMWI – Metro Recycling and Disposal Facility (Franklin);
- WMWI – Orchard Ridge Recycling and Disposal (Menomonee Falls);
- WMWI – Ridgeview RDF (Whitelaw);
- WMWI – Timberline Trail (Weyerhaeuser);
- WMWI – Valley Trail RDF (Berlin);
- City of Milwaukee Northwest Transfer Station;
- City of Milwaukee Lincoln Transfer Station.

Additionally, the Project Team would like to thank all of the active municipal solid waste (MSW) landfills in Wisconsin, all of which were contacted and surveyed to provide disposal data that was used to both formulate the sampling plan for the field work, and to accurately aggregate the resulting waste composition data. Finally, we would like to thank the public and private haulers, and especially the City of Milwaukee, that were able to provide loads of segregated multi-family wastes to be sampled and sorted across the state.

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ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF APPENDICES

List of Figures

List of Tables

TABLE OF CONTENTS

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ES. EXECUTIVE SUMMARY

ES 1. INTRODUCTION

The Wisconsin Department of Natural Resources (DNR) first performed a state-wide waste characterization study in 2002, with the final report published in 2003 (2002 Study). The 2002 Study was a large scale effort that captured the residential, industrial/commercial/institutional (ICI), and construction and demolition (C&D) waste streams.

This report, published in 2010 (2009 Study), summarizes the results of a complete update of the 2002 Study. DNR retained the Project Team of Recycling Connections Corporation (RCC) and MidAtlantic Solid Waste Consultants (MSW Consultants) to perform this comprehensive update. To assure comparability with the 2002 Study, the objectives of the 2009 Study were to determine the statewide aggregate composition by weight for each material type going to Wisconsin landfills, as well as the composition of residential, industrial/commercial/institutional[1] (ICI), and construction and demolition (C&D) waste individually. The 2009 Study, for the first time, also separately characterized waste from the multi-family residential sector.

For solid waste and recycling planners, it is important to differentiate between the sources of wastes so that recycling and diversion programs can be properly targeted. This study defines the following sub-streams of MSW that were targeted for separate sampling and analysis:

- **Residential Waste:** Residential wastes are generated predominantly by single family households, but also include all residential structures with up to four dwelling units.
- **ICI - Industrial/Commercial/Institutional Waste:** This category includes wastes generated by non-residential sources including commercial businesses, institutions, and industrial facilities (and excludes special industrial wastes or industrial wastes not classified as MSW). *It is important to note that the ICI sector is defined to include wastes from multi-family dwellings with five or more multi-family units.* Although multi-family wastes are by definition included in the ICI generator sector, a separate analysis of these wastes (which include residential wastes generated in residential structures with five or more dwelling units) was also included in this study.
- **Construction and Demolition (C&D) Debris:** This sector includes wastes generated during construction, renovation and/or demolition activities (not including road building).

Half of the landfills in this study receive the majority of incoming wastes from transfer trailers that originate at remote transfer stations, and many other landfills receive a significant fraction of transferred wastes. Although "transfer trailers" are not actually a generator sector in the true sense of the word, omitting these disposed wastes from the waste stream would have excluded a significant fraction of Wisconsin-generated wastes from this statewide study. The transfer trailer fraction of the waste was apportioned into the appropriate generator source category on a proportional basis for this study.

[1] By definition, the ICI waste stream includes wastes generated from multi-family apartments and condominiums with five or more units.

ES 2. OVERVIEW OF STATEWIDE WASTE COMPOSITION

Figure ES-1 shows the breakdown of major material groups for the aggregate statewide waste stream (encompassing residential, ICI, C&D and transfer trailer wastes). Results are shown both in percentage terms, as well as the estimated mean tons disposed. As shown, organics, C&D materials, and paper are the three largest contributing material groups.

Figure ES-1 2009 Statewide Waste Composition by Material Group

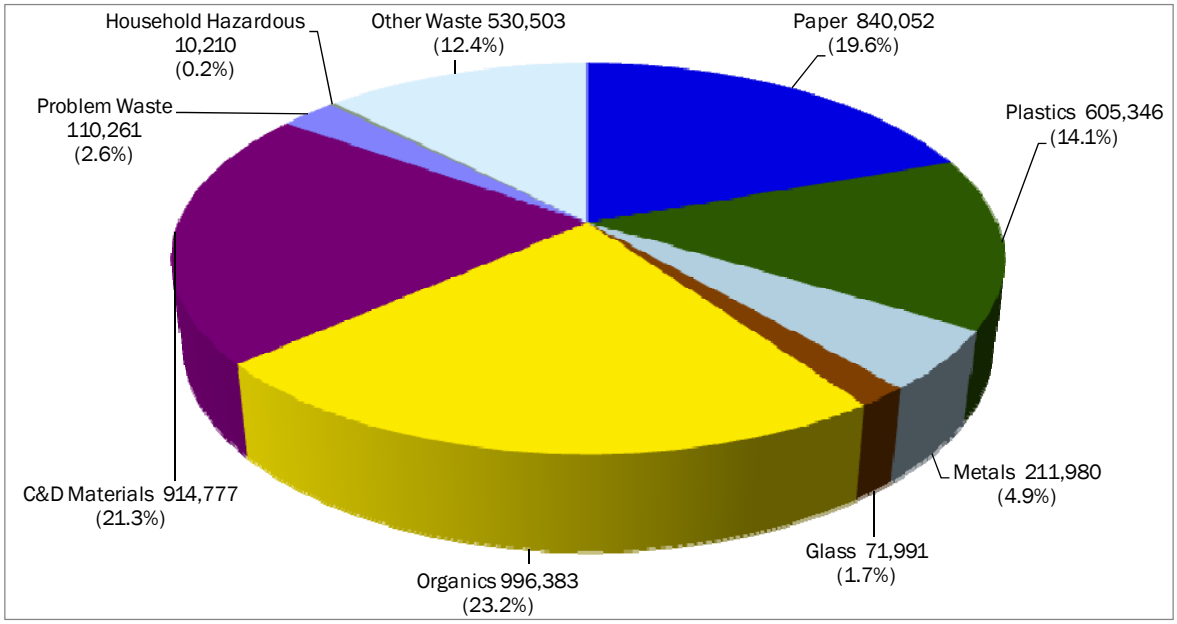

Figure ES-2 compares the quantity of each material group from the 2009 Study against the results of the 2002 Study. As shown, the waste stream has changed since the 2002 Study. The proportions of C&D materials, paper and metals have declined, while organics and plastics have increased.

Figure ES-2 Landfilled Waste Comparison, 2002 and 2009 Statewide Aggregate (1,000 Tons)

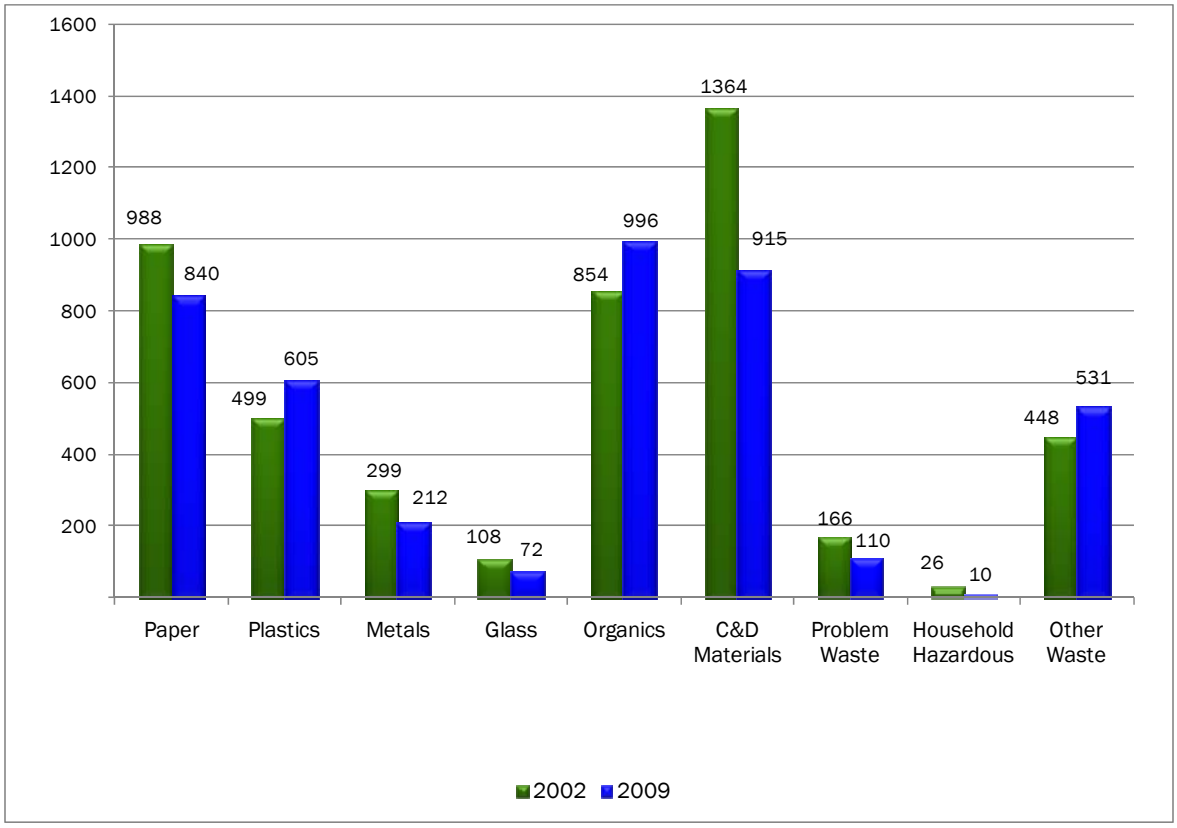

Table ES-1 compares the ten most prevalent individual material categories disposed in both the 2002 and 2009 Studies. Both the percent composition and absolute tons are shown in the table. As shown in the table notes, it was necessary to recombine several material categories from the 2009 Study to assure comparability with the 2002 Study.

Table ES-1 Top 10 Most Prevalent Material Categories, 2002 and 2009

2002 Material Category	2002 Tons	2002 Percent	2009 Material Category	2009 Tons	2009 Percent
Wood - Untreated	607,650	12.8%	Food	455,259	10.6%
Food	486,619	10.2%	Wood – Untreated [1]	383,638	8.9%
Roofing Shingles	284,752	6.0%	Roofing Shingles	247,349	5.8%
Compostable Paper	228,310	4.8%	Composite/Other Plastic [2]	242,094	5.7%
Mixed Recyclable Paper	201,715	4.2%	Plastic Film [3]	238,126	5.6%
Plastic Film	188,990	4.0%	Compostable Paper	213,694	5.0%
Cardboard - recyclable	188,176	4.0%	Bulky Items [4]	172,554	4.0%
Composite/Other Plastic	174,597	3.7%	Cardboard - recyclable	167,216	3.9%
Ferrous Metals	171,086	3.6%	Yard Waste - <6"	161,256	3.8%
Rock/Concrete/Brick	165,727	3.5%	Bottom Fines/Dirt	155,853	3.6%
2002 Total	**2,697,622**	**56.8%**	**2009 Total**	**2,437,039**	**56.8%**

Note: Totals may not sum due to rounding discrepancies.

[1] Wood–Untreated includes untreated dimensional lumber, engineered wood, painted/stained wood and other recyclable wood.

[2] Composite/Other Plastic includes other plastic and composite/other plastic categories.

[3] Plastic Film includes plastic shopping bags, industrial film packaging, agricultural plastic film, and other plastic film.

[4] Bulky Items includes bulky items and wood furniture

Table ES-2 below shows the contribution by each generator sector to the top ten most prevalent materials disposed of in 2009.

Table ES-2 Top 10 Most Prevalent Material Categories by Generator Sector

Material Category	Total Tons	Residential Percent	ICI Percent	C&D Percent	Total
Food	455,259	50.9%	48.5%	0.7%	100.0%
Wood – Untreated [1]	383,638	17.6%	35.0%	47.4%	100.0%
Roofing Shingles	247,349	6.4%	2.1%	91.5%	100.0%
Composite/Other Plastic [2]	242,094	37.5%	60.1%	2.4%	100.0%
Plastic Film [3]	238,126	28.1%	71.2%	0.7%	100.0%
Compostable Paper	213,694	53.1%	45.8%	1.1%	100.0%
Bulky Items [4]	172,554	28.0%	60.7%	11.2%	100.0%
Cardboard - recyclable	167,216	16.1%	78.3%	5.6%	100.0%
Yard Waste - <6"	161,256	60.4%	37.0%	2.5%	100.0%
Bottom Fines/Dirt	155,853	41.9%	43.3%	14.7%	100.0%
Total Tons	**2,437,039**				

Note: Totals may not sum due to rounding discrepancies.

[1] Wood – Untreated combines untreated dimensional lumber, untreated engineered wood, painted/stained wood and other recyclable wood.

[2] Composite/Other Plastic combines other plastic and composite/other plastic

[3] Plastic Film combines plastic shopping bags – film, plastic industrial film packaging, agricultural plastic film, and other plastic film.

[4] Bulky Items includes bulky items and wood furniture.

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1. INTRODUCTION

1.1. BACKGROUND

The State of Wisconsin has long been at the forefront of progressive waste management and recycling. Wisconsin's 1989 Act 335, commonly referred to as the Recycling Law, required communities to establish effective recycling programs and banned certain materials from state landfills. As a result of these efforts it is estimated that Wisconsin recycles or composts between 35 and 40 percent of its municipal solid waste. While this is positive, further opportunities exist for improving stagnated recycling rates, managing the state's resources as efficiently as possible and reducing the substantial impact of waste disposal.

At the current time there are 68 municipal solid waste and industrial waste landfills operating in the state which collectively reported disposing of approximately 8.7 million tons of wastes in 2009. In addition, there are 29 active fills that accept construction and demolition (C&D) wastes exclusively. The Wisconsin Department of Natural Resources (DNR) is tasked with oversight of these facilities, which it accomplishes through its five regions. In addition to management of disposal facilities, the DNR has long maintained a strong focus on recycling and source reduction, sponsoring many programs and grants to increase recycling across the state. One of the first steps in managing the waste stream and improving recycling and source reduction involves knowing what materials continue to be disposed of. Waste characterization studies have proved to provide such detailed information.

Many states and counties conduct waste characterization studies at regular intervals to evaluate recycling program effectiveness, monitor changes in the disposed waste stream, confirm the effectiveness of landfill disposal bans, identify potential diversion opportunities, and otherwise help manage their waste streams. Other states have conducted such studies as a service to city and county governments who rely on the data for their local planning needs. DNR first performed a statewide waste characterization study in 2002, with the final report published in 2003 (2002 Study). The 2002 Study was a large scale effort that captured the residential, industrial/commercial/institutional[1] (ICI), and construction and demolition (C&D) waste streams.

This report, published in 2010 (2009 Study), summarizes the results of field data collection performed in 2009. DNR retained the Project Team of Recycling Connections Corporation (RCC) and MidAtlantic Solid Waste Consultants (MSW Consultants) to perform this comprehensive update. To assure comparability with the 2002 Study, the objectives of the 2009 Study were to determine the statewide aggregate composition by weight for each material type going to Wisconsin landfills, as well as the composition of residential, ICI, and C&D waste individually. The 2009 Study, for the first time, also separately characterized waste from the multi-family residential sector.

[1] By definition, the ICI waste stream includes wastes generated from multi-family apartments and condominiums.

1.2. COMPARISONS BETWEEN 2002 AND 2009 STUDIES

From the outset, it was DNR's intent that the 2009 Study be performed so that the results could be reasonably compared to the 2002 Study results. Such comparability will provide the greatest insight to solid waste and recycling planners in evaluating changes to the disposed waste stream.

However, DNR's original request for proposals (RFP) for this project contained some new technical requirements that were not addressed in the 2002 Study. The Project Team provided a proposal for conducting this study that also listed some new approaches to obtain the desired data. Readers should be aware of both the similarities and the differences (some minor and some potentially significant) between the two studies. These are summarized below and addressed in greater detail in the body of the report.

1.2.1 SIMILARITIES

- **Same Host Facilities**: The host facilities from the 2002 Study provided a reasonably representative snapshot of disposed wastes generated in Wisconsin, and the same facilities were enlisted to host field data collection again in the 2009 Study. Both studies limited their analysis only to licensed municipal solid waste disposal facilities (i.e., C&D landfills were not included in the study).
- **Same Seasonal Field Data Collection**: Field data collection for the 2009 Study was performed within roughly the same seasonal windows – August-September and November-December – to assure comparability with the 2002 Study.
- **Comparable Sampling Targets**: It was reported by DNR that the confidence intervals achieved for the 2002 Study for each of the three waste streams were sufficiently narrow to satisfy the needs of the state's planners and other users of the data. For this reason, roughly comparable sample targets were established for the 2009 Study.
- **Special Waste Focus**: Incidence of sharps, mercury-containing devices, and reusable items were measured in both the 2002 and 2009 Studies.
- **Material Categories**: Material categories were almost identical in the 2002 and 2009 Studies, although DNR made some minor modifications for the 2009 Study. In both studies, certain materials were counted and photographed in addition to being weighed.
- **In-state Wastes Only**: Both studies were confined to sampling and sorting wastes generated and disposed of in Wisconsin.
- **Confidentiality:** In both studies, the detailed sample data that were obtained at individual landfills was kept confidential from DNR. The results shown in both reports represent aggregate data across all participating host landfills.

1.2.2 DIFFERENCES

- **No Commercial/Self Haul Analysis**: The 2009 Study did not attempt to duplicate the analysis of commercially-hauled versus self-hauled wastes that was contained in the 2002 Study.
- **Allocation of Samples to Regions Based on Waste Generation**: The 2002 Study obtained roughly the same number of samples from each of the five DNR regions, so that

waste composition could be analyzed and compared in detail by region. Because it was not considered a focus by DNR to provide regionally differentiated results in the 2009 Study, the total number of samples was allocated to each region in proportion to the waste generation from that region in the 2009 Study. The 2009 Study report significantly abbreviates the presentation of regional waste characterization data.

- **Transferred Wastes Included in Sampling**: Because a high fraction of wastes in Wisconsin are consolidated and transferred prior to final disposal, "transfer trailer waste" was sampled in the 2009 Study. Transferred wastes typically contain a mix of residential, ICI and even C&D wastes, and it is not possible to differentiate the origin of samples from transfer trailer loads. However, nearly 41 percent of the state's waste stream arrives in transfer trailers for landfill disposal. The 2009 Study separately analyzes this significant fraction of disposed wastes, which can then be compared to the composition of the residential, ICI and C&D waste streams individually.
- **C&D Separately Reported**: In 2002, landfills were not required to report C&D separately on their disposal reports provided to DNR. In 2009, disposal reports for the first time contained a separate material category for C&D waste (Category 25). C&D could be more easily verified in 2009 as a result of this change in reporting (with the exception of C&D waste that arrived on transfer trailers mixed with other MSW).
- **Development of Weighting Factors for Generator Sectors**: The 2002 Study relied on a survey of host landfills, supplemented by a survey of a subset of originating transfer stations, as the basis for developing weighting factors to allocate statewide wastes into the residential, ICI, and C&D fraction. The 2009 Study relied on a state-wide survey of landfills to divide wastes into residential, ICI, C&D and Transfer Trailer (i.e., mixed waste) fractions, and applied regression analysis to allocate Transfer Trailer wastes to the other three generator sectors.
- **Visual Surveying of C&D Loads**: The 2009 Study used visual, volumetric surveying of entire truckloads of C&D wastes to estimate C&D waste composition. Visual, volumetric estimates of C&D wastes were subsequently converted to weight-based estimates based on applying industry standard density factors and normalizing the resulting weight estimates based on actual scale ticket weights. This visual surveying method has become more widely used since the 2002 Study was completed, and has been found a more holistic and cost-effective means to characterize C&D wastes (or any waste stream with homogenous loads and/or a prevalence of large, bulky items in each load). The 2002 Study relied on physically sampling and sorting 200 to 300 pound samples of loads of C&D waste.

The similarities and differences are addressed in further detail where appropriate throughout this report.

1.2.3 WASTE AND RECYCLING MARKET CONDITIONS

It should be noted that the national and world economy experienced the effects of a significant economic downturn in 2008 -2009, with effects that lingered through the sampling period. While it is beyond the scope of this study to quantify the impacts, it can be qualitatively asserted that waste generation patterns may have been abnormal during 2009 for a number of reasons:

- Higher unemployment and slow or negative business growth has resulted in absolute and per-capita decreases in waste generation. Such decreases on a per-capita basis have not been seen for decades. It stands to reason that relatively more waste generation is occurring at home (i.e., the residential sector) rather than in the ICI sector as a result of this unemployment and general belt tightening.
- The building market was especially hard hit during this downturn, with construction lower than average for both residential and non-residential projects. Lack of development or redevelopment has a direct impact on the generation of C&D wastes.
- Markets for recycled materials, like many commodities markets, dropped precipitously in the early part of the year, although they recovered moderately as the year progressed. Field data collection for the 2009 Study likely avoided any aberrant waste disposal resulting from the temporary collapse of recycled material markets. This is especially true because there is no evidence of significant landfilling of recyclables in Wisconsin or elsewhere in the U.S. as a result of the adverse market conditions.

In addition to these extraordinary market conditions in 2009, it should also be noted that the waste management industry in general has changed since 2002, the last time this study was performed. Single stream recycling has emerged as the predominant strategy for recyclables collection and processing. Processors have emerged in some markets in Wisconsin to intercept and recover C&D debris to a greater degree than existed in 2002, which offsets the disposal patterns for this material. Private, vertically integrated companies have consolidated, exchanged assets, and spawned new private sector competitors, all of which offsets the flow of wastes from point of generation to final disposal. The results of this study should optimally capture the impact of these changes on waste composition since 2002. But it was not within the scope of this study to conclusively demonstrate the causes of any changes that may be observed.

1.3. REPORT ORGANIZATION

The remainder of this report presents the methodology and results of the 2009 Wisconsin statewide waste composition study. The report is divided into the following sections:

- **Methodology:** This section provides an overview of waste generation and disposal data available from DNR landfill reports and supplemented with direct surveys, and provides the detailed sampling plan that was developed to govern the study process and to provide statistically defensible data. This section also summarizes the field data collection methods and analytical methods applied in the study.
- **Results:** Detailed results about the composition of Wisconsin's landfilled waste are presented in this section. Results are presented in both tabular and graphical format to highlight findings of interest. Results are presented in the aggregate and by generator type.
- **Appendices:** Supplemental data and field data collection forms are contained in several appendices. Specific appendices include:
  - Material category detailed definitions and mapping of C&D visual categories to overall categories.
  - Landfill survey instruments.
  - Field data forms.

2. METHODOLOGY

2.1. GENERATOR SECTORS

For solid waste and recycling planners, it is important to differentiate between the sources of wastes so that recycling and diversion programs can be properly targeted. This study defines the following four generator sectors that were targeted for separate sampling and analysis:

- **Residential Waste:** Residential wastes are generated predominantly by single family households, but also include all residential structures with up to four dwelling units. Residential waste is most often collected by public and private collection entities in commercial compacting collection trucks. Residential wastes have historically been delivered in rearload compacting trucks, sideload automated trucks, and a small amount from self-haulers. Based on the driver interviews conducted during the study, it was observed that a meaningful fraction of residential wastes are being collected in frontload vehicles with carry-cans.
- **ICI - Industrial/Commercial/Institutional Waste:** This category includes wastes generated by non-residential sources including commercial businesses, institutions, and industrial facilities (excepting any special industrial wastes or industrial wastes elsewhere classified). *It is important to note that the ICI sector is defined to include wastes from multi-family dwellings with five or more units.* These multi-family buildings, such as high-rise and garden apartments and condominiums, usually receive commercial container service (or compactor roll-off service) and are collected on the same routes with other non-residential wastes. ICI wastes have been defined to include multi-family wastes for two reasons. First, there are significant practical difficulties with obtaining representative, segregated samples of multi-family wastes in a statewide study given commercial collection practices. Second, this definition is consistent with definitions in Wisconsin's Recycling Law.
- **Construction and Demolition (C&D) Debris:** This sector includes wastes generated during construction, renovation and/or demolition activities. C&D debris is usually collected in open top roll-off boxes sited at construction sites, as well as by self-haulers such as roofers, drywallers, and other related building support professions.
- **Multi-family Residential Waste**: This includes residential wastes that are generated in residential structures with five or more dwelling units. Although multi-family wastes are by definition included in the ICI generator sector, there are important reasons for separately evaluating multi-family waste. Apartments and condominiums have less space available to residents and management to support source separated recycling, and higher transience also leads to lower recycling participation at multi-family dwellings. Recycling planners must design recycling programs that are tailored to multi-family dwellings.

All results are presented separately for these four generator sectors. However, to derive these results, this study separately analyzed mixed wastes arriving in Transfer Trailers. This method is new to the 2009 Study.

According to a survey of all landfills in the state (discussed in more detail later in this section), half of the landfills in this study received the majority of incoming wastes from transfer trailers that have originated at remote transfer stations, and many other landfills receive a significant

fraction of transferred wastes. These trailers hold up to 100 cubic yards of wastes that may include a mixture of residential, ICI, and even some C&D wastes tipped at the originating transfer station. Although "transfer trailers" are not actually a generator sector in the true sense of the word, omitting these disposed wastes from the waste stream would have excluded a significant fraction of Wisconsin-generated wastes from this statewide study. For this reason, the 2009 Study included both direct hauled and transferred wastes in the analysis.

It is also important to note that the results for the residential, ICI and C&D generator sectors are representative of wastes across the state. Conversely, the analysis of multi-family wastes did not attempt to provide a defensible, state-wide characterization of the multi-family waste stream. This is because of the practical limitations associated with obtaining representative, geographically and demographically distributed samples of multi-family wastes across such a large geographic waste shed. Rather, the Project Team secured participation from haulers to deliver segregated loads of multi-family wastes at 11 of the 14 host disposal facilities. Because of a strong commitment from the City of Milwaukee, which provides collection to multi-family properties across the City, a significant number of samples were obtained from within city limits. Although multi-family samples were not obtained in a rigorously representative fashion (e.g., Milwaukee-area multi-family waste is over-weighted), the results do illustrate the differences between the single family and multi-family waste streams.

2.2. WISCONSIN WASTE GENERATION AND DISPOSAL

2.2.1 STATEWIDE

As a first step in characterizing wastes generated and disposed of in Wisconsin, landfill disposal data were compiled from the tonnage capacity reports DNR receives from all permitted municipal solid waste (MSW) landfills in Wisconsin. These reports summarize waste disposal by waste type, where waste types are designated for state fee purposes. This waste characterization study focuses on the following waste types:

- Category 1: Municipal wastes, and
- Category 25: Construction and demolition (C&D) waste.

According to DNR, all residential, commercial, institutional, and not-elsewhere-classified industrial wastes are captured in Category 1. Beginning January 1, 2009, all unmixed C&D wastes were classified in Category 25. It was noted, however, that some C&D waste is still included in Category 1 when it is mixed with MSW on a transfer trailer.

It should be noted that the Sampling Plan for this project was developed with 2007 disposal data. In 2007 (and also in the 2002 Study), C&D waste was included either in Category 1 or in Category 6 (all other solid waste), at the discretion of the reporting landfills.[1] Based on feedback provided during a survey of the state's MSW landfills in early 2009 (which relied on 2007 disposal data because the 2008 disposal reports had not been submitted yet), C&D

[1] It was reported by DNR that in 2008 and prior years, Category 6 included certain wastes that were not targeted in this study, including asbestos, liquids from bioreactor operations, solidified waste, and PCB contaminated sediments. However, this category also may have included C&D debris, which was reported by some of the landfills to make up a significant fraction of Category 6 wastes when the landfills were surveyed about their 2007 disposal data. With the addition of Category 25 for C&D waste starting with the 2009 disposal reports, we have compared the 2002 Study disposed wastes with the sum of the Category 1 and Category 25 wastes in 2009.

debris was predominantly included in Category 1. However, this ambiguity was eliminated beginning with the 2009 disposal reports.

As shown in Table 2-1, in 2009 4.3 million tons of MSW and C&D waste (Categories 1 and 25) waste generated in Wisconsin was disposed of in 33 MSW landfills permitted for proper disposal of these waste. Data from the 2002 Study are also shown in the table (it is presumed, but not confirmed, that this total reflects Category 1 wastes reported for that year).

Table 2-1 Disposal Summary (Category 1 and 25 Waste) for Wisconsin MSW Landfills

WDNR Region	2002 Study (2001 Tonnage)		2009 Study (2009 Tonnage)			
	In-State Tons Disposed	Percent of Total Disposed [1]	In-State Category 1 (MSW)	In-State Category 25 (C&D)	In-State Total	Percent of Total Disposed [1]
Northern	327,802	6.9%	184,869	11,133	196,002	4.6%
Northeast	1,183,610	24.9%	918,276	77,658	995,934	23.2%
West Central	585,096	12.3%	573,045	56,495	629,540	14.7%
South Central	934,348	19.7%	734,249	79,048	813,297	19.0%
South East	1,721,362	36.2%	1,562,902	93,829	1,656,731	38.6%
Total	**4,752,218**	**100.0%**	**3,973,341**	**318,163**	**4,291,503**	**100.0%**

[1] Totals may not sum due to rounding discrepancies.

2.2.2 HOST LANDFILLS

An objective of both the 2002 and 2009 Studies was to perform data collection at the disposal facilities that receive the largest quantities of municipal solid wastes generated in Wisconsin. Imported wastes have been excluded from both studies. Table 2-2 summarizes the landfills that were selected to host field sampling and sorting activities in both the 2009 and 2002 Studies. This table also shows the percentage of waste from each region that was disposed of in these landfills in 2009.

Table 2-2 Disposal Summary (Municipal Solid Waste) for Host Landfills (2009 Data)

DNR Region	Facility Name	In-State Tons Disposed	Percent of Total Disposed Within Region
Northern	WASTE MANAGEMENT WI - TIMBERLINE TRAIL RDF	131,637	67.2%
	BFI WASTE SYSTEMS OF NORTH AMERICA INC		
Northeast	W M W I - VALLEY TRAIL	505,070	50.7%
	VEOLIA ES HICKORY MEADOWS LANDFILL LLC		
	W M W I - RIDGEVIEW RECYCLING & DISPOSAL		
	OUTAGAMIE CNTY SW DIV LF		
West Central	VEOLIA ES CRANBERRY CREEK LF LLC	403,428	64.1%
	VEOLIA ES SEVEN MILE CREEK LF LLC		
South Central	W M W I - DEER TRACK PARK INC	598,137	73.5%
	VEOLIA ES GLACIER RIDGE LF LLC		
	DANE CNTY LF #2 RODEFELD		
Southeast	WMWI-ORCHARD RIDGE RECYCLING & DISPOSAL	1,241,851	75.0%
	VEOLIA ES EMERALD PARK LANDFILL LLC		
	W M W I - METRO RECYCLING & DISPOSAL		
	All Host Landfills Total	**2,880,123**	**67.1%**

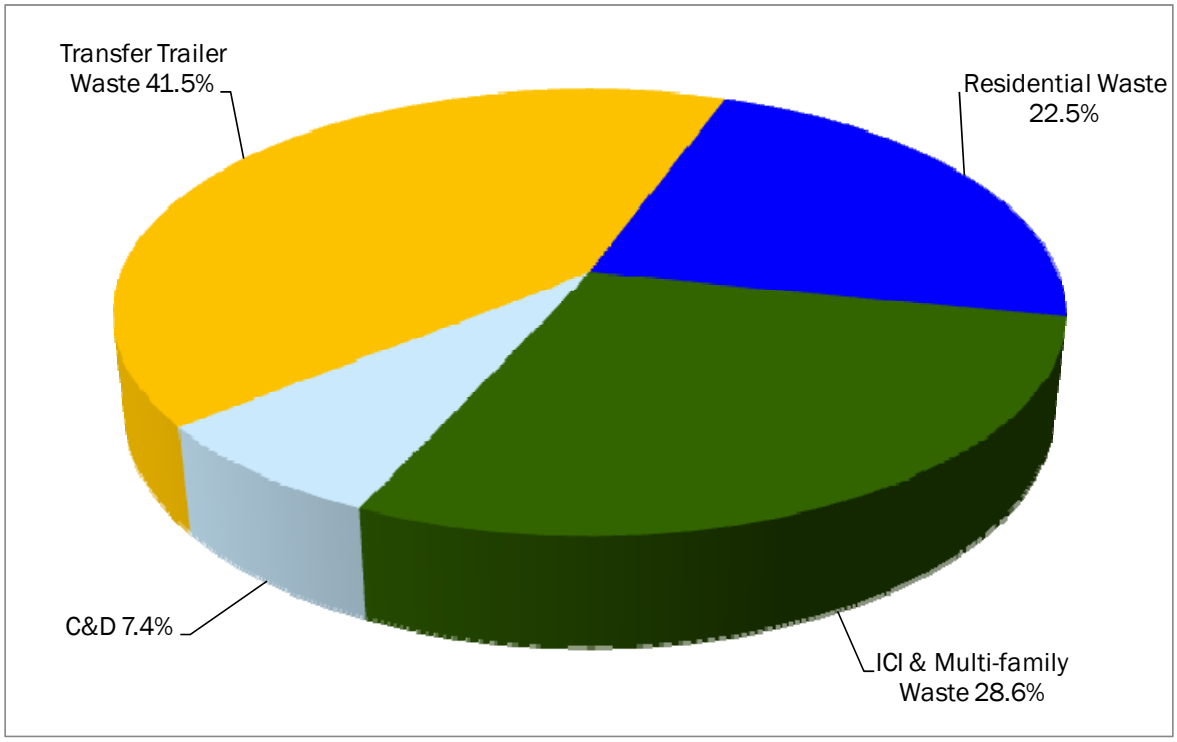
As shown in this table, the host landfills selected for this study were among the largest in each region in terms of waste receipts. The 14 host disposal facilities shown above disposed of 67.1 percent of all Wisconsin-generated Category 1 and Category 25 waste in 2009.

The Project Team subsequently surveyed each of the host disposal facilities shown in the table above to determine the relative contribution of wastes from each of the generator sectors defined in the study. Ultimately, all 33 of the landfills receiving municipal solid wastes were included in the survey to obtain information about the sources of waste disposed, with the vast majority providing scale reports or an estimate of the requested data. The Landfill Questionnaire is included in this document as Appendix B.

Survey responses were compiled to estimate the breakdown of disposed waste by each of the generator sectors defined in this study. Figure 2-1 summarizes the resulting estimates of waste disposal by generator sector. As shown, roughly 42 percent of all wastes generated in

Wisconsin were found to first be consolidated at a transfer station before transport to a landfill for final disposal.[2]

Figure 2-1 Contribution of Waste by Generator Sector (Based on Landfill Surveys)



[2] It should be noted that these are estimates based on best-available information provided by 30 of the 33 surveyed landfills. Some facilities were able to supply relatively detailed information based on scale records, while others provided estimates only. Actual values could vary from the values shown, and it is not possible to place a statistical error range around these figures.

Based on DNR feedback on this breakdown, it was subsequently determined that transfer trailer wastes should be allocated to the residential, ICI and C&D generator sectors for purposes of reporting the final results of this study. This was accomplished through a regression analysis of the observed waste composition of the residential, ICI and C&D waste streams, to solve for the observed composition of the Transfer Trailer waste stream. The results of this analysis are shown in Table 2-3, and a complete discussion is contained in Appendix D.

Table 2-3 Estimated Contribution of Generator Sectors to Transfer Trailer Wastes

Generator Sector	Percent
Residential	26.6%
ICI	49.6%
C&D	23.8%
Total	**100.0%**

Figure 2-2 compares the estimated breakdown from the 2009 Study analysis of waste contribution by generator sector with the estimate by generator sector as shown in the 2002 Study; the same data are shown in Table 2-4 and are used for data aggregation.

Figure 2-2 Comparison of Wastes by Generator Sector, 2002 and 2009 Study

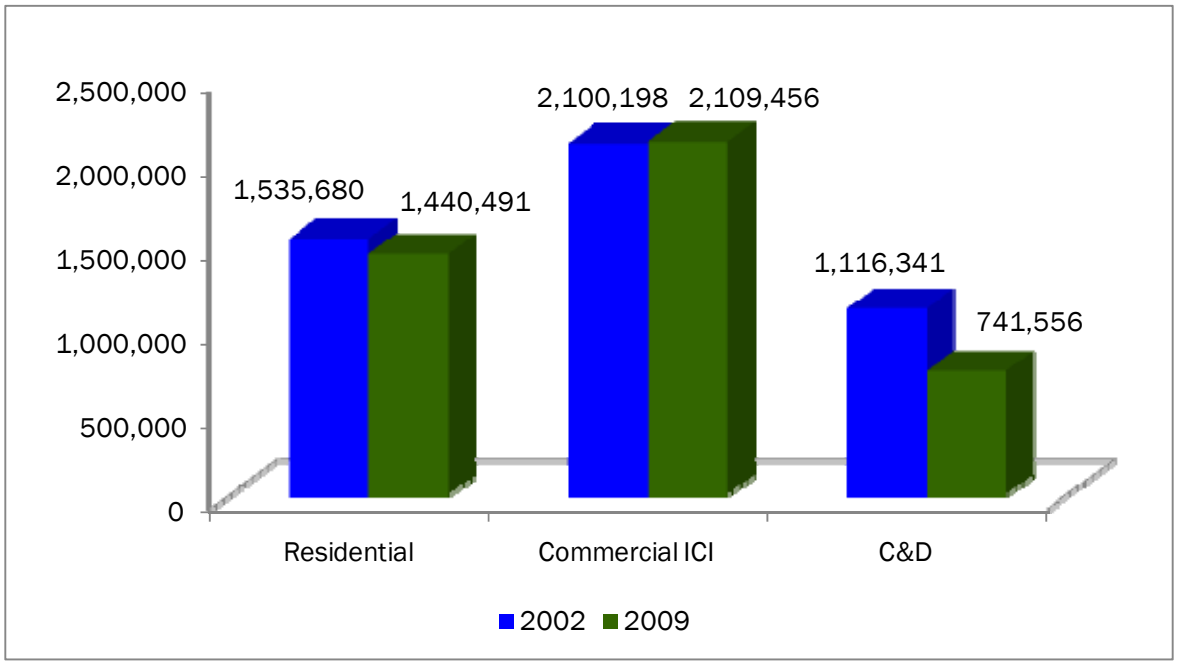


Table 2-4 Annual Waste Disposal by Generator Sector

Generator Sector	Tons, 2002	Tons, 2009	Percent, 2009
Residential	1,535,680	1,440,491	33.6%
ICI	2,100,198	2,109,456	49.2%
C&D	1,116,341	741,556	17.3%
Total	**4,752,219**	**4,291,503**	**100.0%**

Note: Totals may not sum due to rounding discrepancies.

As shown, the distribution of disposed wastes by generator is roughly in proportion from both studies. However, the 2009 Study suggests that there was a significant reduction in C&D waste generation compared to the 2002 Study. Because of limitations to the landfill surveying process and because of error ranges introduced by the regression analysis of transfer trailer waste composition, these results exhibit some level of variance. However, the general breakdown appears reasonable given their qualitative correlation to the macroeconomic variables that drive waste generation and waste disposal.

2.3. SAMPLING TARGETS

The Project Team's proposal for this project provided for 340 manually sorted samples of residential, ICI, and multi-family wastes, and 605 visually surveyed loads of C&D debris. Based on the responses to the Landfill Surveys, Table 2-5 summarizes the allocation of these samples by generator sector. Table 2-5 also shows the actual number of samples obtained by generator sector. As shown, sampling targets were achieved or slightly exceeded.

Table 2-5 Sample Allocation Summary

Generator Sector	Sample Type	Planned Samples	Actual Samples	Difference
Residential	Manually sorted	74	86	+12
ICI	Manually sorted	112	114	+2
Transfer Trailers	Manually sorted	94	94	0
C&D	Visually surveyed	605	602	-3
Multi-Family Residential	Manually sorted	60	64	+4
Total		**945**	**960**	**+15**

2. METHODOLOGY

To determine the number of samples targeted at each host disposal facility, total allocated samples were distributed in proportion to the reported waste quantities by generator within each region. Table 2-6 summarizes the planned and actual sampling targets for the manually sorted samples.

Table 2-6 Planned vs Actual Distribution of Manually Sorted Samples

DNR Region	Host Facility	Planned Samples					Actual	Difference
		Single Family	ICI	Transfer Trailers	Multi-Family	Total Samples		
NE	Outagamie County SW Division	14	10	0	4	28	29	+1
NE	WMWI – Valley Trail RDF	2	7	16	2	27	27	0
NE	WMWI – Ridgeview RDF	2	8	4	0	14	17	+3
NE	Veolia E.S. Hickory Meadows LLC	2	3	12	4	21	19	-2
NO	WMWI – Timberline Trail	1	4	7	0	12	12	0
NO	BFI Waste Systems of N. America	4	1	1	2	8	8	0
SC	Veolia E.S Glacier Ridge	5	4	10	2	21	21	0
SC	Dane County #2 Rodefeld	4	9	1	4	18	18	0
SC	WMWI – Deer Track Park, Inc.	4	7	13	0	24	17	-7
SE	Veolia E.S. Emerald Park LLC	19	12	7	4	42	38	-4
SE	WMWI – Metro Recycling & Disposal	3	14	0	16 [1]	33	50	+17
SE	WMWI – Orchard Ridge Recyc & Disp	5	20	10	16 [2]	51	53	+2
WC	Veolia E.S. Seven Mile Creek	5	9	6	2	22	21	-1
WC	Veolia E.S. Cranberry Creek	4	4	7	4	19	28	9
	Planned	**74**	**112**	**94**	**60**	**340**	**358**	**+18**
	Actual	**86**	**114**	**94**	**64**	**358**		
	Difference	**12**	**2**	**0**	**4**	**18**		

[1] Sampling and sorting performed at the City of Milwaukee Lincoln Transfer Station.
[2] Sampling and sorting performed at the City of Milwaukee Northwest Transfer Station.

As shown in the table, the Project Team was successfully able to sample and sort the targeted distribution of incoming truckloads across the host disposal facilities, with minor variation. Based on DNR landfill disposal reports and on the survey responses provided by the host landfills, the samples shown above reasonably represent the universe of municipal solid wastes disposed in Wisconsin, by region and by generator sector.

A similar method was initially used to allocate visual surveys of C&D loads. Based on the direct feedback received from landfills during the site visits, the Project Team allocated C&D samples across the facilities in rough proportion to the expected availability of C&D loads arriving at each facility. Table 2-7 shows this distribution.

Table 2-7 Planned vs. Actual Distribution of Visually Surveyed C&D Samples

DNR Region	Facility	Planned	Actual	Difference
NE	Outagamie County SW Division	100	148	+48
NE	WMWI – Valley Trail RDF	15	10	-5
NE	WMWI – Ridgeview RDF	40	26	-14
NE	Veolia ES Hickory Meadows Landfill LLC	10	5	-5
NO	WMWI – Timberline Trail	5	5	0
NO	BFI Waste Systems of North America, Inc.	5	9	+4
SC	Veolia ES Glacier Ridge Landfill LLC	10	9	-1
SC	Dane County #2 Rodefeld	90	107	+17
SC	WMWI – Deer Track Park, Inc.	45	19	-26
SE	Veolia ES Emerald Park Landfill LLC	80	92	+12
SE	WMWI – Metro Recycling & Disposal Facility	45	32	-13
SE	WMWI – Orchard Ridge Recycling & Disposal	15	13	-2
WC	Veolia ES Seven Mile Creek Landfill LLC.,	125	97	-28
WC	Veolia ES Cranberry Creek Landfill LLC	20	30	+10
	Total	**605**	**602**	**-3**

As shown, the Project Team ultimately captured the targeted numbers of C&D loads from a macro level. However, significant variation existed at the various landfills, causing the actual distribution of C&D loads to vary from the facility-specific targets. Although host landfills responded to surveys designed to identify the availability of C&D wastes, in practice these estimates did not always materialize. Because of this dynamic, the Project Team accepted a higher number of C&D loads at landfills where these loads were plentiful, to compensate for shortfalls at other landfills. Although there were some significant discrepancies, note that the sample distribution by region was less affected (i.e., regional allocations were closer to targets) and that overall targets were met.

On a broader note, construction levels nationally and in Wisconsin were at historical lows while the field work was being conducted in 2009. Most of the landfills reported that the general economic downturn and the drop-off in construction was reducing the amount of this waste being disposed of at the time of the 2009 Study. Additionally, the Project Team learned that C&D deliveries to municipal solid waste landfills in several metropolitan areas, especially in the Southeast Region (Milwaukee area), were recently reduced by the opening of new C&D recycling facilities.

It should also be noted that some of the host disposal facilities are known to limit or prohibit the delivery of certain types of C&D debris from being disposed. DNR reported, for example, that the Dane County Landfill does not accept commercial roofing debris. The Project Team believes the distribution of C&D visual samples across all 14 host disposal facilities provided sufficiently representative data for use in determining the composition of C&D waste entering municipal solid waste landfills at the time of sampling in 2009, despite these facility-specific details.

2.4. FIELD DATA COLLECTION SCHEDULE

The 2009 Study performed sampling and sorting of residential, ICI, and transfer trailer wastes during the same two seasonal time periods as the 2002 Study. Specifically, both studies performed the first seasonal field data collection effort in August/September to capture summer season waste, and again in November/December to capture winter season wastes.

However, the Project Team made one significant change in this schedule for the C&D sampling and visual surveying. Feedback from the host facilities indicated that the generation of C&D debris drops off sharply in the winter months. Even landfills that report significant quantities of C&D on an annual basis indicated that C&D deliveries in the November/December timeframe are limited. For this reason, all C&D sampling and visual surveying was performed in the summer season.

Table 2-8 shows the field data collection schedule for all host facilities over both seasons.

Table 2-8 Field Data Collection Schedule

Region	August/September	Physical Sampling and Sorting Dates	C&D Visual Surveying Dates
Northern	BFI Waste Systems of North America, Inc.	Aug 4-5	Aug 4
Northeastern	WMWI – Ridgeview RDF	Aug 6-7	Aug 17-18
Northeastern	Outagamie County SW Division	Aug 10-12	Aug 10-14
South Central	WMWI – Deer Track Park, Inc.	Aug 13-14	Aug 21-24
Southeastern	WMWI – Orchard Ridge Recycling & Disposal	Aug 15-19 [1]	Aug 29
Southeastern	WMWI – Metro Recycling & Disposal Facility	Aug 20-25 [2]	Aug 31
West Central	Veolia ES Cranberry Creek Landfill LLC	Aug 26-27	Aug 12-13
Northern	WMWI – Timberline Trail	Nov 2-3	Aug 5
West Central	Veolia ES Seven Mile Creek Landfill	Nov 4-5	Aug 6-11
South Central	Veolia ES Glacier Ridge Landfill LLC	Nov 6-9	Aug 20
Southeastern	Veolia ES Emerald Park Landfill	Nov 10-12	Sep 1-3
South Central	Dane County #2 Rodefeld	Nov 16-17	Aug 25-28
Northeastern	WMWI – Valley Trail RDF	Nov 18-19	Aug 14
Northeastern	Veolia ES Hickory Meadows	Nov 23-24	Aug 19

[1] Includes one day at the City of Milwaukee Northwest Transfer Station.
[2] Includes two days at the City of Milwaukee Lincoln Transfer Station.

2.5. FIELD DATA COLLECTION

This section describes the procedures applied by the Project Team while in the field.

2.5.1 LOAD SELECTION AT INDIVIDUAL FACILITIES

Although daily sampling targets by generator sector were known in advance, samples were obtained systematically at each facility to assure that no individual judgment was introduced into the random selection of loads for sampling (with the exception of multi-family samples, described separately later in this section).

The Project Team's Field Supervisor divided the total number of expected incoming loads of each truck type (residential rearload/sideload; commercial frontload; transfer trailer; open top roll-off and self haul) by the number of samples needed that day from that facility. The resulting number is the sampling frequency and determined whether every third vehicle, every sixth vehicle, or every 20th vehicle was selected for sampling. This strategy is the known as the "nth truck" approach.

The Field Supervisor, working in coordination with facility personnel, kept a tally of vehicles from each truck type as they entered the facility. When the designated nth truck arrived, the vehicle was directed to the sampling area.

The Field Supervisor interviewed the drivers of selected loads to obtain information about origin of the load, validation of waste generating sector, hauler, vehicle type and number, and other data. This information was noted on the Field Supervisor's vehicle selection form, along with a unique identifying number associated with that vehicle on that day. The Project Team has created separate vehicle tracking forms for both the residential/ICI wastes and for C&D wastes; these are shown in Appendix B.

2.5.2 TAKING SAMPLES FROM RESIDENTIAL, ICI, AND TRANSFER TRAILER LOADS

Selected loads of residential, ICI, and transfer trailer wastes were tipped in the designated sampling area. From each selected load, one sample of waste was selected based on systematic "grabs" from the load. The entry point for each grab was taken sequentially moving around the perimeter of the tipped load similar to a clock face. As successive loads tipped, the first samples were taken from 3 o'clock, 6 o'clock, 9 o'clock, 12 o'clock, and then from 1, 4, 7, and 10 o'clock, and so on. Excluding the multi-family loads, only one sample was collected from each tipped load. To insure there was no mixing of the selected loads after sampling, the Field Supervisor would instruct the facility's loader operator to push the remaining load into the working face. If the loader operator was too busy to push the sampled load, the Field Supervisor instructed the driver with the next selected load to be sampled to dump away from the load that had been sampled. When multiple selected loads were staged to be sampled, the Field Supervisor would place a placard with the sample number on the tipped load and place traffic cones around the load to show that it had not been sampled. This protocol was used to ensure that selected loads were not mixed or sampled twice.

Once the area of the tipped load was selected, the Field Supervisor coordinated with a facility-provided loader operator to take a "grab" sample of wastes from that point in the tipped load.

The loader operator used the loader to remove a sample of waste weighing at least 250 pounds. This sample was deposited on a tarp designated to receive samples. The Field Supervisor wrote the sample number on a dry erase white board, and digitally photographed the board and the sample for ongoing cataloging. Figure 2-3 below shows an example of a sample that has been staged for sorting.

2.5.3 TAKING SAMPLES FROM TARGETED MULTI-FAMILY LOADS

At most of the host disposal facilities, the Project Team arranged with one or more haulers to have segregated loads of multi-family wastes delivered for targeted sampling and sorting. These arrangements were made by the Project Team pursuant to a recruiting effort conducted prior to the field work.

Figure 2-3 Example of a Grab Sample Staged for Manual Sorting

When specially collected multi-family loads arrived, they were also directed to the sampling area for processing with the regularly scheduled samples. However, the sampling process for multi-family wastes was not as rigidly systematic as compared to the other generator sectors. Specifically, the Project Team relied on the following sampling protocol for use in taking grab samples from specially-delivered multi-family loads.

1. Some haulers ran special loads that contained less than a full truckload of multi-family wastes. For example, some multi-family truckloads arrived having serviced a relatively small number of multi-family apartment complexes. In other cases, haulers were able to arrange for slightly modified routes that resulted in a full load of multi-family wastes.[3] The driver of each multi-family load was first interviewed to confirm how many and what type of multi-family properties had been collected in the segregated load.
2. Loads that contained waste from only one or two multi-family complexes were only sampled once. Segregated loads of multi-family waste that weighed less than 4,000 pounds resulted in only one sample.
3. Loads that contained waste from multiple multi-family complexes could be sampled twice. Segregated loads that weighed between 4,000 and 10,000 pounds could support up to two samples. In this case, the Field Supervisor made a conscious effort to take one sample from towards the front of the load and the second sample from towards the rear on the opposite side, in an attempt to obtain samples from different multi-family complexes.

[3] The City of Milwaukee was a major contributor to this effort because they already operate dedicated multi-family collection routes.

4. Loads that contained waste from many multi-family complexes (i.e., multi-family full routes) that exceed 10,000 pounds were sampled up to three times. The Field Supervisor attempted to take one sample towards the front of the load, a second sample from the middle of the load on the opposite side, and a third sample towards the rear of the load on the same side as the first sample.

While these sampling strategies were not as purely random as the approach used for residential, ICI and transfer trailer waste, they were necessary to obtain segregated multi-family wastes within the available project resources. The Project Team believes this methodology best balances issues of multi-family waste stream representativeness and cost to obtain samples; however, it should be noted that the multi-family waste composition reported in this Study is not representative of the entire state's multi-family waste stream.

2.5.4 MANUAL SORTING

Once the sample was acquired and placed on a tarp, the material was manually sorted into the prescribed component categories. Plastic 20-gallon bins with sealed bottoms were used to contain the separated components. A picture of the sorting table and bins is shown in Figure 2-4.

Figure 2-4 Sort Table and Bins

Sorters were trained to specialize in certain material groups, with someone handling the paper categories, another the plastics, another the glass and metals, and so on. In this way, sorters became highly knowledgeable in a short period of time as to the definitions of individual material categories. Ultimately, the Project team used a combination of dedicated sort crews and locally recruited light-industrial temporary employees to staff the field data events.

The Crew Chief monitored the bins as each sample was sorted, rejecting materials that were improperly classified. Open bins allowed the Crew Chief to see the material at all times. The Crew Chief also verified the purity of each component during the weigh-out (discussed below). For consistency and accuracy, the same Crew Chief served during both seasonal sorts.

The materials were sorted to particle size of 2 inches or less by hand, until no more than a small amount of homogeneous fine material ("mixed residue") remained. The sort table was covered by a screen that allows half-inch-minus particles to fall through. The layer of materials larger than ½ inch and smaller than two inches was manually sorted to the appropriate categories based on the best judgment of the Crew Chief—most often a combination of Other Paper, Other Organics, or Food Waste. Particles falling through the screen were allocated to the "Bottom Fines/Dirt" category unless they could be clearly identified as belonging in another category.

2.5.5 VISUAL SURVEYING OF C&D LOADS

The Project Team used a visual surveying protocol for characterizing C&D loads. This approach involved making detailed volumetric measurements of the truck and load dimensions, followed by the systematic observation of the major material components in the tipped load. The basic steps to visual surveying were:

1. Measure the dimensions of the incoming load prior to tipping and (if possible) estimate the percent full of the vehicle.
2. Tip the load. If it is a large load, and if possible, have a loader spread out the material so that it is possible to discern dense materials such as block, brick, and dirt that tend to sink to the bottom of the pile.
3. Make a first pass around the load marking the major material categories that are present in the load—cardboard, drywall, dimensional lumber, etc. Estimate the percentage of the load made up of these major materials. If possible, estimate the yardage associated with this material.
4. Make a second pass around the load, noting the secondary material categories contained in the load. Estimate the percentage of the load made up of these materials. If possible, estimate the yardage associated with this material.
5. Validate that the estimated percentages sum to 100 percent, and that the estimated yardage of major material categories is realistic given the overall truck dimensions and volume.

The Project Team dedicated an experienced Field Supervisor to the surveying of C&D loads for the duration of the study.

2.5.6 DATA RECORDING

The Crew Chief was singularly responsible for overseeing all weighing and data recording of each manually sorted sample once sorting was complete. Each bin containing sorted materials from the just-completed samples was carried over to a digital scale. Sorting laborers assisted with carrying and weighing the bins of sorted material, and the Crew Chief recorded all data.

The Crew Chief used a waste composition data sheet to record the sorted sample weights, as well as to record other sampling requirements (such as counting and photographing). Each data sheet containing the sorted weights of each sample could be matched up against the Field Supervisor's sample sheet to assure accurate tracking of the samples each day. The manual sort field data sheet is included in Appendix B.

Similarly, the Field Supervisor had a custom field data form for visual surveys, and was responsible for filling out the form in its entirety for each surveyed sample. This form is also included in the Appendix.

3. RESULTS

3.1. STATEWIDE WASTE COMPOSITION

Figure 3-1 shows the breakdown of major material groups for the aggregate statewide waste stream (encompassing residential, ICI, C&D and transfer trailer wastes). Results are shown both in percentage terms as well as the estimated mean tons disposed. As shown, organics, C&D materials, and paper are the three largest contributing material groups.

Figure 3-1 2009 Statewide Waste Composition by Material Group

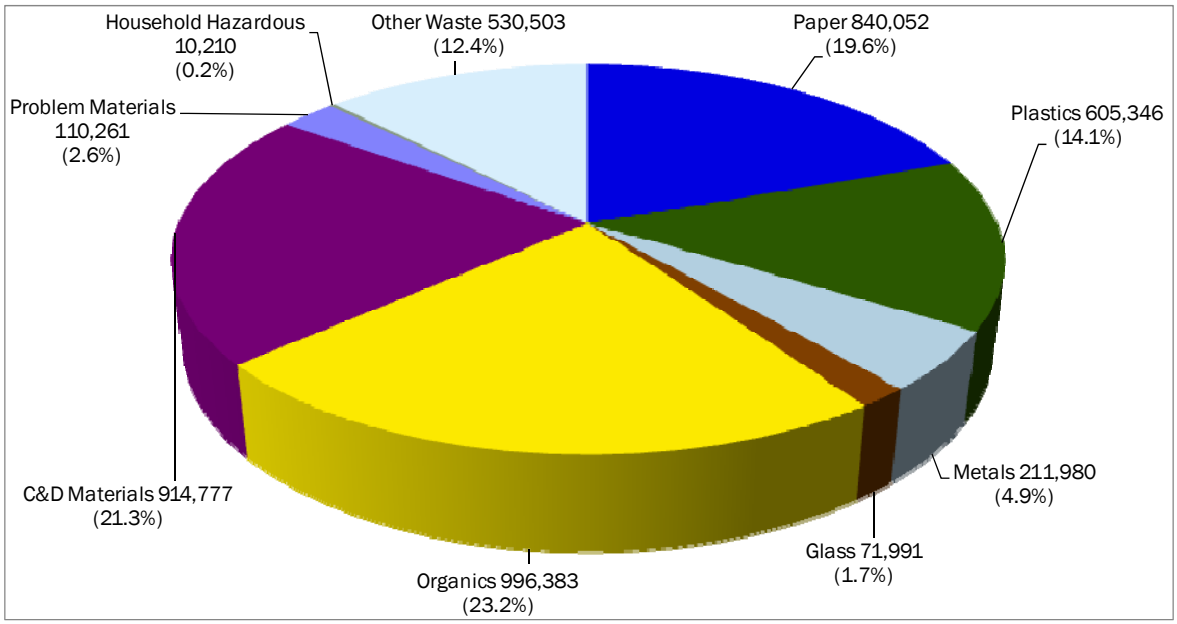


Table 3-1 on the following page provides a detailed statistical profile of the statewide disposed waste stream. For each material category, the estimated disposed tons, mean percent, and lower and upper confidence intervals are shown. Confidence intervals are calculated at a 90 percent level of confidence, consistent with the analysis in the 2002 Study.

3. RESULTS

Table 3-1 2009 Detailed Statewide Waste Composition

Materials	Tons [1]	Mean	90% Conf. Int. Lower	90% Conf. Int. Upper
1 Newspaper (ONP)	64,161	1.5%	1.2%	1.7%
2 High-Grade Office Paper	31,538	0.7%	0.6%	0.9%
3 Magazines/Catalogs	42,508	1.0%	0.8%	1.1%
4 Uncoated OCC	167,216	3.9%	3.3%	4.5%
5 Coated OCC	31,523	0.7%	0.5%	1.0%
6 Boxboard	55,512	1.3%	1.0%	1.6%
7 Mixed Paper - Recyclable	81,977	1.9%	1.6%	2.2%
8 Compostable Paper	213,694	5.0%	4.6%	5.4%
9 Other Paper	151,922	3.5%	2.6%	4.5%
Subtotal Paper	***840,052***	***19.6%***	***18.2%***	***20.9%***
10 PET Beverage Bottles	18,951	0.4%	0.4%	0.5%
11 PET Non-Bev. Bottles/Jars	5,219	0.1%	0.1%	0.1%
12 HDPE Natural Bottles	6,262	0.1%	0.1%	0.2%
13 HDPE Colored Bottles	9,296	0.2%	0.2%	0.3%
14 Other Plastic #3 - #7 Bottles	4,206	0.1%	0.1%	0.1%
15 Food Polystyrene Foam	14,708	0.3%	0.2%	0.4%
16 Other Polystyrene Foam	11,940	0.3%	0.1%	0.4%
17 Other Rigid Plastic Pkg.	54,545	1.3%	0.8%	1.7%
18 Plastic Shopping Bags - film	11,569	0.3%	0.2%	0.3%
19 Plastic Industrial Film Pkg.	34,500	0.8%	0.4%	1.2%
20 Agricultural Plastic Film	5,968	0.1%	0.0%	0.3%
21 Other Plastic Film	186,089	4.3%	3.7%	4.9%
22 Other Plastic	85,881	2.0%	1.6%	2.4%
23 Composite/Other Plastic:	156,213	3.6%	2.9%	4.4%
Subtotal Plastic	***605,346***	***14.1%***	***12.9%***	***15.3%***
24 Alum. Bev. Containers	9,063	0.2%	0.2%	0.2%
25 Other Aluminum:	20,996	0.5%	0.3%	0.7%
26 Ferrous (Tin) Cans	19,909	0.5%	0.4%	0.5%
27 Other Ferrous Scrap	84,735	2.0%	1.6%	2.4%
28 Non-Ferrous Metal	13,558	0.3%	0.2%	0.4%
29 Other Metal	63,720	1.5%	1.0%	1.9%
Subtotal Metal	***211,980***	***4.9%***	***4.3%***	***5.6%***
30 Clear Beverage Containers	11,701	0.3%	0.2%	0.3%
31 Colored Beverage Containers	13,173	0.3%	0.2%	0.4%
32 Glass Food Containers	6,284	0.1%	0.1%	0.2%
33 Other Glass	40,834	1.0%	0.4%	1.5%
Subtotal Glass	***71,991***	***1.7%***	***1.1%***	***2.3%***
34 Yard Materials - <6"	161,256	3.8%	3.1%	4.4%
35 Yard Materials - >6"	18,439	0.4%	0.2%	0.7%
36 Food Scraps	455,259	10.6%	9.7%	11.5%
37 Diapers	83,053	1.9%	1.5%	2.4%
38 Animal Waste/Kitty Litter	53,657	1.3%	1.0%	1.5%
39 Bottom Fines/Dirt	155,853	3.6%	3.1%	4.1%
40 Other Organic Material	68,866	1.6%	1.4%	1.9%
Subtotal Organics	***996,383***	***23.2%***	***21.8%***	***24.6%***
41 Treated Wood	38,548	0.9%	0.6%	1.2%
42 Clean Dimensional Lumber	95,554	2.2%	1.9%	2.6%
43 Clean Engineered Wood	73,287	1.7%	1.3%	2.1%
44 Painted/Stained Wood	188,548	4.4%	3.8%	5.0%
45 Other Recyclable Wood	26,249	0.6%	0.3%	0.9%
46 Rock/Concrete/Bricks:	73,708	1.7%	1.3%	2.1%
47 Drywall - Demolition	34,734	0.8%	0.5%	1.1%
48 Drywall - Clean Scrap	21,340	0.5%	0.3%	0.7%
49 Roofing Shingles	247,349	5.8%	5.1%	6.5%
50 PVC	10,841	0.3%	0.1%	0.4%
51 Ceramics/Porcelain Fixtures	11,403	0.3%	0.1%	0.4%
52 Other C&D	93,215	2.2%	1.8%	2.6%
Subtotal C&D	***914,777***	***21.3%***	***19.7%***	***22.9%***
53 Televisions - CRT	16,904	0.4%	0.1%	0.7%
54 Televisions - Non CRT	3,125	0.1%	0.0%	0.2%
55 Computer Monitors - CRT	2,350	0.1%	0.0%	0.1%
56 Computer Related Electronics	11,077	0.3%	0.1%	0.4%
57 Other Electronic Equip.	14,930	0.3%	0.2%	0.5%
58 Small electrical Appliances	35,238	0.8%	0.6%	1.1%
59 White Gds - Refrig.	10,922	0.3%	0.0%	0.5%
60 White Gds - Non Refrig.	3,554	0.1%	0.0%	0.2%
61 Lead Acid Batteries	6	0.0%	0.0%	0.0%
62 Other Household Batteries (OHB	2,267	0.1%	0.0%	0.1%
63 Fluorescent Light Tubes	90	0.0%	0.0%	0.0%
64 Compact Fluorescent Light Tube	146	0.0%	0.0%	0.0%
65 Tires	9,651	0.2%	0.0%	0.5%
Subtotal Problem Mtls.	***110,261***	***2.6%***	***1.9%***	***3.3%***
66 Paint	482	0.0%	0.0%	0.0%
67 Auto Used Oil/Filters	653	0.0%	0.0%	0.0%
68 Household Hazardous	1,444	0.0%	0.0%	0.1%
69 Medical Waste	7,630	0.2%	0.0%	0.3%
Subtotal Hazardous	***10,210***	***0.2%***	***0.0%***	***0.5%***
70 Textiles	109,012	2.5%	2.1%	3.0%
71 Carpet	128,860	3.0%	2.3%	3.7%
72 Carpet Padding	36,629	0.9%	0.6%	1.1%
73 Wood Pallets	83,447	1.9%	1.3%	2.5%
74 Bulky Items	90,459	2.1%	1.3%	2.9%
75 Wood Furniture	82,095	1.9%	1.3%	2.6%
Subtotal Other Wastes	***530,503***	***12.4%***	***10.9%***	***13.9%***
Total	**4,291,503**	**100.0%**		
Number of Samples	**897**			

Note: Subtotals may not sum due to rounding discrepancies.

Figure 3-2 and Table 3-2 compare the breakdown of material groups from the 2009 Study against the results of the 2002 Study. As shown, the waste stream has changed since the 2002 Study. C&D materials, paper and metals have declined, while organics and plastics have increased.

Figure 3-2 Landfilled Waste Comparison, 2002 and 2009 Statewide Aggregate (1,000 Tons)

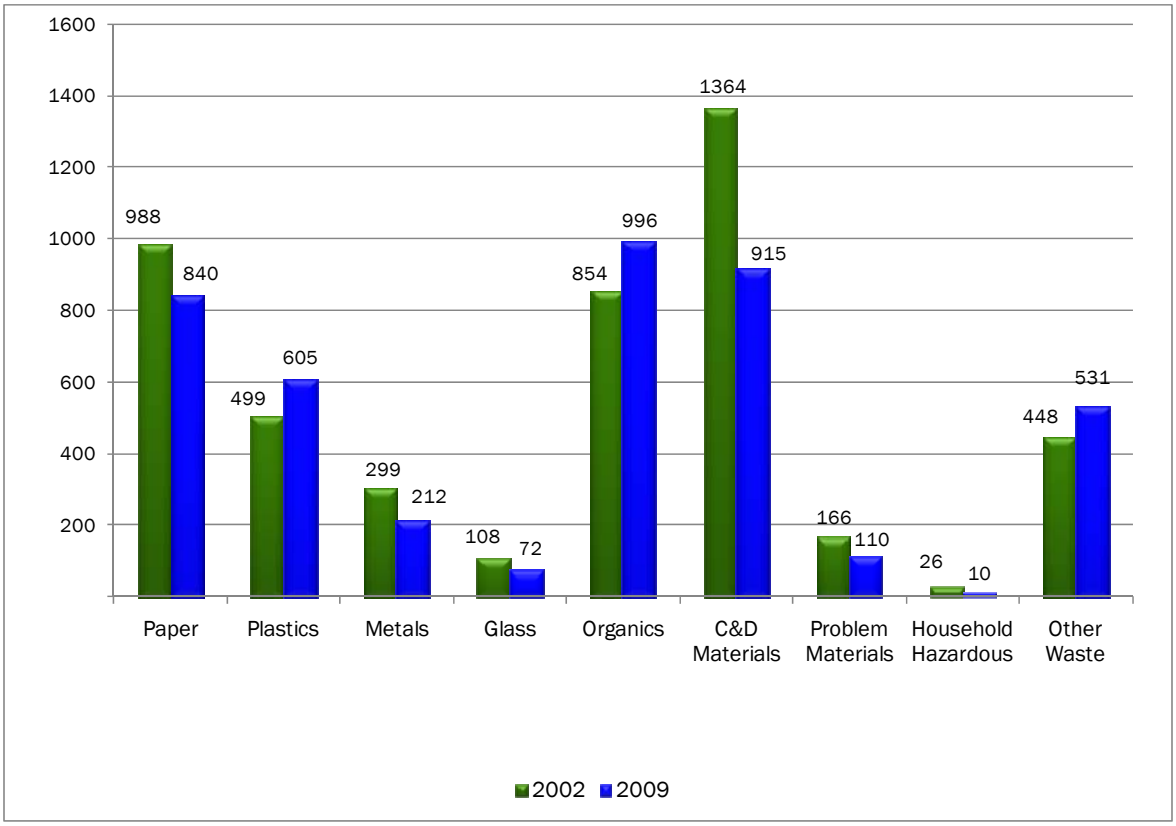


Table 3-2 Landfilled Waste Comparison, 2002 and 2009 Statewide Aggregate

	2002		2009	
Material Group	**Tons**	**Percent**	**Tons**	**Percent**
Paper	987,646	20.8%	840,052	19.6%
Plastics	499,313	10.5%	605,346	14.1%
Metals	299,245	6.3%	211,980	4.9%
Glass	107,862	2.3%	71,991	1.7%
Organics	853,914	18.0%	996,383	23.2%
C&D	1,364,053	28.7%	914,777	21.3%
Problem Materials	165,692	3.5%	110,261	2.6%
Hazardous Waste	26,155	0.6%	10,210	0.2%
Other Waste	448,338	9.4%	530,503	12.4%
Total	**4,752,218**	**100%**	**4,291,503**	**100%**

Note: Totals may not sum due to rounding discrepancies.

3. RESULTS

Table 3-3 compares the ten most prevalent individual material categories disposed in both the 2002 and 2009 Studies. Both the percent composition and absolute tons are shown in the table. As shown in the table notes, it was necessary to recombine several material categories from the 2009 Study to assure comparability with the 2002 Study.

Table 3-3 Top 10 Most Prevalent Material Categories, 2002 and 2009

2002 Material Category	2002 Tons	2002 Percent	2009 Material Category	2009 Tons	2009 Percent
Wood - Untreated	607,650	12.8%	Food	455,259	10.6%
Food	486,619	10.2%	Wood – Untreated [1]	383,638	8.9%
Roofing Shingles	284,752	6.0%	Roofing Shingles	247,349	5.8%
Compostable Paper	228,310	4.8%	Composite/Other Plastic [2]	242,094	5.7%
Mixed Recyclable Paper	201,715	4.2%	Plastic Film [3]	238,126	5.6%
Plastic Film	188,990	4.0%	Compostable Paper	213,694	5.0%
Cardboard - recyclable	188,176	4.0%	Bulky Items [4]	172,554	4.0%
Composite/Other Plastic	174,597	3.7%	Uncoated OCC	167,216	3.9%
Ferrous Metals	171,086	3.6%	Yard Materials - <6"	161,256	3.8%
Rock/Concrete/Brick	165,727	3.5%	Bottom Fines/Dirt	155,853	3.6%
2002 Total	**2,697,622**	**56.8%**	**2009 Total**	**2,437,039**	**56.8%**

Note: Totals may not sum due to rounding discrepancies.

[1] Wood–Untreated includes untreated dimensional lumber, engineered wood, painted/stained wood and other recyclable wood.

[2] Composite/Other Plastic includes other plastic and composite/other plastic categories.

[3] Plastic Film includes plastic shopping bags, industrial film packaging, agricultural plastic film, and other plastic film.

[4] Bulky Items includes bulky items and wood furniture

Figures 3-3 and 3-4 on the following pages compare the change in absolute tons disposed and the percentage composition for every material category in the study.

Figure 3-3 Change in Disposed Tons by Material Category, 2002 to 2009

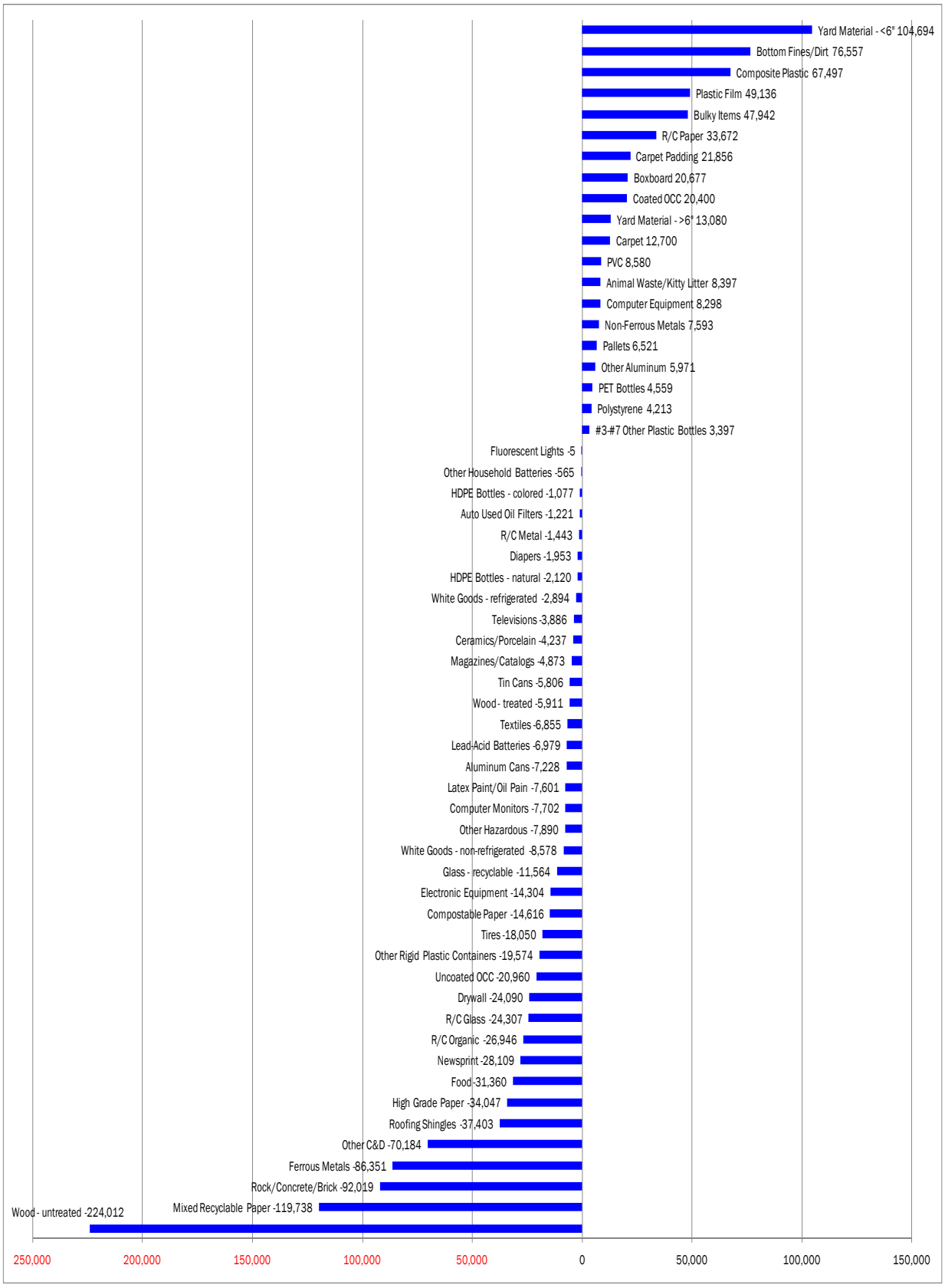
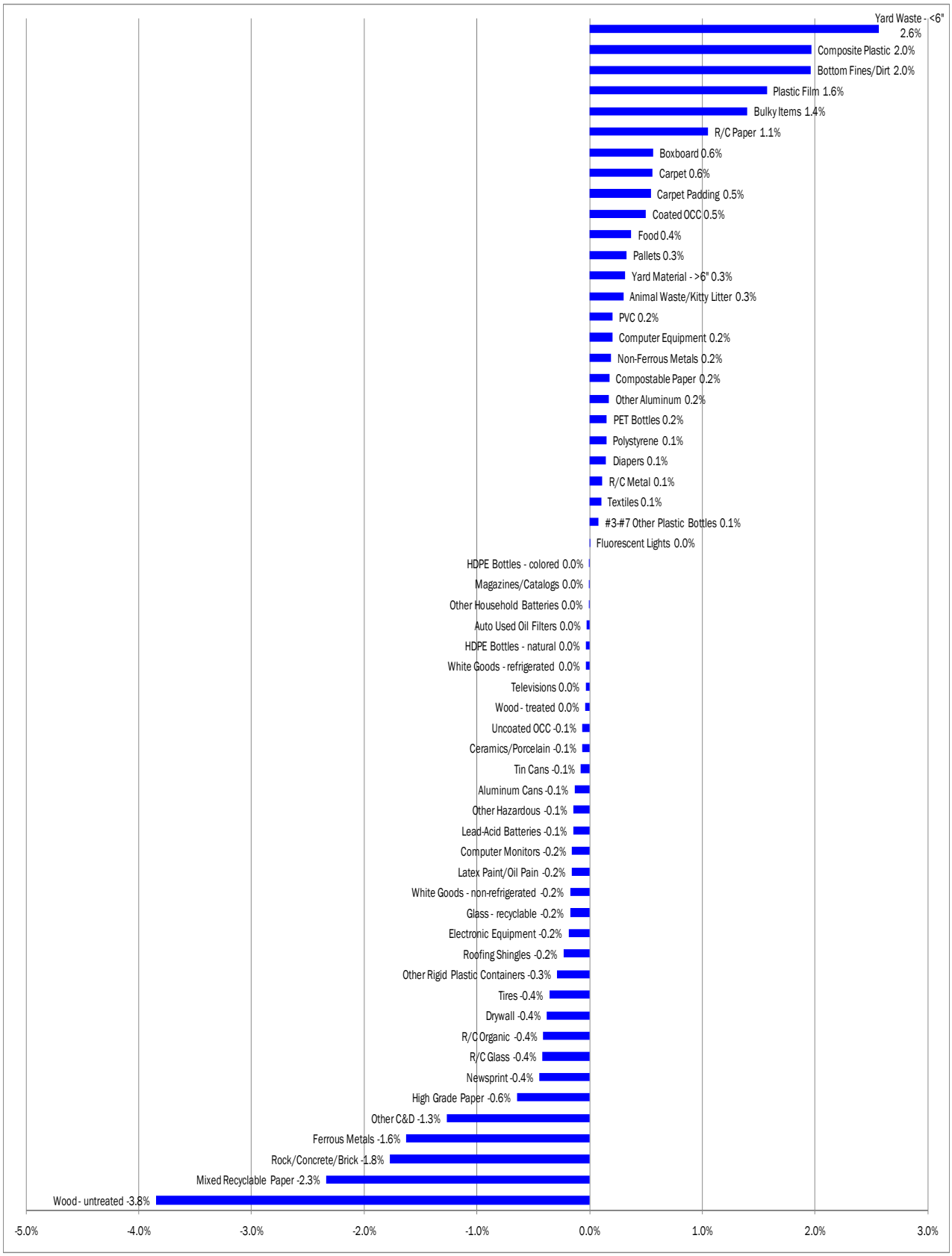


Figure 3-4 Change in Composition Percentage Points by Material Category, 2002 to 2009



3.2. RESIDENTIAL (SINGLE FAMILY) WASTE COMPOSITION

Figure 3-5 presents the breakdown of residential wastes. As shown, organics contribute the largest fraction at 37.3 percent, followed by paper and plastics.

Figure 3-5 2009 Residential Waste Composition by Material Group

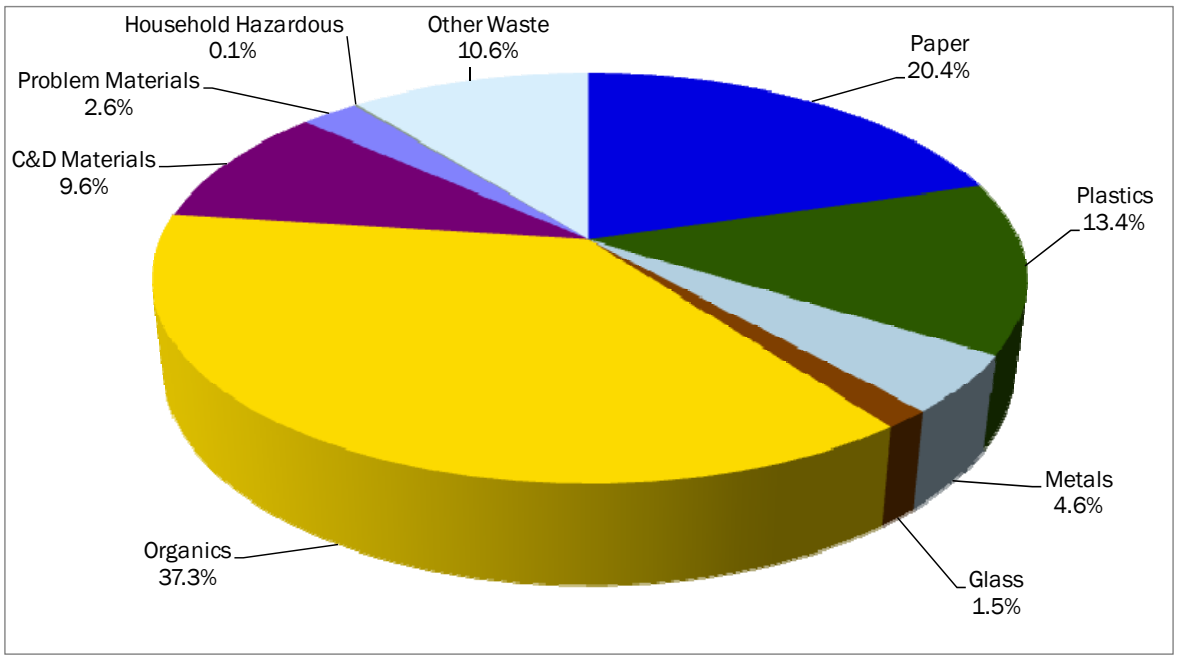


Table 3-4, on the following page, provides a detailed statistical profile of the state's residential waste stream.

Table 3-4 2009 Detailed Statewide Residential Waste Composition

Materials	Tons [1]	Mean	90% Conf. Int. Lower	Upper
1 Newspaper (ONP)	36,435	2.5%	1.9%	3.2%
2 High-Grade Office Paper	10,329	0.7%	0.5%	0.9%
3 Magazines/Catalogs	23,124	1.6%	1.3%	1.9%
4 Uncoated OCC	29,522	2.0%	1.6%	2.5%
5 Coated OCC	2,800	0.2%	0.1%	0.3%
6 Boxboard	21,678	1.5%	1.3%	1.7%
7 Mixed Paper - Recyclable	35,058	2.4%	2.1%	2.8%
8 Compostable Paper	103,706	7.2%	6.4%	8.0%
9 Other Paper	31,111	2.2%	1.8%	2.5%
Subtotal Paper	***293,764***	***20.4%***	***18.8%***	***22.0%***
10 PET Beverage Bottles	7,793	0.5%	0.4%	0.6%
11 PET Non-Bev. Bottles/Jars	2,721	0.2%	0.1%	0.2%
12 HDPE Natural Bottles	2,584	0.2%	0.1%	0.2%
13 HDPE Colored Bottles	4,286	0.3%	0.2%	0.4%
14 Other Plastic #3 - #7 Bottles	2,601	0.2%	0.1%	0.2%
15 Food Polystyrene Foam	6,350	0.4%	0.4%	0.5%
16 Other Polystyrene Foam	3,830	0.3%	0.1%	0.4%
17 Other Rigid Plastic Pkg.	18,929	1.3%	1.1%	1.5%
18 Plastic Shopping Bags - film	6,025	0.4%	0.4%	0.5%
19 Plastic Industrial Film Pkg.	1,455	0.1%	0.1%	0.1%
20 Agricultural Plastic Film	526	0.0%	0.0%	0.1%
21 Other Plastic Film	57,772	4.0%	3.6%	4.4%
22 Other Plastic	27,844	1.9%	1.4%	2.5%
23 Composite/Other Plastic:	49,921	3.5%	2.8%	4.1%
Subtotal Plastic	***192,638***	***13.4%***	***12.3%***	***14.5%***
24 Alum. Bev. Containers	4,327	0.3%	0.2%	0.4%
25 Other Aluminum:	5,935	0.4%	0.2%	0.6%
26 Ferrous (Tin) Cans	10,120	0.7%	0.6%	0.8%
27 Other Ferrous Scrap	10,980	0.8%	0.3%	1.2%
28 Non-Ferrous Metal	4,491	0.3%	0.0%	0.6%
29 Other Metal	30,145	2.1%	1.2%	3.0%
Subtotal Metal	***65,997***	***4.6%***	***3.4%***	***5.7%***
30 Clear Beverage Containers	4,502	0.3%	0.2%	0.4%
31 Colored Beverage Containers	6,033	0.4%	0.3%	0.6%
32 Glass Food Containers	5,136	0.4%	0.3%	0.4%
33 Other Glass	5,362	0.4%	0.3%	0.5%
Subtotal Glass	***21,032***	***1.5%***	***1.2%***	***1.7%***
34 Yard Materials - <6"	93,431	6.5%	5.0%	8.0%
35 Yard Materials - >6"	5,693	0.4%	0.0%	0.8%
36 Food Scraps	251,423	17.5%	15.8%	19.1%
37 Diapers	48,759	3.4%	2.8%	4.0%
38 Animal Waste/Kitty Litter	41,322	2.9%	2.2%	3.6%
39 Bottom Fines/Dirt	64,140	4.5%	3.6%	5.3%
40 Other Organic Material	32,078	2.2%	1.7%	2.8%
Subtotal Organics	***536,848***	***37.3%***	***34.9%***	***39.6%***
41 Treated Wood	5,648	0.4%	0.0%	0.7%
42 Clean Dimensional Lumber	7,092	0.5%	0.2%	0.8%
43 Clean Engineered Wood	5,626	0.4%	0.1%	0.7%
44 Painted/Stained Wood	51,782	3.6%	2.1%	5.1%
45 Other Recyclable Wood	2,916	0.2%	0.1%	0.3%
46 Rock/Concrete/Bricks:	1,421	0.1%	0.0%	0.2%
47 Drywall - Demolition	6,572	0.5%	0.0%	0.9%
48 Drywall - Clean Scrap	1,273	0.1%	0.0%	0.2%
49 Roofing Shingles	15,202	1.1%	0.0%	2.3%
50 PVC	5,181	0.4%	0.0%	0.8%
51 Ceramics/Porcelain Fixtures	9,336	0.6%	0.0%	1.3%
52 Other C&D	26,147	1.8%	1.0%	2.6%
Subtotal C&D	***138,194***	***9.6%***	***6.6%***	***12.6%***
53 Televisions - CRT	5,627	0.4%	0.0%	0.8%
54 Televisions - Non CRT	0	0.0%	0.0%	0.0%
55 Computer Monitors - CRT	0	0.0%	0.0%	0.0%
56 Computer Related Electronics	4,210	0.3%	0.0%	0.6%
57 Other Electronic Equip.	4,434	0.3%	0.1%	0.5%
58 Small electrical Appliances	14,557	1.0%	0.5%	1.5%
59 White Gds - Refrig.	5,887	0.4%	0.0%	0.9%
60 White Gds - Non Refrig.	0	0.0%	0.0%	0.0%
61 Lead Acid Batteries	0	0.0%	0.0%	0.0%
62 Other Household Batteries (OHB	1,926	0.1%	0.1%	0.2%
63 Fluorescent Light Tubes	42	0.0%	0.0%	0.0%
64 Compact Fluorescent Light Tube	106	0.0%	0.0%	0.0%
65 Tires	81	0.0%	0.0%	0.0%
Subtotal Problem Mtls.	***36,871***	***2.6%***	***1.7%***	***3.5%***
66 Paint	634	0.0%	0.0%	0.1%
67 Auto Used Oil/Filters	0	0.0%	0.0%	0.0%
68 Household Hazardous	514	0.0%	0.0%	0.1%
69 Medical Waste	800	0.1%	0.0%	0.1%
Subtotal Hazardous	***1,948***	***0.1%***	***0.0%***	***0.2%***
70 Textiles	39,359	2.7%	2.3%	3.2%
71 Carpet	54,052	3.8%	2.4%	5.1%
72 Carpet Padding	13,606	0.9%	0.4%	1.5%
73 Wood Pallets	5,758	0.4%	0.0%	0.9%
74 Bulky Items	14,864	1.0%	0.3%	1.8%
75 Wood Furniture	25,558	1.8%	1.0%	2.5%
Subtotal Other Wastes	***153,199***	***10.6%***	***8.4%***	***12.8%***
Total	**1,440,491**	**100.0%**		
Number of Samples	**86**			

Note: Subtotals may not sum due to rounding discrepancies.

[1] The tons reported in this table for individual material categories may be over or understated compared to the actual number of tons in residential waste. This is due to the impact of allocating a fraction of transfer trailer wastes, which were analyzed separately in the study, to the residential waste stream. The statistical methods and their associated limitations are discussed more thoroughly in Appendix D.

Figure 3-6 and Table 3-5 compare the breakdown of material groups in the residential waste stream from the 2009 Study against the results of the 2002 Study. As shown in this figure, there have been some significant changes in the waste stream. Plastic and organics have increased significantly, while paper, metals, glass and C&D materials have declined. The incidence of hazardous waste has remained virtually unchanged at a low level.

Figure 3-6 Landfilled Residential Waste Comparison, 2002 and 2009

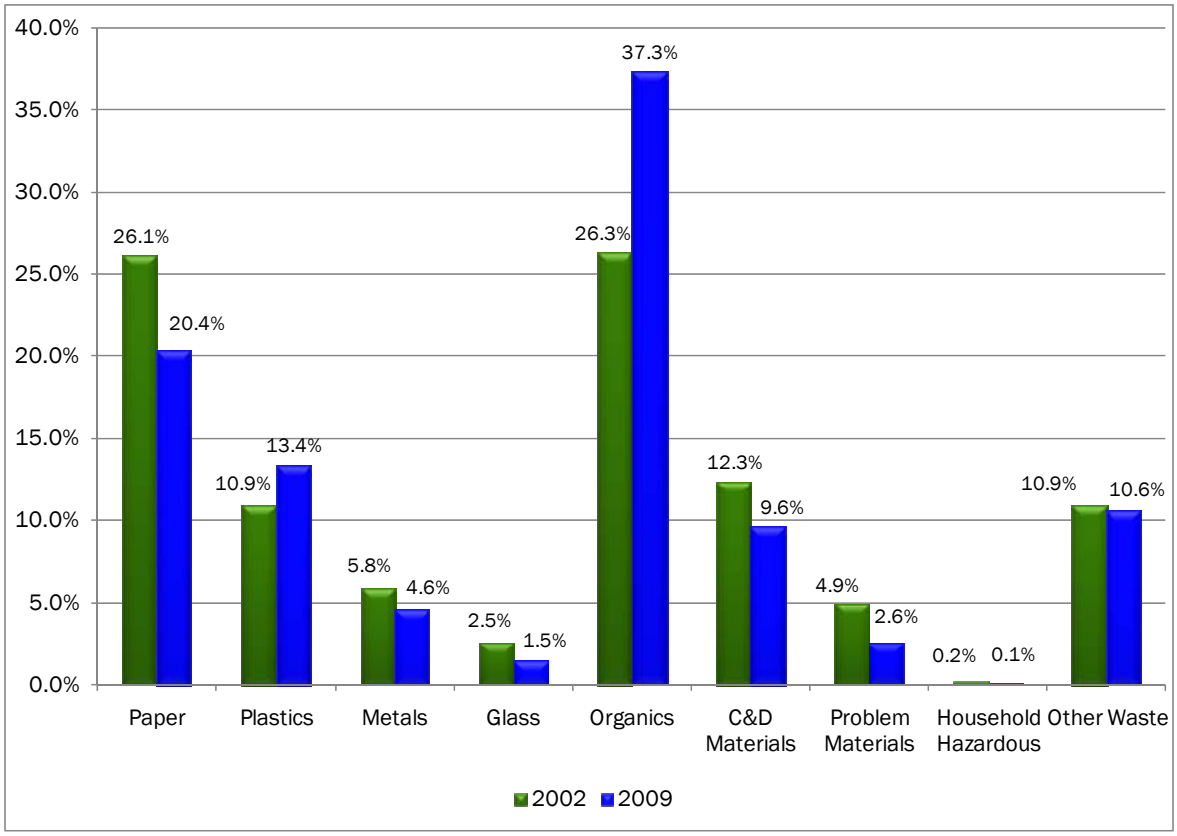


Table 3-5 Landfilled Residential Waste Comparison, 2002 and 2009

	2002		2009	
Material Group	Tons	Percent	Tons [1]	Percent
Paper	400,448	26.1%	293,764	20.4%
Plastics	167,989	10.9%	192,638	13.4%
Metals	89,161	5.8%	65,997	4.6%
Glass	39,148	2.5%	21,032	1.5%
Organics	403,320	26.3%	536,848	37.3%
C&D	189,201	12.3%	138,194	9.6%
Problem Materials	75,668	4.9%	36,871	2.6%
Hazardous Waste	3,286	0.2%	1,948	0.1%
Other Waste	167,458	10.9%	153,199	10.6%
Total [1]	**1,535,679**	**100%**	**1,440,491**	**100%**

Note: Total may not sum due to rounding discrepancies.

[1] The 2009 tons reported in this table for individual material categories may be over or understated compared to the actual number of tons in residential waste. This is due to the impact of allocating a fraction of transfer trailer wastes (which were analyzed separately in the study) to the residential waste stream. The statistical methods and their associated limitations are discussed more thoroughly in Appendix D.

Table 3-6 compares the 10 most prevalent materials in the 2002 and 2009 disposed residential waste stream. As shown, food scraps remain the most prevalent single item, and many of the materials made the top ten in both studies. Particularly interesting is that newspaper made the top 10 list in 2002, but not in 2009. Also, yard materials were found to make up a significant portion in 2009, but not in 2002.

Table 3-6 Top 10 Most Prevalent Residential Material Categories, 2002 and 2009

2002 Material Category	2002 Tons	2002 Percent	2009 Material Category Mapped	2009 Tons [4]	2009 Percent
Food	206,363	13.4%	Food Scraps	251,423	17.5%
Wood - Untreated	115,732	7.5%	Compostable Paper	103,706	7.2%
Mixed Recyclable Paper	103,462	6.7%	Yard Materials - <6"	93,431	6.5%
Compostable Paper	95,567	6.2%	Composite/Other Plastic [1]	77,765	5.4%
Plastic Film	67,876	4.4%	Wood – Untreated [2]	67,415	4.7%
Bulky Items	59,157	3.9%	Plastic Film [3]	65,779	4.6%
Newsprint	58,027	3.8%	Bottom Fines/Dirt	64,140	4.5%
Diapers	56,054	3.7%	Carpet	54,052	3.8%
Textiles	54,826	3.6%	Diapers	48,759	3.4%
Composite/Other Plastic	50,388	3.3%	Animal Waste/Kitty Litter	41,322	2.9%
Total[4]	**867,452**	**56.5%**		**867,794**	**60.5%**

Note: Total may not sum due to rounding discrepancies.

[1] Composite/Other Plastic includes other plastic and composite/other plastic categories.

[2] Wood – Untreated combined untreated dimensional lumber, engineered wood, painted/stained wood and other recyclable wood.

[3] Plastic Film combined plastic shopping bags – film, plastic industrial film packaging, agricultural plastic film, and other plastic film.

[4] The 2009 tons reported in this table for individual material categories may be over or understated compared to the actual number of tons in residential waste. This is due to the impact of allocating a fraction of transfer trailer wastes (which were analyzed separately in the study) to the residential waste stream. The statistical methods and their associated limitations are discussed more thoroughly in Appendix D.

3. RESULTS

3.3. MULTI-FAMILY WASTE COMPOSITION

Figure 3-7 presents the breakdown of multi-family wastes. As with the residential generator sector, organics contribute the largest fraction. However, other wastes (including bulky items, wood furniture and carpet) are a significant component of multi-family waste compared to residential waste.

Figure 3-7 2009 Multi-family Waste Composition by Material Group

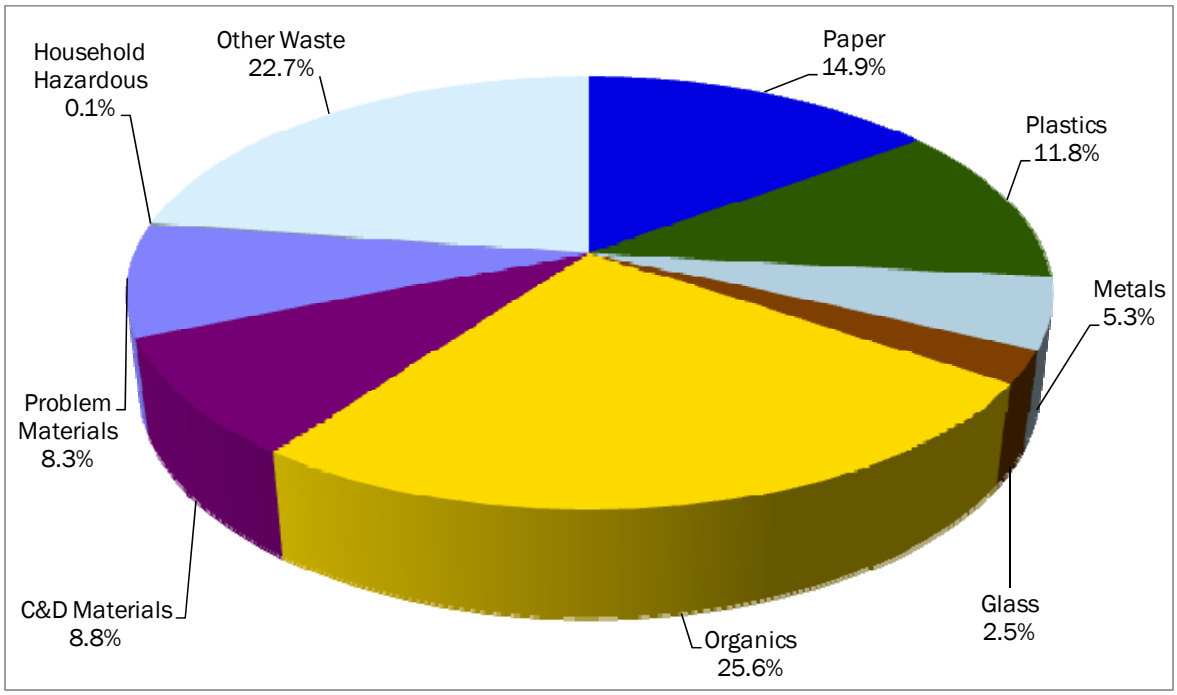


Table 3-7 provides a detailed statistical profile of the multi-family waste stream. Note again that this table *cannot* be considered to be representative of the entire state. Rather, these data are the result of non-representative sampling and sorting of 64 samples of multi-family wastes collected from around the state, but highly concentrated from the City of Milwaukee. Note also that no attempt was made to estimate the total quantity of multi-family waste generated in Wisconsin, and therefore only the composition percentages, and no tonnages, are shown in Table 3-7.

Table 3-7 2009 Detailed Multi-family Waste Composition

Materials	Mean	90% Conf. Int. Lower	Upper
1 Newspaper (ONP)	1.4%	1.0%	1.8%
2 High-Grade Office Paper	1.0%	0.7%	1.3%
3 Magazines/Catalogs	1.6%	1.3%	2.0%
4 Uncoated OCC	2.6%	1.9%	3.3%
5 Coated OCC	0.3%	0.0%	0.6%
6 Boxboard	1.7%	1.5%	2.0%
7 Mixed Paper - Recyclable	1.4%	1.2%	1.6%
8 Compostable Paper	3.5%	2.9%	4.0%
9 Other Paper	1.3%	1.1%	1.6%
Subtotal Paper	***14.9%***	***13.2%***	***16.5%***
10 PET Beverage Bottles	0.8%	0.7%	0.9%
11 PET Non-Bev. Bottles/Jars	0.3%	0.2%	0.3%
12 HDPE Natural Bottles	0.3%	0.3%	0.4%
13 HDPE Colored Bottles	0.2%	0.2%	0.3%
14 Other Plastic #3 - #7 Bottles	0.1%	0.1%	0.2%
15 Food Polystyrene Foam	0.5%	0.4%	0.6%
16 Other Polystyrene Foam	0.1%	0.0%	0.1%
17 Other Rigid Plastic Pkg.	0.8%	0.7%	0.9%
18 Plastic Shopping Bags - film	0.4%	0.4%	0.5%
19 Plastic Industrial Film Pkg.	0.0%	0.0%	0.1%
20 Agricultural Plastic Film	0.0%	0.0%	0.0%
21 Other Plastic Film	2.7%	2.3%	3.1%
22 Other Plastic	3.1%	2.0%	4.3%
23 Composite/Other Plastic:	2.4%	1.8%	3.1%
Subtotal Plastic	***11.8%***	***10.4%***	***13.3%***
24 Alum. Bev. Containers	0.4%	0.4%	0.5%
25 Other Aluminum:	0.2%	0.1%	0.2%
26 Ferrous (Tin) Cans	0.5%	0.5%	0.6%
27 Other Ferrous Scrap	1.1%	0.1%	2.2%
28 Non-Ferrous Metal	0.1%	0.0%	0.2%
29 Other Metal	2.9%	1.9%	3.9%
Subtotal Metal	***5.3%***	***3.8%***	***6.8%***
30 Clear Beverage Containers	1.1%	0.8%	1.3%
31 Colored Beverage Containers	0.5%	0.3%	0.7%
32 Glass Food Containers	0.5%	0.4%	0.6%
33 Other Glass	0.4%	0.3%	0.5%
Subtotal Glass	***2.5%***	***2.1%***	***2.9%***
34 Yard Materials - <6"	3.4%	2.1%	4.7%
35 Yard Materials - >6"	0.6%	0.0%	1.2%
36 Food Scraps	10.9%	9.2%	12.5%
37 Diapers	2.4%	1.9%	2.9%
38 Animal Waste/Kitty Litter	1.1%	0.7%	1.5%
39 Bottom Fines/Dirt	5.8%	4.6%	7.1%
40 Other Organic Material	1.4%	0.9%	2.0%
Subtotal Organics	***25.6%***	***22.8%***	***28.4%***

Materials	Mean	90% Conf. Int. Lower	Upper
41 Treated Wood	0.1%	0.0%	0.1%
42 Clean Dimensional Lumber	1.2%	0.5%	1.8%
43 Clean Engineered Wood	0.2%	0.0%	0.5%
44 Painted/Stained Wood	4.1%	2.7%	5.6%
45 Other Recyclable Wood	0.1%	0.0%	0.1%
46 Rock/Concrete/Bricks:	0.0%	0.0%	0.0%
47 Drywall - Demolition	0.7%	0.1%	1.2%
48 Drywall - Clean Scrap	0.1%	0.0%	0.3%
49 Roofing Shingles	0.0%	0.0%	0.0%
50 PVC	0.1%	0.0%	0.2%
51 Ceramics/Porcelain Fixtures	0.2%	0.0%	0.6%
52 Other C&D	2.0%	0.9%	3.0%
Subtotal C&D	***8.8%***	***6.5%***	***11.1%***
53 Televisions - CRT	2.4%	1.1%	3.6%
54 Televisions - Non CRT	0.3%	0.0%	0.7%
55 Computer Monitors - CRT	0.0%	0.0%	0.0%
56 Computer Related Electronics	0.7%	0.2%	1.1%
57 Other Electronic Equip.	0.4%	0.1%	0.7%
58 Small electrical Appliances	2.0%	1.3%	2.8%
59 White Gds - Refrig.	0.7%	0.0%	1.5%
60 White Gds - Non Refrig.	0.4%	0.0%	1.0%
61 Lead Acid Batteries	0.0%	0.0%	0.0%
62 Other Household Batteries (OHB	0.1%	0.0%	0.2%
63 Fluorescent Light Tubes	0.0%	0.0%	0.0%
64 Compact Fluorescent Light Tube	0.0%	0.0%	0.0%
65 Tires	1.3%	0.6%	1.9%
Subtotal Problem Mtls.	***8.3%***	***6.5%***	***10.2%***
66 Paint	0.01%	0.0%	0.0%
67 Auto Used Oil/Filters	0.00%	0.0%	0.0%
68 Household Hazardous	0.01%	0.0%	0.0%
69 Medical Waste	0.03%	0.0%	0.1%
Subtotal Hazardous	***0.1%***	***0.1%***	***0.1%***
70 Textiles	1.6%	1.2%	2.0%
71 Carpet	4.7%	3.0%	6.3%
72 Carpet Padding	0.7%	0.2%	1.2%
73 Wood Pallets	0.1%	0.0%	0.1%
74 Bulky Items	8.8%	5.9%	11.7%
75 Wood Furniture	6.9%	4.4%	9.4%
Subtotal Other Wastes	***22.7%***	***18.8%***	***26.7%***
Total	**100.0%**		
Number of Samples	**64**		

Note: Subtotals may not sum due to rounding discrepancies.

Table 3-8 shows the 10 most prevalent materials in the 2009 disposed multi-family waste stream.[1] Unlike residential waste, bulky waste (including wood furniture) and carpet were major contributors to the multi-family waste stream. Food scraps were also prevalent.

Table 3-8 Top 10 Most Prevalent Multi-family Material Categories, 2009

2009 Material Category	2009 Percent
Bulky Items [1]	15.7%
Food	10.9%
Bottom Fines/Dirt	5.8%
Wood – untreated [2]	5.6%
Composite/Other Plastic [3]	5.5%
Carpet	4.7%
Compostable Paper	3.5%
Yard Materials - <6"	3.4%
Plastic Film [4]	3.2%
Other Metal	2.9%
Total [5]	**61.2%**

[1] Bulky Items includes bulky items and wood furniture.
[2] Wood–untreated includes untreated dimensional lumber, engineered wood, painted/stained wood and other recyclable wood.
[3] Composite/Other Plastic includes other plastic and Composite/other plastic.
[4] Plastic Film includes plastic shopping bags, industrial film packaging, agricultural plastic film, and other plastic film.
[5] Total may not sum due to rounding discrepancies.

[1] Multi-family wastes were not analyzed separately in the 2002 Study, and therefore no comparisons can be shown.

3.4. ICI WASTE COMPOSITION

Figure 3-8 presents the breakdown of ICI wastes. The largest material group in the ICI sector was found to be paper, followed closely by organics. Plastics were more prevalent in the ICI waste stream compared to residential wastes.

Figure 3-8 2009 ICI Waste Composition by Material Group

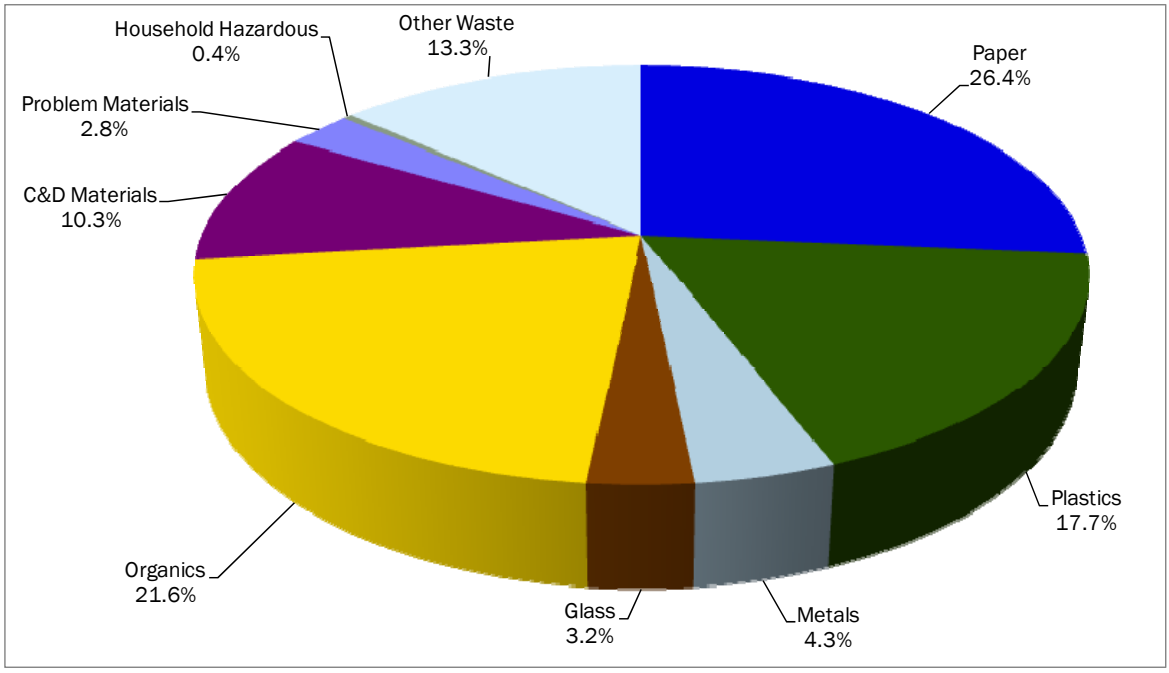


Table 3-9, on the following page, provides a detailed statistical profile of the state's ICI waste stream.

Table 3-9 2009 Detailed Statewide ICI Waste Composition

Materials	Tons[1]	Mean	90% Conf. Int. Lower	Upper
1 Newspaper (ONP)	23,442	1.1%	0.6%	1.6%
2 High-Grade Office Paper	21,198	1.0%	0.6%	1.4%
3 Magazines/Catalogs	14,247	0.7%	0.4%	1.0%
4 Uncoated OCC	143,751	6.8%	5.2%	8.4%
5 Coated OCC	34,522	1.6%	0.9%	2.4%
6 Boxboard	36,935	1.8%	0.9%	2.6%
7 Mixed Paper - Recyclable	45,518	2.2%	1.3%	3.0%
8 Compostable Paper	89,534	4.2%	3.4%	5.0%
9 Other Paper	146,700	7.0%	4.3%	9.6%
Subtotal Paper	***555,846***	***26.4%***	***23.0%***	***29.7%***
10 PET Beverage Bottles	9,302	0.4%	0.4%	0.5%
11 PET Non-Bev. Bottles/Jars	2,093	0.1%	0.1%	0.1%
12 HDPE Natural Bottles	2,903	0.1%	0.1%	0.2%
13 HDPE Colored Bottles	3,501	0.2%	0.1%	0.2%
14 Other Plastic #3 - #7 Bottles	1,661	0.1%	0.0%	0.1%
15 Food Polystyrene Foam	10,406	0.5%	0.2%	0.8%
16 Other Polystyrene Foam	9,676	0.5%	0.1%	0.8%
17 Other Rigid Plastic Pkg.	43,264	2.1%	0.7%	3.4%
18 Plastic Shopping Bags - film	4,313	0.2%	0.1%	0.3%
19 Plastic Industrial Film Pkg.	42,420	2.0%	0.9%	3.1%
20 Agricultural Plastic Film	8,662	0.4%	0.0%	0.8%
21 Other Plastic Film	111,221	5.3%	3.6%	6.9%
22 Other Plastic	40,462	1.9%	1.3%	2.5%
23 Composite/Other Plastic:	83,914	4.0%	2.3%	5.7%
Subtotal Plastic	***373,798***	***17.7%***	***14.7%***	***20.7%***
24 Alum. Bev. Containers	3,935	0.2%	0.1%	0.2%
25 Other Aluminum:	2,333	0.1%	0.1%	0.1%
26 Ferrous (Tin) Cans	8,749	0.4%	0.2%	0.6%
27 Other Ferrous Scrap	33,110	1.6%	0.9%	2.2%
28 Non-Ferrous Metal	4,142	0.2%	0.0%	0.4%
29 Other Metal	39,435	1.9%	0.8%	2.9%
Subtotal Metal	***91,704***	***4.3%***	***3.0%***	***5.7%***
30 Clear Beverage Containers	6,978	0.3%	0.2%	0.5%
31 Colored Beverage Containers	9,449	0.4%	0.1%	0.8%
32 Glass Food Containers	1,472	0.1%	0.0%	0.1%
33 Other Glass	49,188	2.3%	0.7%	4.0%
Subtotal Glass	***67,088***	***3.2%***	***1.2%***	***5.2%***
34 Yard Materials - <6"	57,256	2.7%	1.5%	3.9%
35 Yard Materials - >6"	10,063	0.5%	0.0%	0.9%
36 Food Scraps	239,546	11.4%	9.3%	13.4%
37 Diapers	35,327	1.7%	0.6%	2.8%
38 Animal Waste/Kitty Litter	18,030	0.9%	0.3%	1.4%
39 Bottom Fines/Dirt	66,239	3.1%	2.2%	4.1%
40 Other Organic Material	28,267	1.3%	0.9%	1.8%
Subtotal Organics	***454,729***	***21.6%***	***19.0%***	***24.1%***
41 Treated Wood	15,092	0.7%	0.1%	1.3%
42 Clean Dimensional Lumber	26,980	1.3%	0.6%	1.9%
43 Clean Engineered Wood	38,908	1.8%	1.0%	2.7%
44 Painted/Stained Wood	46,157	2.2%	1.2%	3.2%
45 Other Recyclable Wood	21,687	1.0%	0.2%	1.8%
46 Rock/Concrete/Bricks:	17,611	0.8%	0.0%	1.7%
47 Drywall - Demolition	11,501	0.5%	0.0%	1.2%
48 Drywall - Clean Scrap	5,115	0.2%	0.0%	0.6%
49 Roofing Shingles	4,986	0.2%	0.0%	0.6%
50 PVC	3,353	0.2%	0.0%	0.3%
51 Ceramics/Porcelain Fixtures	1,788	0.1%	0.0%	0.2%
52 Other C&D	24,008	1.1%	0.5%	1.7%
Subtotal C&D	***217,186***	***10.3%***	***7.5%***	***13.1%***
53 Televisions - CRT	8,619	0.4%	0.0%	0.9%
54 Televisions - Non CRT	5,372	0.3%	0.0%	0.5%
55 Computer Monitors - CRT	0	0.0%	0.0%	0.0%
56 Computer Related Electronics	5,274	0.3%	0.0%	0.5%
57 Other Electronic Equip.	5,250	0.2%	0.0%	0.5%
58 Small electrical Appliances	17,295	0.8%	0.3%	1.3%
59 White Gds - Refrig.	4,538	0.2%	0.0%	0.6%
60 White Gds - Non Refrig.	2,684	0.1%	0.0%	0.3%
61 Lead Acid Batteries	0	0.0%	0.0%	0.0%
62 Other Household Batteries (OHB	607	0.0%	0.0%	0.0%
63 Fluorescent Light Tubes	44	0.0%	0.0%	0.0%
64 Compact Fluorescent Light Tube	57	0.0%	0.0%	0.0%
65 Tires	10,300	0.5%	0.0%	1.1%
Subtotal Problem Mtls.	***60,039***	***2.8%***	***1.3%***	***4.4%***
66 Paint	83	0.0%	0.0%	0.0%
67 Auto Used Oil/Filters	0	0.0%	0.0%	0.0%
68 Household Hazardous	367	0.0%	0.0%	0.0%
69 Medical Waste	7,014	0.3%	0.0%	0.8%
Subtotal Hazardous	***7,464***	***0.4%***	***0.0%***	***1.4%***
70 Textiles	63,113	3.0%	1.7%	4.3%
71 Carpet	54,671	2.6%	1.4%	3.8%
72 Carpet Padding	16,985	0.8%	0.2%	1.4%
73 Wood Pallets	59,316	2.8%	1.3%	4.4%
74 Bulky Items	46,058	2.2%	1.0%	3.3%
75 Wood Furniture	41,459	2.0%	1.1%	2.9%
Subtotal Other Wastes	***281,603***	***13.3%***	***10.3%***	***16.4%***
Total	**2,109,456**	**100.0%**		
Number of Samples	**114**			

Note: Subtotals may not sum due to rounding discrepancies.

[1] The tons reported in this table for individual material categories may be over or understated compared to the actual number of tons in ICI waste. This is due to the impact of allocating a fraction of transfer trailer wastes, which were analyzed separately in the study, to the ICI waste stream. The statistical methods and their associated limitations are discussed more thoroughly in Appendix D.

Figure 3-9 and Table 3-10 compare the breakdown of material groups in the ICI waste stream from the 2009 study against the results of the 2002 study. As shown in this figure, two of the largest material groups, paper and organics, do not appear to have changed significantly. Conversely, plastics have increased, and C&D has decreased significantly.

Figure 3-9 Landfilled ICI Waste Comparison, 2002 and 2009

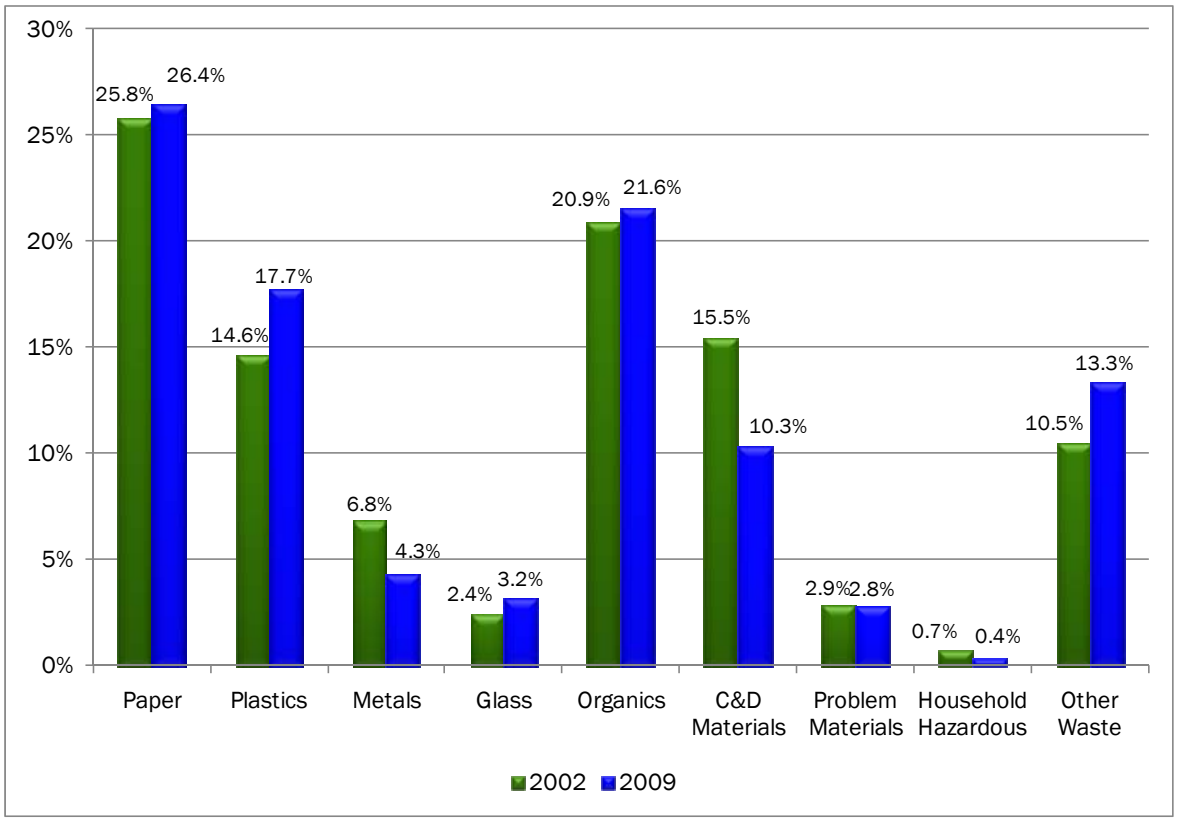


Table 3-10 Landfilled ICI Waste Comparison, 2002 and 2009

	2002		2009	
Material Group	Tons	Percent	Tons[2]	Percent
Paper	541,213	25.8%	555,846	26.4%
Plastics	306,635	14.6%	373,798	17.7%
Metals	142,502	6.8%	91,704	4.3%
Glass	49,949	2.4%	67,088	3.2%
Organics	439,815	20.9%	454,729	21.6%
C&D	324,508	15.5%	217,186	10.3%
Problem Materials	60,374	2.9%	60,039	2.8%
Hazardous Waste	15,524	0.7%	7,464	0.4%
Other Waste	219,677	10.5%	281,603	13.3%
Total [1]	**2,100,197**	**100%**	**2,109,456**	**100%**

[1] Totals may not sum due to rounding discrepancies.

[2] The tons reported in this table for individual material categories may be over or understated compared to the actual number of tons in ICI waste. This is due to the impact of allocating a fraction of transfer trailer wastes (which were analyzed separately in the study) to the ICI waste stream. The statistical methods and their associated limitations are discussed more thoroughly in Appendix D.

Table 3-11 compares the 10 most prevalent materials in the 2002 and 2009 disposed ICI waste stream. As shown, food scraps remain the most prevalent single item, and many of the materials made the top ten in both studies. In contrast to the residential waste stream, where food scraps have increased, there has been a decrease in food scraps in the ICI waste stream. Corrugated cardboard has remained stubbornly high in the ICI waste stream.

Table 3-11 Top 10 Most Prevalent ICI Material Categories, 2002 and 2009

2002 Material Category	2002 Tons	2002 Percent	2009 Material Category	2009 Tons [6]	2009 Percent
Food	277,650	13.2%	Food Scraps	239,546	11.4%
Wood - untreated	213,143	10.1%	Plastic Film [1]	166,617	7.9%
Compostable Paper	131,327	6.3%	Other Paper	146,700	7.0%
Cardboard - recyclable	119,358	5.7%	Uncoated OCC	143,751	6.8%
Plastic Film	115,426	5.5%	Wood – untreated [2]	133,732	6.3%
Composite/Other Plastic	112,161	5.3%	Composite/Other Plastic [3]	124,376	5.9%
Mixed Recyclable Paper	92,036	4.4%	Compostable Paper	89,534	4.2%
Ferrous Metals	90,240	4.3%	Bulky Items [4]	87,517	4.1%
Other Non-recyclable Paper	86,024	4.1%	Bottom Fines/Dirt	66,239	3.1%
Carpet	60,772	2.6%	Textiles	63,113	3.0%
Total [5]	**1,298,137**	**61.5%**		**1,261,126**	**59.8%**

[1] Plastic Film combines plastic shopping bags – film, plastic industrial film packaging, agricultural plastic film, and other plastic film.
[2] Wood – Untreated combines clean dimensional lumber, clean engineered wood, painted/stained wood and other recyclable wood.
[3] Composite/Other Plastic combines other plastic and composite/other plastic.
[4] Bulky Items combines bulky items and wood furniture.
[5] Total may not sum due to rounding
[6] The tons reported in this table for individual material categories may be over or understated compared to the actual number of tons in ICI waste. This is due to the impact of allocating a fraction of transfer trailer wastes, which were analyzed separately in the study to the ICI waste stream. The statistical methods and their associated limitations are discussed more thoroughly in Appendix D.

3.5. C&D WASTE COMPOSITION

Figure 3-10 presents the breakdown of C&D waste by material group. Unsurprisingly, C&D materials make up over 80 percent of C&D waste. Notably, negligible amounts of problem materials and hazardous materials were observed.

Figure 3-10 2009 C&D Waste Composition by Material Group

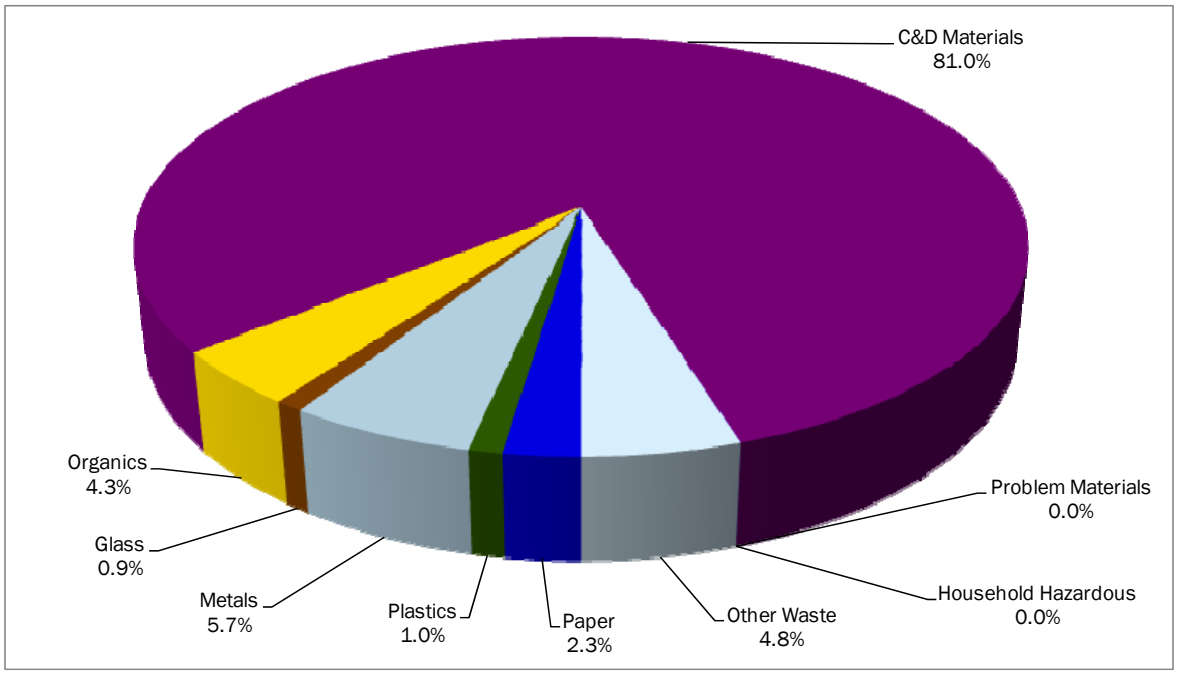


Table 3-12, on the following page, provides a detailed statistical profile of the state's C&D waste stream.

Table 3-12 2009 Detailed Statewide C&D Waste Composition

Materials	Tons [1]	Mean	90% Conf. Int. Lower	90% Conf. Int. Upper
1 Newspaper (ONP)	268	0.0%	0.0%	0.0%
2 High-Grade Office Paper	380	0.1%	0.0%	0.1%
3 Magazines/Catalogs	515	0.1%	0.1%	0.1%
4 Uncoated OCC	10,236	1.4%	1.1%	1.6%
5 Coated OCC	344	0.0%	0.0%	0.1%
6 Boxboard	671	0.1%	0.1%	0.1%
7 Mixed Paper - Recyclable	881	0.1%	0.1%	0.1%
8 Compostable Paper	2,224	0.3%	0.3%	0.3%
9 Other Paper	1,629	0.2%	0.2%	0.2%
Subtotal Paper	***17,150***	***2.3%***	***2.0%***	***2.7%***
10 PET Beverage Bottles	39	0.0%	0.0%	0.0%
11 PET Non-Bev. Bottles/Jars	43	0.0%	0.0%	0.0%
12 HDPE Natural Bottles	50	0.0%	0.0%	0.0%
13 HDPE Colored Bottles	64	0.0%	0.0%	0.0%
14 Other Plastic #3 - #7 Bottles	30	0.0%	0.0%	0.0%
15 Food Polystyrene Foam	114	0.0%	0.0%	0.0%
16 Other Polystyrene Foam	77	0.0%	0.0%	0.0%
17 Other Rigid Plastic Pkg.	789	0.1%	0.1%	0.1%
18 Plastic Shopping Bags - film	87	0.0%	0.0%	0.0%
19 Plastic Industrial Film Pkg.	224	0.0%	0.0%	0.0%
20 Agricultural Plastic Film	41	0.0%	0.0%	0.0%
21 Other Plastic Film	1,174	0.2%	0.1%	0.2%
22 Other Plastic	627	0.1%	0.1%	0.1%
23 Composite/Other Plastic:	4,344	0.6%	0.3%	0.8%
Subtotal Plastic	***7,703***	***1.0%***	***0.5%***	***1.6%***
24 Alum. Bev. Containers	12	0.0%	0.0%	0.0%
25 Other Aluminum:	3,511	0.5%	0.4%	0.6%
26 Ferrous (Tin) Cans	0	0.0%	0.0%	0.0%
27 Other Ferrous Scrap	35,888	4.8%	4.1%	5.6%
28 Non-Ferrous Metal	2,686	0.4%	0.3%	0.5%
29 Other Metal	0	0.0%	0.0%	0.0%
Subtotal Metal	***42,097***	***5.7%***	***4.0%***	***7.3%***
30 Clear Beverage Containers	15	0.0%	0.0%	0.0%
31 Colored Beverage Containers	13	0.0%	0.0%	0.0%
32 Glass Food Containers	0	0.0%	0.0%	0.0%
33 Other Glass	6,334	0.9%	0.5%	1.2%
Subtotal Glass	***6,362***	***0.9%***	***0.4%***	***1.3%***
34 Yard Materials - <6"	3,895	0.5%	0.3%	0.7%
35 Yard Materials - >6"	479	0.1%	0.0%	0.1%
36 Food Scraps	3,245	0.4%	0.4%	0.4%
37 Diapers	601	0.1%	0.1%	0.1%
38 Animal Waste/Kitty Litter	372	0.1%	0.1%	0.1%
39 Bottom Fines/Dirt	22,538	3.0%	1.8%	4.3%
40 Other Organic Material	457	0.1%	0.1%	0.1%
Subtotal Organics	***31,588***	***4.3%***	***2.5%***	***6.0%***
41 Treated Wood	14,450	1.9%	1.4%	2.5%
42 Clean Dimensional Lumber	65,077	8.8%	7.3%	10.2%
43 Clean Engineered Wood	35,190	4.7%	3.8%	5.7%
44 Painted/Stained Wood	74,757	10.1%	8.3%	11.8%
45 Other Recyclable Wood	6,333	0.9%	0.6%	1.1%
46 Rock/Concrete/Bricks:	97,622	13.2%	9.9%	16.4%
47 Drywall - Demolition	12,493	1.7%	1.1%	2.3%
48 Drywall - Clean Scrap	25,723	3.5%	2.5%	4.4%
49 Roofing Shingles	218,653	29.5%	24.8%	34.1%
50 PVC	1,405	0.2%	0.1%	0.2%
51 Ceramics/Porcelain Fixtures	5,793	0.8%	0.3%	1.3%
52 Other C&D	43,238	5.8%	4.8%	6.9%
Subtotal C&D	***600,736***	***81.0%***	***57.8%***	***100.0%***
53 Televisions - CRT	0	0.0%	0.0%	0.0%
54 Televisions - Non CRT	0	0.0%	0.0%	0.0%
55 Computer Monitors - CRT	0	0.0%	0.0%	0.0%
56 Computer Related Electronics	0	0.0%	0.0%	0.0%
57 Other Electronic Equip.	0	0.0%	0.0%	0.0%
58 Small electrical Appliances	0	0.0%	0.0%	0.0%
59 White Gds - Refrig.	0	0.0%	0.0%	0.0%
60 White Gds - Non Refrig.	0	0.0%	0.0%	0.0%
61 Lead Acid Batteries	14	0.0%	0.0%	0.0%
62 Other Household Batteries (OHB	0	0.0%	0.0%	0.0%
63 Fluorescent Light Tubes	8	0.0%	0.0%	0.0%
64 Compact Fluorescent Light Tube	0	0.0%	0.0%	0.0%
65 Tires	110	0.0%	0.0%	0.0%
Subtotal Problem Mtls.	***133***	***0.0%***	***0.0%***	***0.0%***
66 Paint	0	0.0%	0.0%	0.0%
67 Auto Used Oil/Filters	0	0.0%	0.0%	0.0%
68 Household Hazardous	0	0.0%	0.0%	0.0%
69 Medical Waste	0	0.0%	0.0%	0.0%
Subtotal Hazardous	***0***	***0.0%***	***0.0%***	***0.0%***
70 Textiles	0	0.0%	0.0%	0.0%
71 Carpet	5,392	0.7%	0.6%	0.9%
72 Carpet Padding	1,282	0.2%	0.1%	0.2%
73 Wood Pallets	12,919	1.7%	1.3%	2.2%
74 Bulky Items	11,560	1.6%	1.1%	2.0%
75 Wood Furniture	4,633	0.6%	0.4%	0.9%
Subtotal Other Wastes	***35,787***	***4.8%***	***3.3%***	***6.3%***
Total	**741,556**	**100.0%**		
Number of Samples	**603**			

Note: Subtotals may not sum due to rounding discrepancies.

[1] The tons reported in this table for individual material categories may be over or understated compared to the actual number of tons in C&D waste. This is due to the impact of allocating a fraction of transfer trailer wastes, which were analyzed separately in the study, to the C&D waste stream. The statistical methods and their associated limitations are discussed more thoroughly in Appendix D.

Figure 3-11 and Table 3-13 compare the breakdown of material groups in the C&D waste stream from the 2009 Study against the results of the 2002 Study. As shown in this figure, C&D appears to be similar in the 2009 Study, although absolute quantities are lower because of the overall decrease in C&D waste generation.

Figure 3-11 Disposed C&D Waste Comparison, 2002 and 2009

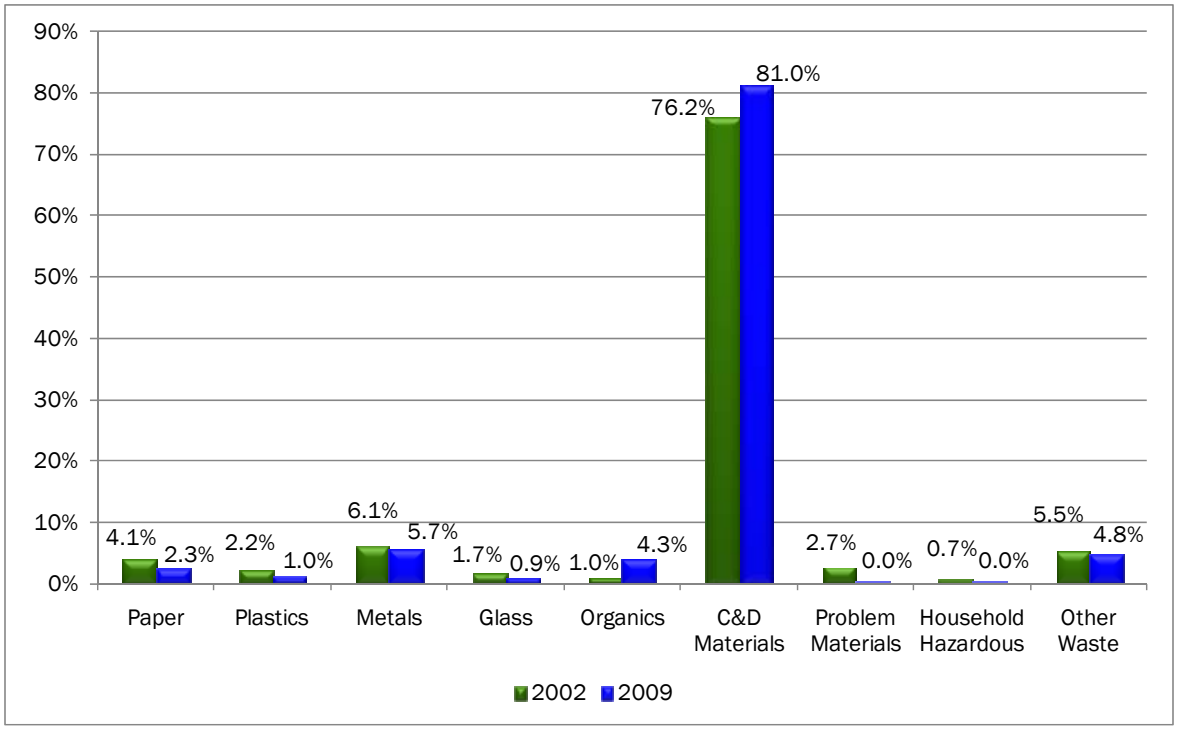


Table 3-13 Landfilled C&D Waste Comparison, 2002 and 2009

	2002		2009	
Material Group	Tons	Percent	Tons[2]	Percent
Paper	45,985	4.1%	17,150	2.3%
Plastics	24,689	2.2%	7,703	1.0%
Metals	67,581	6.1%	42,097	5.7%
Glass	18,765	1.7%	6,362	0.9%
Organics	10,779	1.0%	31,588	4.3%
C&D	850,344	76.2%	600,736	81.0%
Problem Materials	29,650	2.7%	133	0.0%
Hazardous Waste	7,345	0.7%	0	0.0%
Other Waste	61,202	5.5%	35,787	4.8%
Total[1]	**1,116,340**	**100%**	**741,556**	**100%**

[1] Total may not sum due to rounding discrepancies.

[2] The tons reported in this table for individual material categories may be over or understated compared to the actual number of tons in ICI waste. This is due to the impact of allocating a fraction of transfer trailer wastes, which were analyzed separately in the study to the ICI waste stream. The statistical methods and their associated limitations are discussed more thoroughly in Appendix D.

Table 3-14 compares the 10 most prevalent materials in the 2002 and 2009 disposed C&D waste stream. As shown, roofing shingles and untreated wood were the most prevalent materials in both Studies. Most C&D materials saw a decrease in tonnage in 2009 compared to 2002.

Table 3-14 Top 10 Most Prevalent C&D Material Categories, 2002 and 2009

2002 Material Category	2002 Tons	2002 Percent	2009 Material Category	2009 Tons	2009 Percent
Roofing Shingles	277,650	13.2%	Roofing Shingles	218,653	29.5%
Wood - untreated	213,143	10.2%	Wood – untreated [1]	181,357	24.5%
Compostable Paper	131,327	6.3%	Rock/Concrete/Bricks:	97,622	13.2%
Cardboard - recyclable	119,358	5.7%	Other C&D	43,238	5.8%
Plastic Film	115,426	5.5%	Drywall [2]	38,217	5.2%
Composite/Other Plastic	112,161	5.3%	Other Ferrous Scrap	35,888	4.8%
Mixed Recyclable Paper	92,036	4.4%	Bottom Fines/Dirt	22,538	3.0%
Ferrous Metals	90,240	4.3%	Bulky Items [3]	16,193	2.2%
R/C Paper	86,024	4.1%	Treated Wood	14,450	1.9%
Carpet	60,772	2.9%	Pallets	12,919	1.7%
Total [4]	**1,298,137**	**61.8%**		**681,076**	**91.8%**

[1] Wood – Untreated combines dimensional lumber, engineered wood, painted/stained wood and other recyclable wood.
[2] Drywall includes both clean and demo.
[3] Bulky Items combined bulky Items and wood furniture.
[4] Totals may not sum due to rounding discrepancies.

Figure 3-12 and Table 3-15 on the following page show the C&D waste stream subdivided by material groups that are more closely associated with C&D waste.

Figure 3-12 C&D Materials Categories

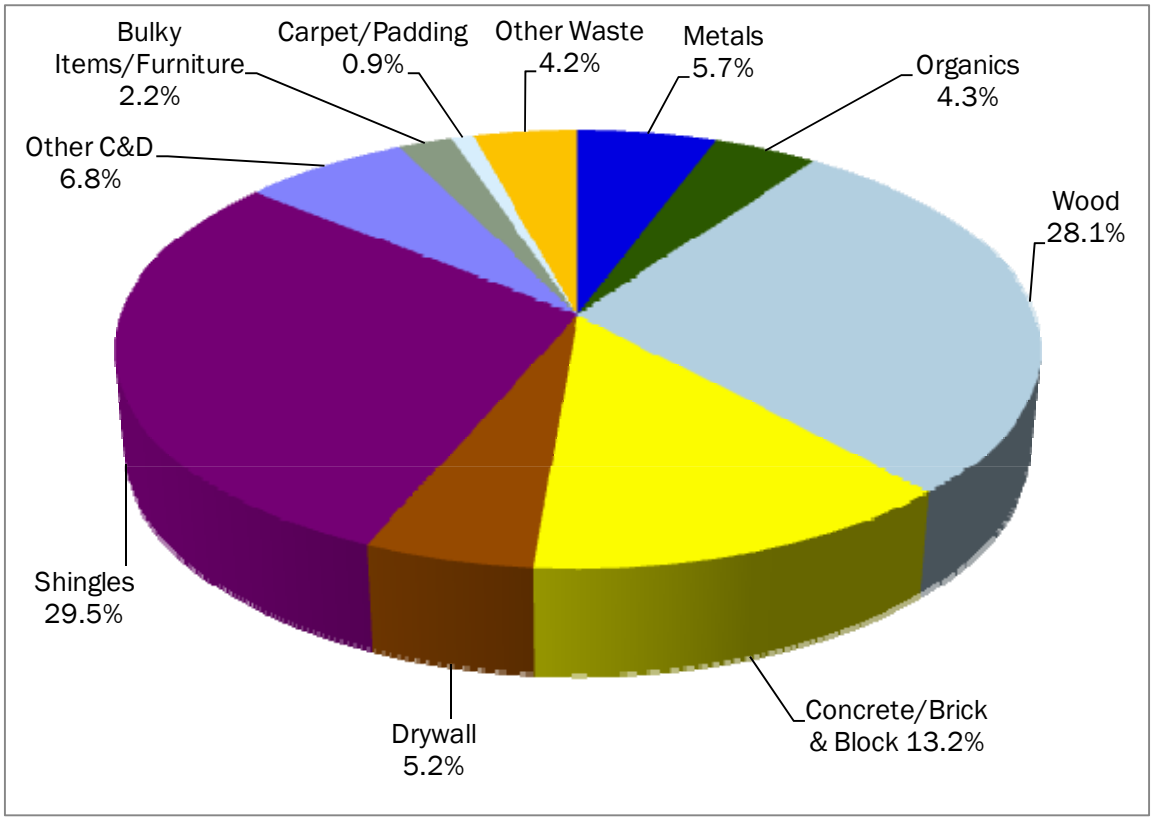


Table 3-15 shows how individual material categories were combined to create the pie chart in Figure 3-12.

Table 3-15 Mapping of Material Categories to Groups Shown in Figure 3-12

Material Group Name	Material Categories Included	Tons	Percent
Metals	All metal categories	42,097	5.7%
Organics	All organics categories	31,588	4.3%
Wood	All wood categories including wood pallets	208,726	28.1%
Concrete/Brick/Block	Concrete/Brick/Block	97,622	13.2%
Drywall	Clean and demo drywall	38,217	5.2%
Shingles	Shingles	218,653	29.5%
Other C&D	Other C&D, ceramics and C&D PVC	50,436	6.8%
Bulky Items/Furniture	Bulky items & furniture	16,193	2.2%
Carpet/Padding	Carpet & carpet padding	6,674	0.9%
Other Waste	All paper, all plastics, all glass, all problem materials, all HHW and textiles	31,349	4.2%
Totals		**741,556**	**100.0%**

Note: Totals may not sum due to rounding discrepancies.

3.6. COMPARISONS

This section attempts to concisely compare certain results from each of the generator sectors defined in this study, as well as the statewide aggregate waste stream.

3.6.1 COMPARISON BY GENERATOR SECTOR

Table 3-16 compares the five most prevalent materials in each generator sector. Of interest, food scraps are the first or second most prevalent in four of the five generator sectors, with the only exception being C&D wastes.

Table 3-16 Comparison of Top 5 Most Prevalent Categories by Generator Sector, 2009

	Statewide	Residential	Multi-family	ICI	C&D
1	Food Scraps (10.6%)	Food Scraps (17.5%)	Bulky Items (15.7%) [4]	Food Scraps (11.4%)	Roofing Shingles (29.5%)
2	Wood – Untreated [1] (8.9%)	Compostable Paper (7.2%)	Food Scraps (10.9%)	Plastic Film (7.9%) [3]	Wood – untreated (24.5%) [1]
3	Roofing Shingles (5.8%)	Yard Materials <6" (6.5%)	Bottom Fines/Dirt (5.8%)	Other Paper (7.0%)	Rock/Concrete/ Bricks (13.2%)
4	Composite/Other Plastic (5.7%) [2]	Composite/ Other Plastic (5.4%) [2]	Wood – untreated (5.6%) [1]	Uncoated OCC (6.8%)	Other C&D (5.8%)
5	Plastic Film (5.6%) [3]	Wood – untreated (4.7%) [1]	Composite/ Other Plastic (5.5%) [2]	Wood – untreated (6.3%) [1]	Drywall (5.2%) [5]

[1] Wood–untreated includes clean dimensional lumber, clean engineered wood, painted/stained wood and other recyclable wood.
[2] Composite/Other Plastic includes other plastic and composite/other plastic.
[3] Plastic Film combines plastic shopping bags – film, plastic industrial film packaging, agricultural plastic film, and other plastic film.
[4] Bulky Items includes bulky items and wood furniture
[5] Drywall includes gypsum wallboard – demolition and gypsum wallboard –clean scrap.

Table 3-17 shows the percent composition of each material and material group for each of the five generator sectors.

Table 3-17 Detailed Comparison of Composition Percent by Generator Sector, 2009

	Material	State-wide	Residential	ICI [1]	C&D
1	Newspaper (ONP)	1.5%	2.5%	1.1%	0.0%
2	High-Grade Office Paper	0.7%	0.7%	1.0%	0.1%
3	Magazines/Catalogs	1.0%	1.6%	0.7%	0.1%
4	Uncoated OCC	3.9%	2.0%	6.8%	1.4%
5	Coated OCC	0.7%	0.2%	1.6%	0.0%
6	Boxboard	1.3%	1.5%	1.8%	0.1%

	Material	State-wide	Residential	ICI [1]	C&D
7	Mixed Paper – Recyclable	1.9%	2.4%	2.2%	0.1%
8	Compostable Paper	5.0%	7.2%	4.2%	0.3%
9	Other Paper	3.5%	2.2%	7.0%	0.2%
	Subtotal Paper	**19.6%**	**20.4%**	**26.4%**	**2.3%**
10	PET Beverage Bottles	0.4%	0.5%	0.4%	0.0%
11	PET Non-Beverage Bottles/Jars	0.1%	0.2%	0.1%	0.0%
12	HDPE Natural Bottles	0.1%	0.2%	0.1%	0.0%
13	HDPE Colored Bottles	0.2%	0.3%	0.2%	0.0%
14	Other Plastic #3 - #7 Bottles	0.1%	0.2%	0.1%	0.0%
15	Food Polystyrene Foam	0.3%	0.4%	0.5%	0.0%
16	Other Polystyrene Foam	0.3%	0.3%	0.5%	0.0%
17	Other Rigid Plastic Packaging	1.3%	1.3%	2.1%	0.1%
18	Plastic Shopping Bags - film	0.3%	0.4%	0.2%	0.0%
19	Plastic Industrial Film Packaging	0.8%	0.1%	2.0%	0.0%
20	Agricultural Plastic Film	0.1%	0.0%	0.4%	0.0%
21	Other Plastic Film	4.3%	4.0%	5.3%	0.2%
22	Other Plastic	2.0%	1.9%	1.9%	0.1%
23	Composite/Other Plastic	3.6%	3.5%	4.0%	0.6%
	Subtotal Plastic	**14.1%**	**13.4%**	**17.7%**	**1.0%**
24	Aluminum Beverage Containers	0.2%	0.3%	0.2%	0.0%
25	Other Aluminum:	0.5%	0.4%	0.1%	0.5%
26	Ferrous (Tin) Cans	0.5%	0.7%	0.4%	0.0%
27	Other Ferrous Scrap	2.0%	0.8%	1.6%	4.8%
28	Non-Ferrous Metal	0.3%	0.3%	0.2%	0.4%
29	Other Metal	1.5%	2.1%	1.9%	0.0%
	Subtotal Metal	**4.9%**	**4.6%**	**4.3%**	**5.7%**
30	Glass Clear Beverage Containers	0.3%	0.3%	0.3%	0.0%
31	Glass Colored Beverage Containers	0.3%	0.4%	0.4%	0.0%
32	Glass Food Containers	0.1%	0.4%	0.1%	0.0%
33	Other Glass	1.0%	0.4%	2.3%	0.9%
	Subtotal Glass	**1.7%**	**1.5%**	**3.2%**	**0.9%**
34	Yard Materials - <6"	3.8%	6.5%	2.7%	0.5%
35	Yard Materials - >6"	0.4%	0.4%	0.5%	0.1%
36	Food Scraps	10.6%	17.5%	11.4%	0.4%
37	Diapers	1.9%	3.4%	1.7%	0.1%
38	Animal Waste/Kitty Litter	1.3%	2.9%	0.9%	0.1%
39	Bottom Fines/Dirt	3.6%	4.5%	3.1%	3.0%
40	Other Organic Material	1.6%	2.2%	1.3%	0.1%
	Subtotal Organic	**23.2%**	**37.3%**	**21.6%**	**4.3%**
41	Treated Wood	0.9%	0.4%	0.7%	1.9%
42	Untreated Clean Dimensional Lumber	2.2%	0.5%	1.3%	8.8%
43	Untreated Clean Engineered Wood	1.7%	0.4%	1.8%	4.7%
44	Painted/Stained Wood	4.4%	3.6%	2.2%	10.1%
45	Other Recyclable Wood	0.6%	0.2%	1.0%	0.9%
46	Rock/Concrete/Bricks:	1.7%	0.1%	0.8%	13.2%
47	Gypsum Wallboard - Demolition	0.8%	0.5%	0.5%	1.7%
48	Gypsum Wallboard - Clean Scrap	0.5%	0.1%	0.2%	3.5%
49	Roofing Shingles	5.8%	1.1%	0.2%	29.5%
50	PVC	0.3%	0.4%	0.2%	0.2%
51	Ceramics/Porcelain Fixtures	0.3%	0.6%	0.1%	0.8%
52	Other C&D	2.2%	1.8%	1.1%	5.8%
	Subtotal C&D	**21.3%**	**9.6%**	**10.3%**	**81.0%**

	Material	State-wide	Residential	ICI [1]	C&D
53	Televisions - CRT	0.2%	0.4%	0.4%	0.0%
54	Televisions - Non CRT	0.3%	0.0%	0.3%	0.0%
55	Computer Monitors - CRT	0.1%	0.0%	0.0%	0.0%
56	Computer Related Electronics	0.3%	0.3%	0.3%	0.0%
57	Other Electronic Equipment (OEE)	0.3%	0.3%	0.2%	0.0%
58	Small electrical Appliances	0.8%	1.0%	0.8%	0.0%
59	White Goods - Refrigerated	0.3%	0.4%	0.2%	0.0%
60	White Goods - Non Refrigerated	0.1%	0.0%	0.1%	0.0%
61	Lead Acid Batteries	0.0%	0.0%	0.0%	0.0%
62	Other Household Batteries (OHB)	0.1%	0.1%	0.0%	0.0%
63	Fluorescent Light Tubes	0.0%	0.0%	0.0%	0.0%
64	Compact Fluorescent Light Tubes	0.0%	0.0%	0.0%	0.0%
65	Tires	0.2%	0.0%	0.5%	0.0%
	Subtotal Problem Mat'ls	**2.6%**	**2.6%**	**2.8%**	**0.0%**
66	Paint	0.0%	0.0%	0.0%	0.0%
67	Automotive Used Oil/Filters	0.0%	0.0%	0.0%	0.0%
68	Household Hazardous Waste	0.0%	0.0%	0.0%	0.0%
69	Medical Waste	0.2%	0.1%	0.3%	0.0%
	Subtotal Hazardous	**0.2%**	**0.1%**	**0.4%**	**0.0%**
70	Textiles	2.5%	2.7%	3.0%	0.0%
71	Carpet	3.0%	3.8%	2.6%	0.7%
72	Carpet Padding	0.9%	0.9%	0.8%	0.2%
73	Wood Pallets	1.9%	0.4%	2.8%	1.7%
74	Bulky Items	2.1%	1.0%	2.2%	1.6%
75	Wood Furniture	1.9%	1.8%	2.0%	0.6%
	Subtotal Other Waste	**12.4%**	**10.6%**	**13.3%**	**4.8%**
	Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Note: Subtotals may not sum due to rounding discrepancies.
[1] ICI includes multi-family waste.

3.6.2 FOCUS ON RESIDENTIAL: SINGLE FAMILY VS MULTI-FAMILY

Because the residential waste stream by definition includes predominantly single family wastes, this study allowed for a comparison of single family and multi-family landfilled wastes. Table 3-18 highlights the significance (or lack thereof) of any differences in traditionally landfilled recyclable materials. The bolded values in the table indicate the generator sector that disposed of more of a recyclable material, and the far right column indicates if this difference is statistically strong, statistically weak, or statistically the same.

Table 3-18 Discarded Recyclables by Single Family and Multi-family Households in 2009

Material Category	Residential (Single Family)			Multi-family			Significance of Difference
	Average Percent	Confidence Interval		Average Percent	Confidence Interval		
		Lower	Upper		Lower	Upper	
More Prevalent in Residential Waste							
Newspaper (ONP)	**2.5%**	**1.9%**	**3.2%**	1.4%	1.0%	1.8%	Strong
Mixed Paper - Recyclable	**2.4%**	**2.1%**	**2.8%**	1.4%	1.2%	1.6%	Strong
Ferrous (Tin) Cans	**0.7%**	**0.6%**	**0.8%**	0.5%	0.5%	0.6%	Weak
Yard Materials - <6"	**6.5%**	**5.0%**	**8.0%**	3.4%	2.1%	4.7%	Strong
Residential Waste and Multi-family Waste are the Same							
Magazines/Catalogs	1.6%	1.3%	1.9%	1.6%	1.3%	2.0%	Same
Boxboard	1.5%	1.3%	1.7%	1.7%	1.5%	2.0%	Same
HDPE Colored Bottles	0.3%	0.2%	0.4%	0.2%	0.2%	0.3%	Same
Glass Colored Beverage Containers	0.4%	0.3%	0.6%	0.5%	0.3%	0.7%	Same
Yard Materials - >6"	0.4%	0.0%	0.8%	0.6%	0.0%	1.2%	Same
More Prevalent in Multi-family Waste							
High-Grade Office Paper	0.7%	0.5%	0.9%	**1.0%**	**0.7%**	**1.3%**	Weak
Uncoated OCC	2.0%	1.6%	2.5%	**2.6%**	**1.9%**	**3.3%**	Weak
PET Beverage Bottles	0.5%	0.4%	0.6%	**0.8%**	**0.7%**	**0.9%**	Weak
PET Non-Beverage Bottles/Jars	0.2%	0.1%	0.2%	**0.3%**	**0.2%**	**0.3%**	Weak
HDPE Natural Bottles	0.2%	0.1%	0.2%	**0.3%**	**0.3%**	**0.4%**	Strong
Aluminum Beverage Containers	0.3%	0.2%	0.4%	**0.4%**	**0.4%**	**0.5%**	Weak
Glass Clear Beverage Containers	0.3%	0.2%	0.4%	**1.1%**	**0.8%**	**1.3%**	Strong
Glass Food Containers	0.4%	0.3%	0.4%	**0.5%**	**0.4%**	**0.6%**	Weak

Table 3-19 compares the incidence of discarded recyclables in the residential waste stream in both 2002 and 2009. As shown, traditional fiber and container recyclables appear in the landfilled waste stream to a significantly lower degree in 2009 compared to 2002. Conversely, yard materials were observed to increase.

Table 3-19 Changes in Discarded Residential Recyclables, 2002 and 2009

Material Category	2002			2009			Significance of Difference
	Average Percent	Confidence Interval		Average Percent	Confidence Interval		
		Lower	Upper		Lower	Upper	
More Prevalent in 2009							
Yard Materials - <6"	1.9%	1.3%	2.4%	**6.5%**	**5.0%**	**8.0%**	Strong
Yard Materials - >6"	0.1%	0.0%	0.2%	**0.4%**	**0.0%**	**0.8%**	Weak
2002 and 2009 are the Same							
Uncoated OCC	2.4%	1.5%	3.3%	2.0%	1.6%	2.5%	Same
Magazines/Catalogs	1.9%	1.6%	2.2%	1.6%	1.3%	1.9%	Same
Boxboard	1.4%	1.2%	1.5%	1.5%	1.3%	1.7%	Same
PET Bottles/Jars	0.6%	0.5%	0.7%	0.7%	N/A	N/A	Same
HDPE Colored Bottles	0.4%	0.3%	0.5%	0.3%	0.2%	0.4%	Same
More Prevalent in 2002							
Newspaper (ONP)	**3.8%**	**3.2%**	**4.3%**	2.5%	1.9%	3.2%	Strong
High-Grade Office Paper	**1.6%**	**1.3%**	**2.0%**	0.7%	0.5%	0.9%	Strong
Mixed Paper - Recyclable	**6.7%**	**6.0%**	**7.5%**	2.4%	2.1%	2.8%	Strong
Aluminum Beverage Containers	**0.5%**	**0.4%**	**0.7%**	0.3%	0.2%	0.4%	Strong
Ferrous (Tin) Cans	**0.9%**	**0.7%**	**1.0%**	0.7%	0.6%	0.8%	Weak
HDPE Natural Bottles	**0.3%**	**0.2%**	**0.3%**	0.2%	0.1%	0.2%	Weak
Glass Food and Beverage Containers	**1.5%**	**1.2%**	**1.8%**	1.1%	N/A	N/A	Strong

3.7. SPECIAL WASTES

3.7.1 SHARPS

Hypodermic syringes used for home insulin injection and other medical uses were counted during the 2002 and 2009 Studies. The counts for 2009 are summarized in Table 3-20. It should be noted that the 900 sharps found in one C&D sample is, in our opinion, an outlier. This sample contained a 9-box case of lancets, with each box containing 100 apparently unused lancets (presumably discarded from a home renovation project). A residential sample contained four sharps disposal containers marked hazardous. These disposal containers were estimated to contain 120 syringes for insulin injection (presumably). Excluding these samples, a total of 83 individual sharps were encountered, all during the manual sorting of non-C&D samples. These sharps were found loose in the sampled waste.

Table 3-20 Incidence of Sharps by Generator Sector

Generator Sector	Sharps Found	Total Samples With Sharps	Total Samples	Percent of Loads Sampled With Sharps[1]
Residential	148	5	78	6.4%
Multi-family	17	5	64	7.8%
ICI	33	6	114	5.3%
C&D	900	1	603	0.2%
Transfer Trailer	5	4	94	4.3%
Total	**1,103**	**21**	**953**	**2.2%**

[1] Some loads contained more than one sharp.

3.7.2 MERCURY CONTAINING DEVICES

Mercury-containing items include items such as thermometers, thermostat switches, blood pressure cuffs, barometers, and containers of mercury. No mercury-containing devices were found during either the 2002 or 2009 Studies.

3.7.3 REUSABLE ITEMS

Consistent with the 2002 Study, an attempt was made in this study to identify reusable construction-related items being disposed. These reusable items were counted and recorded. Reusable items were defined as being in reusable condition based on a number of factors:

- Large items (doors, windows, shelves, etc.) had to be intact and have no obvious appearance of defectiveness. Uncut lumber (dimensional and engineered) was included as reusable if it was clean of hardware and otherwise uncut and unpainted.
- Small items – such as hardware, shingles, construction supplies, etc. – were required to still be unopened or almost entirely unused and in their original packaging (or in other

packaging capable of storing the product together). For example, a door in good condition would count as reusable. However, a couple of hinges in good condition would not, yet a box of hinges would count as reusable.

The 2002 Study reported finding 22 reusable items observed in 400 manually sorted samples. The 2009 Study included a significant variation in the data collection procedure that impacts the ability to compare the two studies. Specifically, in the 2009 Study, loads of C&D were visually surveyed in their entirety. This means that the Field Supervisor could observe and note apparently reusable items throughout the entire load of C&D debris.

In the 2009 Study, the Field Supervisor reported observing 249 reusable items observed in 603 visually surveyed C&D samples. This is shown in Table 3-21. No reusable items were found in the physically sorted residential, multi-family, ICI, or transfer trailer samples. Both the Field Supervisor and Crew Chief of the manually sorted samples regarded damaged items – whether the damage occurred prior to or during collection and disposal – as not reusable.

Table 3-21 Incidence of Reusable Items by Region and Generator Sector

Region	Reusable Items Found	Samples Containing Reusable Items	Total Samples	Percent of Loads Sampled [1]
Northeast	8	3	189	1.6%
North	2	1	14	7.1%
Southcentral	137	27	136	19.9%
Southeast	80	8	137	5.8%
Westcentral	22	6	127	4.7%
Total	**249**	**45**	**603**	**7.5%**

[1] Some loads contained more than one reusable item.

Similar to the 2002 study the most frequently observed usable items were glass or wood doors and windows. Also noted in the 2009 study with some frequency were intact ceramic bath fixtures such as sinks and toilets.

3.7.4 MATERIALS BANNED FROM LANDFILL DISPOSAL - STATEWIDE

As a final note, some materials that are banned from disposal in landfills in Wisconsin were found during the course of this study. In most cases, hazardous or problematic materials were found in trace quantities. However, other materials have been banned not because of any hazardous properties, but because they can be better managed in another fashion (i.e., recycling or composting).

Table 3-22 itemizes the materials that were either (a) banned from landfill disposal in Wisconsin at the time of sampling or (b) banned under the electronics recycling law that went into effect after the sampling process was completed. Although the mean quantity of these materials is reported as the "most likely" estimate of disposal tonnages, it should be noted that the actual disposed value lies within the confidence intervals only. Table 3-22 therefore shows the upper and lower confidence intervals calculated as disposal tonnages.

Table 3-22 Materials Banned from Landfill Disposal (Range of Tons Disposed)

Material Category	Disposed Quantity (tons)			Mean Lbs/capita [1]
	Mean	Lower Bound	Upper Bound	
Current Ban				
Yard Materials - <6"	161,256	132,943	189,569	57.0
White Goods - Refrigerated	10,922	481	21,363	3.9
White Goods - Non Refrigerated	3,554	0	9,308	1.3
Lead Acid Batteries	6	0	68	0.0
Tires	9,651	0	20,931	3.4
Upcoming Ban				
Automotive Used Oil/Filters	653	79	1,227	0.2
Televisions – CRT	16,904	4,175	29,632	6.0
Televisions - Non CRT	3,125	0	10,264	1.1
Computer Monitors - CRT	2,350	0	4,844	0.8
Computer Related Electronics	11,077	4,445	17,709	3.9
Other Electronic Equipment (OEE)	14,930	7,239	22,621	5.3

[1] Population of 5.65 million as of January 1, 2009, reported by U.S. Census Bureau.

All of these items occur only sporadically in the waste stream, which means there is high variance in the sample data. So, confidence intervals are wide on a relative basis. Stated another way, these items were generally not found in a lot of samples. This means that the actual incidence of these materials, and the estimated tons disposed, also falls within a wide range. For example, we can be 90 percent confident that between 481 and 21,363 tons of white goods-refrigerated were disposed, even though the summary tables in this study report the mean estimate of 10,922 tons.

In practice, it is possible that some of the banned wastes that were sorted in our samples would have been rejected by the landfill operator at the time of attempted disposal at the landfill face or (in the case of transfer stations) removed prior to loading into the transfer trailer. So, the reported quantities for some of these materials may overstate the actual amount being landfilled in Wisconsin.

One exception to this statement is yard materials, which were found regularly across residential and ICI samples during both seasons of the study.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. CONCLUSIONS

- **Comprehensiveness**: The 2009 Study was successfully able to obtain and analyze samples of wastes spanning the generator sectors and geographic regions of Wisconsin. With over 900 samples of waste captured, including over 600 visually surveyed loads of C&D, the study provided a comprehensive snapshot of disposed waste composition for calendar year 2009.
- **Impact of Economy**: It should be recognized that the field data collection for this study took place during a year in which the national and global economy was emerging from a recessionary period. Because of the economy, it is possible that residential and ICI waste generators exhibited differing waste generation, recycling and disposal practices than would otherwise prevail. This is almost certainly the case with regard to the generation of C&D debris, which was curtailed in 2009 compared to 2002. It was beyond the scope of this study to correlate waste generation or disposal to economic factors.
- **Comparability**: Despite some differences in the approach for the 2009 Study – primarily involving the segregation of transfer trailer waste and use of visual surveying instead of physical sorting of C&D wastes – the results of the 2009 Study can be closely compared to the 2002 Study. Solid waste and recycling planners can rely on the 2009 Study to identify statistically significant changes to the landfilled waste stream. Examples include a decrease in landfilled paper, metal and C&D; and increases in landfilled plastics and organics. Similar comparisons can be made individually by generator sector.
- **Opportunities**: Wisconsin continues to have opportunities to divert additional wastes from landfill disposal. Organics remain the most significant fraction of non-C&D wastes that could be targeted for separation and diversion. C&D debris, though below historical levels because of adverse economic conditions affecting the building sector, continues to be a significant fraction of the waste stream. It should be noted that Wisconsin appears to be doing a good job diverting traditionally targeted fiber and container recyclables, as these were not observed in great quantity in the landfilled waste stream.

4.2. RECOMMENDATIONS

- **Continue Performing Statewide Studies**: Statewide studies both inform about the overall disposed waste stream for state-level planners, and also provide data to county, municipal, and private solid waste and recycling stakeholders for a variety of uses. The Department of Natural Resources joins state agencies from roughly ten other states at conducting statewide waste characterization analyses on a regular basis, and should continue to perform a similar project over seven to 10 year intervals.
- **Improve Reporting for C&D Wastes**: At the outset of 2009, DNR implemented a new category for tracking C&D waste at municipal solid waste landfills. With this in place, DNR should next consider tracking C&D quantities at C&D landfills by requiring these facilities to report tons accepted based either on scale data or on reasonable volume

conversion factors. Such complete information would improve future waste characterization study sampling plan development for C&D wastes.

- **Establish Transfer Station Reporting**: The state's landfill disposal reports are helpful in tracking overall disposal trends. However, with over 41 percent of disposed wastes reported to be coming through transfer stations prior to final disposal, it can be argued that expanding the reporting requirements to transfer stations would improve the ability of state-level planners to accurately track and monitor the waste stream as it is handled and transported from point of generation to final disposal. Such data will also improve the development of future waste characterization sampling plans.
- **Expand Sorting at Transfer Stations**: The strategy of sorting at landfills has been successful, and the state's landfills have been exceptionally good hosts. However, if transfer station reporting is not implemented as described in the prior bullet, DNR should consider targeting a representative number of transfer stations in future studies. While some transfer stations may not have sufficient space to host field data collection, it is hypothesized that other facilities would be interested and able to host such field work. Waste handling practices – such as floor sorts and other processing – could be better identified and would provide direct data on the management of wastes in urban and suburban areas relative to rural areas.
- **Specialization in Future Studies**: A number of other states that have regularly conducted statewide waste characterization studies have, over time, structured the studies to investigate certain waste streams in greater detail. In addition to measuring the composition of disposed wastes in total and by generator sector, some states have opted to focus on:
  - Targeted generator sampling of the most prevalent business types (e.g., grocery stores, manufacturing, retail malls, etc.) that generate significant quantities of waste;
  - Enhanced research into waste generation indicators for certain waste streams, especially C&D debris, to improve future sampling plans for this waste stream;
  - Measuring contamination rates in disposed material (for both particulate matter and moisture) as a means of investigating dirty MRF processing potential;
  - Calculating energy and heating values in disposed waste for incineration and thermal conversion processes; and
  - Determining the composition of residuals from recyclables processing facilities to test recovery efficiency and potential for additional processing.

  If Wisconsin continues to support large statewide waste characterization studies, it may consider integrating one or more of these tests in the future. Such future efforts would be limited by available funding, but could provide additional insight into diversion and recycling opportunities in Wisconsin.

APPENDIX A

MATERIAL DEFINITIONS

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APPENDIX A – MATERIAL DEFINITIONS

A.1. MATERIAL DEFINITIONS

PAPER

1. Newsprint (ONP) - printed ground wood newsprint, including glossy advertisements and inserts typically found in newspapers.

2. High grade office paper - high grade continuous form computer paper, white paper including bond, photocopy and notebook paper, and colored ledger paper primarily found in offices.

Key points:

- Kraft envelopes go into "Mixed paper – recyclable."
- If high grade paper is wet, it should still go into this category because it is assumed to have become wet after being discarded.
- If paper is brighter than pastel, it belongs in Mixed paper - recyclable.

Examples:

- Bond computer paper, index cards, computer cards, notebook paper, xerographic and typing paper, tablets (yellow and with clear glue binding), manila folders, white register receipts, non-glossy fax paper.

3. Magazines/catalogs - magazines, catalogs, promotional materials printed on glossy paper; does not include telephone directories or books.

4. Uncoated OCC - recyclable - uncoated cardboard with a wavy core and not contaminated with other materials such as wax or plastic coating.

Key points:

- OCC with styrofoam attached to it that cannot be removed belongs in Other paper category.

5. Coated OCC - cardboard coated with wax or plastic.

6. Boxboard - chipboard boxes not coated with wax, plastic or metal.

Examples:

- Cereal boxes, other chipboard food containers, shirt boxes.
- Wet-strength papers used to package items such as ice cream and cases of soda pop and beer belong in Mixed paper – recyclable.

7. Mixed paper - recyclable - paper that would be included in residential "mixed mail" or commercial "office pack" recycling programs, not including the grades identified above.

Examples:

- Paper bags (including kraft), envelopes, egg cartons, tissue roll cores, telephone directories, books, brightly colored paper, calendars, "junk" mail, tablets with colored glue bindings, wet-strength papers used to package items such as ice cream and cases of soda pop and beer.

8. 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.

9. Other paper - all paper that doesn't fit into the categories specified above and items that are primarily paper but include other materials such as plastic or metal.

Key points:
- If the sorter is 99% sure that the generator intended to reuse the paper in such a way that it became contaminated for recycling, put that paper into this category (e.g., paper used to dispose of chewing gum, paper sprayed with paint).
- If it would take an effort to make the paper recyclable, put it into this category.

Examples:
- Paper or boxboard coated with wax, plastic or metal, photographs, laminated paper.

PLASTIC

10. PET bottles - beverage - plastic bottles with a neck composed of polyethylene terephthalate and used for containing a beverage.

11. PET bottles/jars – non-beverage – plastic bottles and necked jars composed of polyethylene terephthalate not used for containing a beverage

Key points:
- Look for the label "1" on the bottom.
- PET and PVC can be differentiated because PET containers have a nub or 'belly button' while PVC containers have a seam or 'smile.'
- Items not clearly identified as PET, narrowing down to a neck, go into Other containers.

Examples:
- Some bottles for detergent, toiletries and honey, jars for peanut butter and mayonnaise.

12. HDPE bottles - natural - natural, or unpigmented, high-density polyethylene bottles with necks.

Key points:
- Look for the label "2" on the bottom.
- Opaque or translucent matte finish.
- Must narrow down to a neck, otherwise it goes in Other rigid plastic packaging.

Examples:

- Clear or uncolored bottles for dairy products, detergent, windshield fluid, eye drops, rubbing alcohol, vinegar, motor oil, and some shampoo, fabric softener, antifreeze, bleach.

13. HDPE bottles - colored - colored high-density polyethylene bottles with necks

Key points:

- Look for the label "2" on the bottom.
- Must narrow down to a neck, otherwise it goes in Other rigid plastic packaging.

Examples:

- Colored bottles for orange juice, detergent, windshield fluid, motor oil, and some shampoo, fabric softener, antifreeze, bleach.

14. Other plastic bottles #3-#7 – All other plastic bottles that narrow down to a neck.

15. Foam polystyrene – food - polystyrene or "styrofoam" that is designed for serving food or beverages.

Example:

- Coffee cups, fast food containers, plates and bowls made of styrofoam. Styrofoam coolers go into Foam polystyrene – other.

16. Foam polystyrene – other – packaging made primarily from foam polystyrene that either consists of loose particles intended to fill space and cushion the packaged article in a shipping container, or consists of rigid materials shaped to hold and cushion the packaged article in a shipping container.

17. Other rigid plastic packaging– all other non-film packaging that does not fit into the above categories including tubs and lids, pails, jars, plant pots and flats, clamshells, caps, closures, blister packs and other miscellaneous plastic packaging.

18. Plastic film shopping bags – grocery and shopping bags provided at retail checkout. Plastic nonwoven, non-film shopping bags (i.e., reusable shopping bags) go in Other plastic. Bread bags, fruit and vegetable bags, dry cleaner bags go in Other plastic film.

19. Plastic film industrial packaging – film plastic used for stretch wrapping pallets of products; wraps used for protection of products during transport.

Examples:

- Boat wrap, furniture wrap, mattress bags, film bubble wrap.

20. Plastic film agricultural – film plastic used for storage of farm materials such as feed; plastic film used for mulch.

21. Other plastic film - all other flexible plastic film regardless of resin type.

Examples:

- Shower curtains, Tyvek packaging and building wrap, garbage bags, snack bags, food wrappings, and plastic tarpaulins.

22. Composite/Other plastic - All items that were plastic but combined with metal, wood, or glass.

Examples:

- Toys, cosmetic compacts, toothpaste tubes, disposable razors, plastic hangers with metal, writing pens or any other mixture of plastic with any product.

23. Other plastic - anything plastic that is not identifiable as one of the categories above.

Examples:

- Molded toys, plastic clothes hangers, corrugated plastic/fiberglass roofing, plastic lawn furniture, plastic hoses, drinking straws, credit cards, and CDs or DVDs.

METALS

24. Aluminum beverage containers - Aluminum beverage containers.

25. Other aluminum - All aluminum except beverage containers.

Key points:

- If the material is not recognizable as aluminum and it as not attracted to a magnet, it belongs in Other non-ferrous.

Examples:

- Aluminum foil, aluminum pie plates, aluminum siding, aluminum lawn chairs.

26. Ferrous ("tin") cans - steel food and beverage containers, including steel soft drink, beer and other beverage containers, and steel pet food cans.

27. Other ferrous scrap - Ferrous and alloyed ferrous metal scrap to which a magnet is attracted (includes household, commercial and industrial materials).

Examples:

- Metal clothes hangers, sheet metal products, pipes, steel drums, aerosol cans, compressed gas containers, stainless steel cookware, flashing, and metal scraps.

28. Non-ferrous metal - all other non-magnetic metal, such as brass and copper, and including stainless steel, that are not recognized as aluminum.

29. Other metal – metal that cannot be put in any other category. This includes items made mostly of metal but combined with other materials and items made of both ferrous and non-ferrous metals.

Examples:

- Motors, insulated wire, engines, and lawn mowers.

GLASS

30. Clear containers - beverage - clear glass beverage containers.

31. Colored containers – beverage – colored glass beverage containers.

32. Glass food containers – clear and colored glass food containers.

33. Other glass - all glass that doesn't fit into the categories specified above and items that are primarily glass but include other materials such as plastic or metal.

Key points:

- If the glass is broken and not 100 percent identifiable as food or beverage glass, it belongs in Other glass.

Examples:

- Plate glass, drinking glass, cooking utensils, ash trays, mirrors, Pyrex, dinner plates and other household ceramic items, medicine and chemical bottles, incandescent light bulbs, and fragments.

ORGANIC MATERIALS

34. Yard materials - <6" – leaves, grass clippings, yard and garden debris and brush, including clean woody vegetative material no greater than 6 inches in diameter.

Key points:

- This material does not include stumps, roots or shrubs with intact root balls.

35. Yard materials - >6" - woody vegetative material greater than 6 inches in diameter, stumps, roots or shrubs with intact root balls.

36. Food scraps - Material capable of being decomposed by micro-organisms with sufficient rapidity as to cause nuisances from odors and gases; putrescibles.

Examples:

- Food preparation waste, food scraps, spoiled food, kitchen wastes, waste parts from butchered animals.

37. Diapers - infant and adult disposable diapers. Cotton diapers belong in Textiles category.

38. Animal waste/kitty litter – self defined.

Key points:

- Animal carcasses belong in Other organic material.

39. Bottom fines/dirt – small fragments that pass through the ¼" sort screen, and miscellaneous fines and dirt.

40. Other organic material - all organic material that doesn't fit into the categories specified above, and items that are primarily organic but include other materials such as plastic or metal.

Examples:
- Cotton balls, feminine hygiene products, hair, rubber products, and animal carcasses.

CONSTRUCTION & DEMOLITION DEBRIS

41. Treated wood - lumber that is either green or brown treated.

Examples:
- Outdoor decking and steps/ramps, railroad ties, some wood fencing and siding, and playground equipment.

42. Untreated clean dimensional lumber – unpainted, untreated new or demolition dimensional lumber such as 2x4s, 2x6s, etc. May contain nails or other trace contaminants

43. Untreated 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.

44. Painted/stained wood – wood that has had an external coating applied, such as paint or varnish.

Examples:
- Painted siding, baseboards and moldings, cabinets, varnished handrails, finished wood doors.

45. Other recyclable wood – recyclable wood not included in any other category, including untreated, unpainted scrap from furniture and cabinet making and untreated, unpainted scrap from roofing and siding.

46. Rock, concrete, brick – Rock gravel, Portland cement mixtures (set or unset), fire-clay bricks, asphalt pavement.

47. Gypsum wallboard - demo – used gypsum drywall typically with paint, wallpaper, or other finish coating.

48. Gypsum wallboard – clean scrap – unpainted gypsum drywall construction cutoffs and scrap.

49. Roofing shingles – asphalt shingles tarpaper; also tarpaper from built-up roofing.

50. PVC – construction and demolition materials made of polyvinyl chloride; primarily piping.

51. Ceramics/porcelain fixtures – Finished ceramic or porcelain household fixtures such as toilets, tiling, and sinks.

52. Other C&D - any other material used in home construction.

Examples:

- Insulation, linoleum, nails, adhesives, tubs, showers, and cabinets, composite ceiling tiles, fiberglass insulation, asphalt from built-up roofing.

PROBLEM MATERIALS

53. Televisions - CRT – televisions with cathode-ray tubes.

54. Televisions – non-CRT – LCD, plasma, and other televisions without cathode-ray tubes. **COUNT**

55. Computer monitors - CRT - computer monitors with cathode-ray tubes.

56. Computer-related electronics – equipment with large circuitry that is computer-related.

Examples:

- Laptops, flat-screen monitors, desktop computer processing units, keyboards, printers, mice, disk drives, modems, and fax machines

57. Other electronic equipment – household items with significant circuitry.

Examples:

- Digital cameras, cell phones, telephones, video game devices, personal digital assistants, MP3 players, DVD and CD players, stereo equipment, phone answering machines. COUNT CELLPHONES; PHOTO

58. Small electrical appliances - small products or appliances with electrical cord or battery power source and may have small electronic devices such as digital readouts and controls but are not heavily reliant on computer circuitry.

Examples:

- Small kitchen and bathroom appliances (toasters, hair dryers, etc.), lamps, fans, vacuum cleaners, and power tools.

59. White goods - refrigerated - major appliances that are primarily encased in metal and are designed to contain refrigerants.

Examples:

- Refrigerators, freezers, and dehumidifiers.

60. White goods – non-refrigerated – major appliances that are primarily encased in metal and are not designed to contain refrigerants.

Examples:

- Stoves, water heaters, washers, dryers, dishwashers, and microwave ovens.

61. Lead-acid batteries - automotive, tractor, motorcycle, and boat batteries.

62. Other household batteries - all batteries, including household (rechargeable and non-rechargeable) and button batteries.

63. Fluorescent light tubes – fluorescent light tubes not including fixtures.
Many of these are broken by the time they are collected from the generator to the time they are transported and then sorted from the sample. To the extent possible, the pronged light fixture end pieces will be counted and paired to determine how many tubes were in the sample.

64. Compact fluorescent light bulbs – compact fluorescent light bulbs not including fixtures. **COUNT**
Many of these are broken by the time they are collected and sorted from the sample. However, light fixture plugs and connecting ballasts are found. To the extent possible, the number of CFLs will be estimated based on the fragments found

65. Tires - automobile, truck, tractor, motorcycle, bicycle, wheelbarrow, trailer and other pneumatic tires. **COUNT**

HOUSEHOLD HAZARDOUS

66. Paint –latex paint that has not dried, wet and dry oil-base paint, aerosol cans containing paint. Does not include empty paint cans, empty aerosol paint cans.

67. Automotive - used oil/filters - automotive oil and oil filters.

68. Household hazardous waste – all household and commercial products characterized as "toxic," "corrosive," "flammable," "ignitable," "radioactive," "poisonous," and "reactive."

Examples:

- Cleaners, solvents, antifreeze, acids, bases, mercury-containing devices such as thermostats and thermometers (even if containment is broken and mercury is no longer present), pesticides/fertilizers, fluorescent light ballasts, and smoke detectors.

69. Other problem materials (Medical Waste) - items such as prescription and over the counter pharmaceuticals, used medical devices such as aspirator, feeding, breathing, and other tubing, infectious waste, and sharps. Sharps are counted and photographed.

Examples:

- Pharmaceuticals, sharps and infectious waste.

OTHER WASTE

70. Textiles - clothing, bedding, curtains, blankets, stuffed animals, cotton diapers, other cloth material, shoes, and leather goods. Textiles may be synthetic or organic.

71. Carpet – general category of flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material.

72. Carpet padding – polyurethane padding used as a carpet underlay.

73. Wood pallets – wood pallets and crating materials commonly used for industrial and commercial packaging and shipping.

74. Bulky items – upholstered furniture, mattresses.

75. Wood furniture – broken or intact, finished or unfinished wood furniture.

A.2. SPECIAL INSTRUCTIONS

For both the physically sorted and visually surveyed samples, it was also necessary to count and photograph certain materials, if found. To assure accuracy of calculating visual volumetric estimates to weigh-based estimates, it was further necessary to estimate the weight and/or dimensions of certain items. Tables A-1 and A-2 summarize the special data recording instructions for selected material categories in both the physical sorts and the visual surveys.

Table A-1 Special Instructions for Manually Sorted Samples

Material Group	Count	Photo
Televisions – CRT	✓	
Televisions - Non CRT	✓	
Computer Monitors - CRT	✓	
Other Electronic Equipment	✓	✓
White Goods - Refrigerated	✓	
White Goods - Non Refrigerated	✓	
Lead Acid Batteries	✓	
Other Household Batteries	✓	✓
Fluorescent Light Tubes	✓	
Compact Fluorescent Light Tubes	✓	
Automotive Used Oil/Filters	✓	
Household Hazardous Waste	✓	
Medical Waste	✓	✓
Tires	✓	
Mercury Containing Devices [1]	✓	✓

[1] Classified as category 68, Household Hazardous Waste.

Table A-2 Special Instructions for Visually Surveyed Loads

Material Group	Count	Photo	Estimate Weight	Estimate Dimensions
PET bottles – beverage	✓			
Aluminum Beverage Cans	✓			
White Goods – Refrigerated			✓	✓
White Goods - Non-Refrigerated			✓	✓
Glass Beverage Bottles	✓			
CRT	✓		✓	✓
Electronics			✓	✓
Cell Phones	✓	✓		
Lead-acid batteries	✓			
Tires	✓			
Fluorescent Light Bulbs	✓			
Household Hazardous Waste	✓			
Non-Common Household Dry Cell Batteries	✓	✓		
Medical Waste - Sharps	✓	✓		
Automotive Oil Filters and Fluids	✓		✓	
Mercury Containing Devices [1]	✓	✓		

[1] Classified as category 68, Household Hazardous Waste.

A.3. MAPPED VISUAL CATEGORIES

The visual surveying approach used for the C&D samples required some modification to the material categories for data collection purposes. This is because many of the material categories defined in Section A.1 do not appear in the C&D waste stream to a level of statistical significance. The Project Team worked with DNR to develop an abbreviated list of material categories for use in the visual surveying process. This is shown in Table A-3.

Table A-3 Summary of Visual Material Groups

PAPER	
Uncoated OCC - recyclable	Other Paper
PLASTICS	
PET bottles - beverage	HDPE Buckets
PVC	Film Packaging
Other plastic	
METALS	
Aluminum Cans	Other aluminum
Other ferrous scrap	Non-ferrous metal
GLASS	
Glass Bottles	Other Glass
ORGANICS	
Yard Materials	Dirt/Sand
C&D MATERIALS	
Treated wood	Untreated clean dimensional lumber
Untreated clean engineered wood	Painted/stained wood
Other recyclable wood	Rock, concrete, brick
Gypsum wallboard - demo	Gypsum wallboard – clean scrap
Roofing shingles	Ceramics/porcelain fixtures
Other C&D	
PROBLEM MATERIALS	
CRT	Electronics
White goods - refrigerated	White goods – non-refrigerated
Lead-acid batteries	Tires
Fluorescent Light Bulbs	Household Hazardous Waste
HOUSEHOLD HAZARDOUS	
Household Hazardous Waste	
OTHER WASTE	
Carpet	Carpet padding
Wood pallets	Bulky items
Wood furniture	Mixed MSW

Table A-4 shows how the abbreviated list of material categories used for visual surveying of C&D wastes maps into the full material category list. It should also be noted that the Mixed MSW category was allocated across all of the other material categories in proportion to the statewide composition of non-C&D waste.

Table A-4 Mapped 2009 Proposed Visual Material Groups and Categories

Group	No.	2009 Category	No.	Proposed Visual Category
PAPER	1	Newsprint (ONP)	2	Other paper
	2	High grade office paper	2	Other paper
	3	Magazines/catalogs	2	Other paper
	4	Uncoated OCC - recyclable	1	Uncoated OCC - recyclable
	5	Coated OCC	2	Other paper
	6	Boxboard	2	Other paper
	7	Mixed paper - recyclable	2	Other paper

APPENDIX A

Group	No.	2009 Category	No.	Proposed Visual Category
	8	Compostable paper	2	Other paper
	9	Other paper	2	Other paper
PLASTIC	10	PET bottles - beverage	3	PET bottles - beverage
	11	PET bottles/jars – non-beverage	41	Mixed MSW
	12	HDPE bottles - natural	41	Mixed MSW
	13	HDPE bottles - colored	41	Mixed MSW
	14	Other plastic bottles #3-#7	41	Mixed MSW
	15	Foam polystyrene – food	41	Mixed MSW
	16	Foam polystyrene – other	41	Mixed MSW
	17	Other rigid plastic packaging	4	HDPE Buckets
	18	Plastic film shopping bags	5	PVC
	19	Plastic film industrial packaging	7	Other plastic
	20	Plastic film agricultural	6	Film Packaging
	21	Other plastic film	7	Other plastic
	22	Composite plastic	7	Other plastic
	23	Other plastic	7	Other plastic
METALS	24	Aluminum beverage containers	8	Aluminum Cans
	25	Other aluminum	9	Other aluminum
	26	Ferrous (“tin”) cans	10	Other ferrous scrap
	27	Other ferrous scrap	10	Other ferrous scrap
	28	Non-ferrous metal	11	Non-ferrous metal
	29	Other metal	11	Non-ferrous metal
GLASS	30	Clear containers - beverage	12	Glass Bottles
	31	Colored containers – beverage	12	Glass Bottles
	32	Glass food containers	12	Glass Bottles
	33	Other glass	13	Other Glass
ORGANIC	34	Yard materials - <6”	14	Yard materials - <6”
	35	Yard materials - >6”	14	Yard materials - >6”
	36	Food scraps	40	Mixed MSW
	37	Diapers	40	Mixed MSW
	38	Animal waste/kitty litter	40	Mixed MSW
	39	Bottom fines/dirt	15	Dirt
	40	Other organic material	40	Mixed MSW
	41	Treated wood	16	Treated wood
	42	Untreated clean dimensional lumber	17	Untreated clean dimensional lumber

Group	No.	2009 Category	No.	Proposed Visual Category
C&D DEBRIS	43	Untreated clean engineered wood	18	Untreated clean engineered wood
	44	Painted/stained wood	19	Painted/stained wood
	45	Other recyclable wood	20	Other recyclable wood
	46	Rock, concrete, brick	21	Rock, concrete, brick
	47	Gypsum wallboard - demo	22	Gypsum wallboard - demo
	48	Gypsum wallboard – clean scrap	23	Gypsum wallboard – clean scrap
	49	Roofing shingles	24	Roofing shingles
	50	PVC		
	51	Ceramics/porcelain fixtures	25	Ceramics/porcelain fixtures
	52	Other C&D	26	Other C&D
PROBLEM MATERIALS	53	Televisions - CRT	27	CRT (Count & Estimate Weight)
	54	Televisions – non-CRT	28	Electronics (Count & Estimate Weight)
	55	Computer monitors - CRT	27	CRT (Count & Estimate Weight)
	56	Computer-related electronics	28	Electronics (Count & Estimate Weight)
	57	Other electronic equipment	28	Electronics (Count & Estimate Weight)
	58	Small electrical appliances	28	Electronics (Count & Estimate Weight)
	59	White goods - refrigerated	29	White goods - refrigerated
	60	White goods – non-refrigerated	30	White goods – non-refrigerated
	61	Lead-acid batteries	31	Lead-acid batteries (Estimated Count)
	62	Other household batteries	34	HHW
	63	Fluorescent light tubes	33	Fluorescent Light Bulbs (Estimated Count)
	64	Compact fluorescent light bulbs	33	Fluorescent Light Bulbs (Estimated Count)
	65	Tires	32	Tires
HOUSEHOLD HAZARDOUS	66	Paint	34	HHW
	67	Automotive - used oil/filters	34	HHW
	68	Household hazardous waste	34	HHW
	69	Other problem materials (Medical Waste)	34	HHW
OTHER WASTE	70	Textiles	40	Mixed MSW
	71	Carpet	35	Carpet
	72	Carpet padding	36	Carpet padding
	73	Wood pallets	37	Wood pallets
	74	Bulky items	38	Bulky items
	75	Wood furniture	39	Wood furniture
	76	Mixed MSW	40	Mixed MSW

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APPENDIX B

LANDFILL SURVEY & FIELD FORMS

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Wisconsin 2009 Statewide Waste Composition Study Landfill Questionnaire

NAME OF FACILITY: _____

FACILITY CONTACT: _____

PHONE: _____ **CELL:** _____

EMAIL ADDRESS: _____

FACILITY ADDRESS: _____

CITY: _____ **COUNTY:** _____ **REGION:** _____

NAME OF PERSON RESPONDING TO SURVEY: _____

PHONE: _____ **E-MAIL ADDRESS:** _____

BACKGROUND:

A six person sorting team and one visual surveyor will spend 2 to 3 days at each facility to select, sample, and manually sort 200 pound samples of trash from incoming refuse trucks. The visual surveyor observes loads of C&D material as they are tipped, so major groups of materials in C&D loads can be quantified.

MidAtlantic Solid Waste Consultants (MSW Consultants) will lead the field data collection team and Recycling Connections Corporation will serve as project manager. Both firms are willing to sign waivers of liability as a condition of being granted access to your facility, and copies of the firms' Certificates of Insurance (COI) and MSW's Health and Safety Plan for conducting waste characterization studies will also be provided. Please advise us of any other endorsements that might be requested as a condition of participation.

Physical sorting and visual surveying will occur in August/September and November/December of 2009. Your facility will only need to participate during ***one*** of the two seasons. The manual sorting team and C&D visual surveyor may or may not be at your facility at the same time. This can be discussed. While on site, the manual sorting team will physically sort about 20 loads of waste entering your facility. The visual surveyor will observe about 50 loads of C&D debris.

Your cooperation is greatly appreciated.

Directions: Please check the appropriate box and add information when requested.

GENERAL:

Do you have a preference for the timeframe?	☐ Aug/Sep	☐ Nov/Dec	☐ No Preference
Are there any dates to avoid during your preferred season?	_____	_____	_____
We need to schedule a site visit prior to the sort. *Will this be a problem?* ☐ Yes ☐ No Comments/Question:			
Do you require a liability waiver? ☐ Yes ☐ No If yes, please forward the waiver language.			

GATE INFORMATION:

	Mon. – Fri.	Saturday	Sunday
What are the hours of operation?	_____	_____	_____

	Number of Staffed Scales	Number of Automated Scales
Inbound Vehicles:		
Outbound Vehicles:	_____	_____

WASTE QUANTITIES BY SOURCE:

The study will analyze wastes generated by: single family residential**,** multi-family residential**,** industrial/commercial/institutional (ICI) **and** C&D.

For purposes of planning the study, it is helpful to quantify wastes by **truck type**. In 2007 the WDNR reported that your facility disposed of _____ **tons** of MSW *("Category 1" that includes C&D. If you report C&D in a different Category; please advise)*. Please break down the delivery methods of waste disposed in the table below either in Tons **or** Percent, estimates are fine.

Delivery Method	Tons	Percent
Front Load Compactor (ICI)		
Rear and Sideload Compactor (Residential)		
Roll-Off Compactor (ICI)		
Roll-Off Open Top (C&D)		
Transfer Trailer – In-state origin		
Transfer Trailer – Imported		
Self Haul		
Total	_____ **tons**	**100%**

Please complete the following table showing daily number of loads during a typical week.

Day	Front-Load Compactor	Rear and Side Load Compactor	Roll-Off Compactor	Roll-off Open Top Containers	Self-Haul	Transfer Trailers
Monday # of Loads						
Tuesday # of Loads						
Wednesday # of Loads						
Thursday # of Loads						
Friday # of Loads						
Saturday # of Loads						

WASTE FROM TRANSFER STATIONS: If this facility receives in-state waste from transfer stations, please provide the name and contact information of these transfer stations.

Transfer Station Name	Contact Name	Phone Number	Percent of Waste

If any of these transfer stations are owned by your company, is it possible to sort on-site at the transfer station prior to the loads being loaded into a transfer trailer?

☐ Yes	☐ No

*Comments:*_____

SITE SPACE & EQUIPMENT REQUIREMENTS FOR MANUAL SORTING:

• a 20' x 20' area at the disposal facility for sorting crew to work for 2-3 days. *Can the facility accommodate this?*	☐ Yes	☐ No
• if facility is a landfill, a prepared mulched or graveled 20' x 20' pad near the working face to set up the work area. *Can the facility provide this?*	☐ Yes	☐ No
• if facility is an RDF or transfer station, space inside the structure for conducting the sort. *Can the facility accommodate this?*	☐ Yes	☐ No
• if site will be outside, a tent. *May we set one up?*	☐ Yes	☐ No
• if needed, permission to leave out overnight several unsorted samples contained in carts or covered with tarps. *Is this possible?*	☐ Yes	☐ No
• if needed, arrival at the facility each morning prior to opening to the public. *Is this possible?*	☐ Yes	☐ No
• if needed, permission to work after facility is closed. *Is this possible?*	☐ Yes	☐ No
• to move waste from tipped truckloads to our sort area, we need a loader/bobcat and operator to take grab samples (total commitment approximately one hour per day). *Can the facility provide a loader or bobcat (and operator) to assist with this?*	☐ Yes	☐ No
• to discard sorted samples adjacent to the work area for later removal by the facility. *Is this possible?*	☐ Yes	☐ No
• possible use of restrooms and break rooms. *May we use your facilities?*	☐ Yes	☐ No

(continued)

- Crews will wear hardhats, orange vests, coveralls, boots, safety glasses, dust mask, and gloves. *What additional safety equipment or special personal protective equipment do you require? Please specify:*_____

COMMERCIAL HAULERS COLLECTING MULTI-FAMILY WASTE:

One of the objectives of this study is to obtain and sort samples of wastes generated at multi-family dwellings, which are often collected in front-load trucks and mixed with commercial and institutional waste. We might want to contact one or two haulers to determine if it might be possible to deliver segregated multi-family wastes to us during the sort.

Please provide the following information on the largest commercial haulers that deliver to this facility, or any hauler that you believe might service a lot of multi-family buildings.

Hauler	Contact Name	Phone	Percent of All Commercial

SPACE AND EQUIPMENT REQUIREMENTS FOR C&D VISUAL SURVEYS:

• a separate tipping area (separate cell, separate bay) for C&D compared to MSW. *Do you have one?*	☐ Yes	☐ No
• permission to tip and spread out 2 or 3 loads of C&D for visual surveying prior to processing of the loads adjacent to the C&D tip face (or in an adjacent bay). *Is this possible?*	☐ Yes	☐ No
• preference for a loader to spread out the tipped loads before conducting the visual survey. *Can the facility provide a loader/operator to spread out tipped loads at the C&D tipping area?*	☐ Yes	☐ No

NOTE: Please attach any comments or questions regarding this upcoming waste characterization study, as well as any concerns you may have about your participation.

Thank you for your help with this important project! Once we receive your completed form a Project Team member will be contacting you to discuss your responses and participation details.

Physical Sort Field Supervisor Daily Targeted Samples

Facility _____ **Field Supervisor** _____

Generator Type		Total Needed	Truck Type	Estimated Loads	Targeted Load	Total Sampled
Single Family	SF	8	RL/SL/SH			
Multi-Family	MF		Targeted			
(ICI)	CO	12	FL/COMP/OT/SH			
Transfer Trailer	TT		TT			
	Total	**20**				

Sample ID	Type	Date	Time	Hauler	Truck #	Truck Type	Ticket Number	Weight
MSWNEOC1								
NEOCMSW2								
NEOCMSW3								
NEOCMSW4								
NEOCMSW5								
NEOCMSW6								
NEOCMSW7								
NEOCMSW8								
NEOCMSW9								
NEOCMSW10								

Precipitation _____

Notes

Wisconsin - Physical Sort Field Data Sheet

Location_____

Sample ID:_____ Crew Chief: _____

Date: _____ Time: _____

		Material Group	Weight (Circle if net weight)
PAPER	1	Newspaper (ONP)	
	2	High-Grade Office Paper:	
	3	Magazines/Catalogs	
	4	Uncoated OCC	
	5	Coated OCC	
	6	Boxboard	
	7	Mixed Paper - Recyclable	
	8	Compostable Paper	
	9	Other Paper	
PLASTICS	10	PET Beverage Bottles	
	11	PET Non-Beverage Bottles/Jars	
	12	HDPE Natural Bottles	
	13	HDPE Colored Bottles	
	14	Other Plastic #3 - #7 Bottles	
	15	Food Polystyrene Foam	
	16	Other Polystyrene Foam	
	17	Other Ridged Plastic Packaging	
	18	Plastic Shopping Bags - film	
	19	Plastic Industrial Film Packaging	
	20	Agricultural Plastic Film	
	21	Other Plastic Film	
	22	C&D PVC	
	23	Other Plastic	
	24	Composite/Other Plastic:	
METALS	25	Aluminum Beverage Containers	
	26	Other Aluminum:	
	27	Ferrous (Tin) Cans	
	28	Other Ferrous Scrap	
	29	Non-Ferrous Metal	
	30	Other Metal	
GLASS	31	Clear Beverage Containers	
	32	Colored Beverage Containers	
	33	Glass Food Containers	
	34	Other Glass	
ORGANICS	35	Yard Materials - <6"	
	36	Yard Materials - >6"	
	37	Food Scraps	
	38	Diapers	
	39	Animal Waste/Kitty Litter	
	40	Bottom Fines/Dirt	
	41	Textiles	
	42	Other Organic Material	

Sample ID:_____ Crew Chief: _____

Date: _____ Time: _____

		Material Group	Weight (Circle if net weight)	Count	Photo
WOOD	43	Treated Wood			
	44	Untreated Clean Dimensional Lumber			
	45	Untreated Clean Engineered Wood			
	46	Painted/Stained Wood			
	47	Other Recyclable Wood			
	48	Wood Pallets			
	49	Wood Furniture			
C&D DEBRIS	50	Rock/Concrete/Bricks:			
	51	Gypsum Wallboard - Demolition			
	52	Gypsum Wallboard - Clean Scrap			
	53	Roofing Shingles			
	54	Ceramics/Porcelain Fixtures			
	55	Carpet			
	56	Carpet Padding			
	57	Bulky Items			
	58	Other C&D			
ELECTRONICS	59	Televisions - CRT			
	60	Televisions - Non CRT			
	61	Computer Monitors - CRT			
	62	Computer Related Electronics			
	63	Other electronic Equipment	CELL PHONES		
APPLIANCE	64	Small electrical Appliances			
	65	White Goods - Refrigerated			
	66	White Goods - Non Refrigerated			
HHW	67	Lead Acid Batteries			
	68	Other Household Batteries	NON COMMON		
	69	Fluorescent Light Tubes			
	70	Compact Fluorescent Light Tubes			
	71	Paint			
	72	Automotive Used Oil/Filters			
	73	Household Hazardous Waste			
	74	Medical Waste	SHARPS		
	75				
	76	Tires			

WI - Physical Sort Reusable, HHW Item Description Field Notes Sheet & Mercury Containing Devices

Location ______________________________ Crew Chief: ______________________________

Sample Start Date: ____________________ Sample Finish Date: ____________________

Date	Sample ID	Describe Item(s)	Photo

Visual C&D Field Supervisor Daily Targeted Samples

Facility _____ **Field Supervisor** _____

Day _____ **Date** _____

No.	Sample Number	Notes	No.	Sample Number	Notes
01	**NEOCCD01**		29	**NEOCCD29**	
02	**NEOCCD02**		30	**NEOCCD30**	
03	**NEOCCD03**		31	**NEOCCD31**	
04	**NEOCCD04**		32	**NEOCCD32**	
05	**NEOCCD05**		33	**NEOCCD33**	
06	**NEOCCD06**		34	**NEOCCD34**	
07	**NEOCCD07**		35	**NEOCCD35**	
08	**NEOCCD08**		36	**NEOCCD36**	
09	**NEOCCD09**		37	**NEOCCD37**	
10	**NEOCCD10**		38	**NEOCCD38**	
11	**NEOCCD11**		39	**NEOCCD39**	
12	**NEOCCD12**		40	**NEOCCD40**	
13	**NEOCCD13**		41	**NEOCCD41**	
14	**NEOCCD14**		42	**NEOCCD42**	
15	**NEOCCD15**		43	**NEOCCD43**	
16	**NEOCCD16**		44	**NEOCCD44**	
17	**NEOCCD17**		45	**NEOCCD45**	
18	**NEOCCD18**		46	**NEOCCD46**	
19	**NEOCCD19**		47	**NEOCCD47**	
20	**NEOCCD20**		48	**NEOCCD48**	
21	**NEOCCD21**		49	**NEOCCD49**	
22	**NEOCCD22**		50	**NEOCCD50**	
23	**NEOCCD23**		51	**NEOCCD51**	
24	**NEOCCD24**		52	**NEOCCD52**	
25	**NEOCCD25**		53	**NEOCCD53**	
26	**NEOCCD26**		54	**NEOCCD54**	
27	**NEOCCD27**		55	**NEOCCD55**	
28	**NEOCCD28**		56	**NEOCCD56**	

Weather Conditions **Precipitation** _____ **Cloud Cover %** _____

Wind _____ **Temperature** _____

Wisconsin Visual Survey Field Data Sheet

Sample ID:_____ Field Supervisor: _____

Circle Generator Sector Residential Non-Residential Roads & Bridges

Date: _____ Time: _____

Circle	Construction		Renovation
Activity	Demolition		

Hauler: _____ Truck Type _____

Truck Number _____ Self-Haul Residential (SHR) Self-Haul Comm. (SHC) _____

Ticket Number _____ Load Weight _____

Container Dimensions: _____ Container Yardage: _____ Percent Full: _____

Trailer Dimensions: _____ Container Yardage: _____ Percent Full: _____

Load Pack Density 1 - 3 (1=Low 3=High) _____

		Material Group	Count	Photo	Estimate Wght	Estimate Dim.
SPECIAL INSTRUCTION MATERIALS	1	PET bottles - beverage				
	2	Aluminum Beverage Cans				
	3	White goods - refrigerated				
	4	White goods – non-refrigerated				
	5	Glass Beverage Bottles				
	6	CRT				
	7	Electronics* (Describe)				
	8	Cell Phones				
	9	Lead-acid batteries				
	10	Tires				
	11	Fluorescent Light Bulbs				
	12	Household Hazardous Waste* (Describe)				
	13	Non-Common Household Dry Cell Batteries				
	14	Sharps				
	15	Mercury Containing Devices				
	16	Re-usable Items* (Describe below)				
	17	Automotive Oil Filters and Fluids* (Describe)				

***Describe Item(s):**

Use Back of Page if Necessary

Sample ID:_____ Field Supervisor: _____

		Material Group	% By Volume	% By Volume
PAPER	18	Uncoated OCC - recyclable		
	19	Other Paper		
				Subtotal 100%
PLASTIC	20	HDPE Buckets		
	21	PVC		
	22	Film Plastic		
	23	Other plastic		
				Subtotal 100%
METAL	24	Aluminum		
	25	Ferrous scrap		
	26	Non-ferrous metal		
				Subtotal 100%
GL	27	Glass		
				Subtotal 100%
ORGAN	28	Yard Waste		
	29	Dirt/Sand		
				Subtotal 100%
WOOD	30	Untreated clean dimensional lumber		
	31	Other recyclable wood		
	32	Untreated clean engineered wood		
	33	Painted/stained wood		
	34	Treated wood		
	35	Wood pallets		
	36	Wood furniture		
				Subtotal 100%
C&D MATERIALS	37	Rock, concrete, brick		
	38	Gypsum wallboard - demo		
	39	Gypsum wallboard – clean scrap		
	40	Roofing shingles		
	41	Carpet		
	42	Carpet padding		
	43	Bulky items		
	44	Ceramics/porcelain fixtures		
	45	Other C&D		
				Subtotal 100%
	46	Mixed MSW		
				Subtotal 100%
			100%	**Total**

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APPENDIX C

TRANSFER TRAILER WASTE COMPOSITION

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APPENDIX C – TRANSFER TRAILER WASTE COMPOSITION

Based on the results of the initial landfill survey that was conducted to inform the development of the sampling plan, it was found that 41.5 percent of all landfilled wastes arrive on transfer trailers. Because this is such a large portion of the disposed waste stream, the sampling plan and field data collection plan included extensive sampling and sorting of wastes arriving at landfills in transfer trailers. Based on subsequent discussion with DNR, it was determined that the statewide waste composition results should apportion these transfer trailer tons to their respective generator sectors: residential, ICI and C&D. The main body of the report therefore reflects results only for these three primary generator sectors (as well as multi-family wastes).

The purpose of this appendix is to summarize the results of the sampling and sorting that was performed on transfer trailer loads. These results are presented in parallel to the results shown in the main body of the report for the primary generator sectors.

Figure C-1 presents the breakdown of transfer trailer wastes. Note that transfer trailers can contain residential, multi-family, ICI and C&D wastes. As shown, C&D materials were prevalent in transfer trailer wastes, indicating that some C&D appears to be coming through the state's transfer stations.

Figure C-1 2009 Transfer Trailer Waste Composition by Material Group

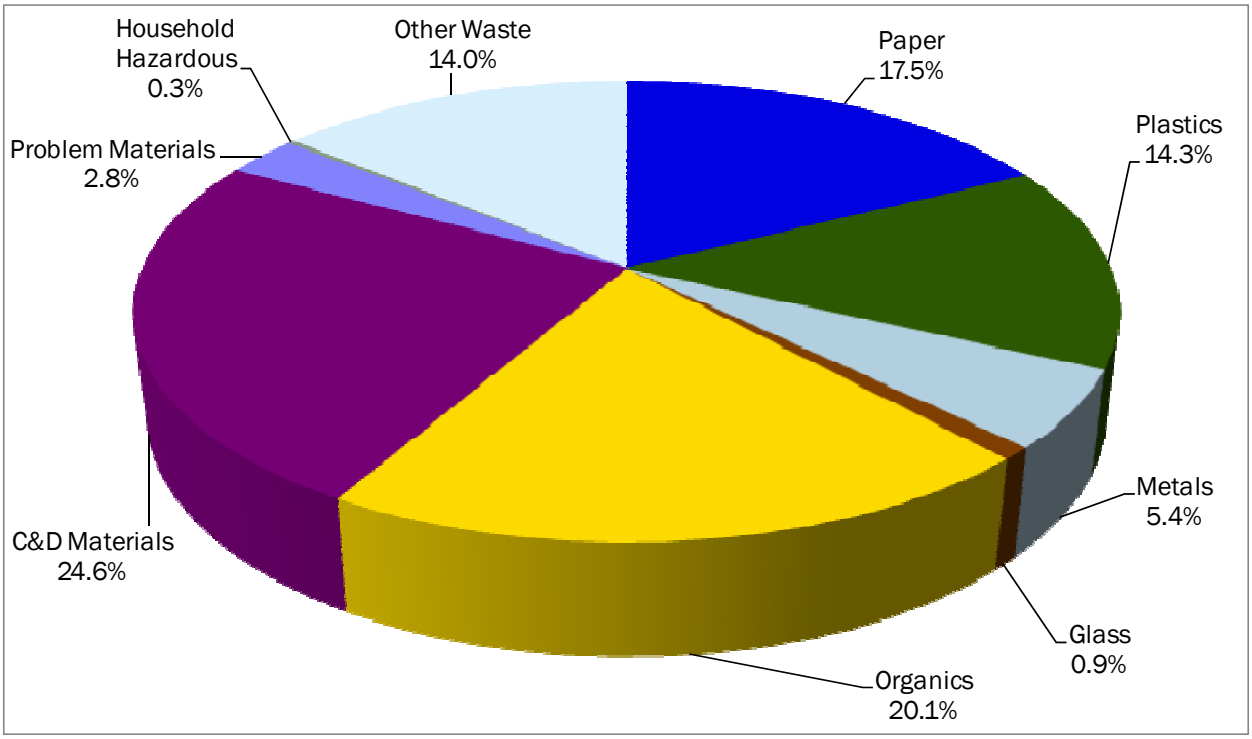

Table C-1, on the following page, provides a detailed statistical profile of the state's transfer trailer waste stream.

APPENDIX C

Table C-1 2009 Detailed Transfer Trailer Waste Composition

Materials	Tons	Mean	90% Conf. Int. Lower	90% Conf. Int. Upper
1 Newspaper (ONP)	25,944	1.5%	1.1%	1.8%
2 High-Grade Office Paper	12,108	0.7%	0.4%	0.9%
3 Magazines/Catalogs	18,472	1.0%	0.8%	1.3%
4 Uncoated OCC	59,379	3.3%	2.6%	4.1%
5 Coated OCC	9,414	0.5%	0.1%	0.9%
6 Boxboard	19,182	1.1%	0.9%	1.3%
7 Mixed Paper - Recyclable	31,579	1.8%	1.4%	2.1%
8 Compostable Paper	91,019	5.1%	4.5%	5.7%
9 Other Paper	44,995	2.5%	1.1%	3.9%
Subtotal Paper	***312,092***	***17.5%***	***15.4%***	***19.6%***
10 PET Beverage Bottles	8,290	0.5%	0.4%	0.6%
11 PET Non-Bev. Bottles/Jars	2,156	0.1%	0.1%	0.2%
12 HDPE Natural Bottles	2,816	0.2%	0.1%	0.2%
13 HDPE Colored Bottles	4,355	0.2%	0.1%	0.3%
14 Other Plastic #3 - #7 Bottles	1,481	0.1%	0.1%	0.1%
15 Food Polystyrene Foam	4,342	0.2%	0.2%	0.3%
16 Other Polystyrene Foam	3,706	0.2%	0.0%	0.4%
17 Other Rigid Plastic Pkg.	16,329	0.9%	0.7%	1.1%
18 Plastic Shopping Bags - film	4,977	0.3%	0.2%	0.3%
19 Plastic Industrial Film Pkg.	8,751	0.5%	0.2%	0.8%
20 Agricultural Plastic Film	557	0.0%	0.0%	0.1%
21 Other Plastic Film	82,093	4.6%	3.6%	5.6%
22 Other Plastic	43,378	2.4%	1.5%	3.3%
23 Composite/Other Plastic:	72,014	4.0%	2.3%	5.8%
Subtotal Plastic	***255,243***	***14.3%***	***11.9%***	***16.8%***
24 Alum. Bev. Containers	3,863	0.2%	0.2%	0.3%
25 Other Aluminum:	14,147	0.8%	0.0%	1.6%
26 Ferrous (Tin) Cans	8,024	0.5%	0.4%	0.5%
27 Other Ferrous Scrap	42,704	2.4%	1.3%	3.5%
28 Non-Ferrous Metal	6,980	0.4%	0.1%	0.7%
29 Other Metal	20,538	1.2%	0.7%	1.6%
Subtotal Metal	***96,256***	***5.4%***	***4.0%***	***6.8%***
30 Clear Beverage Containers	4,612	0.3%	0.2%	0.4%
31 Colored Beverage Containers	3,620	0.2%	0.1%	0.3%
32 Glass Food Containers	1,978	0.1%	0.1%	0.2%
33 Other Glass	5,902	0.3%	0.2%	0.4%
Subtotal Glass	***16,113***	***0.9%***	***0.7%***	***1.1%***
34 Yard Materials - <6"	63,540	3.6%	2.4%	4.7%
35 Yard Materials - >6"	8,557	0.5%	0.0%	0.9%
36 Food Scraps	145,691	8.2%	7.1%	9.3%
37 Diapers	29,503	1.7%	1.2%	2.1%
38 Animal Waste/Kitty Litter	15,262	0.9%	0.4%	1.3%
39 Bottom Fines/Dirt	64,581	3.6%	2.8%	4.4%
40 Other Organic Material	30,686	1.7%	1.3%	2.2%
Subtotal Organics	***357,818***	***20.1%***	***17.9%***	***22.3%***
41 Treated Wood	19,776	1.1%	0.6%	1.7%
42 Clean Dimensional Lumber	47,176	2.7%	1.7%	3.6%
43 Clean Engineered Wood	31,778	1.8%	0.9%	2.7%
44 Painted/Stained Wood	94,852	5.3%	4.2%	6.5%
45 Other Recyclable Wood	8,958	0.5%	0.3%	0.7%
46 Rock/Concrete/Bricks:	20,625	1.2%	0.1%	2.2%
47 Drywall - Demolition	18,271	1.0%	0.2%	1.9%
48 Drywall - Clean Scrap	6,473	0.4%	0.0%	0.8%
49 Roofing Shingles	140,429	7.9%	5.8%	10.0%
50 PVC	4,810	0.3%	0.0%	0.5%
51 Ceramics/Porcelain Fixtures	1,608	0.1%	0.0%	0.2%
52 Other C&D	43,141	2.4%	1.6%	3.3%
Subtotal C&D	***437,897***	***24.6%***	***21.2%***	***28.0%***
53 Televisions - CRT	8,111	0.5%	0.0%	0.9%
54 Televisions - Non CRT	0	0.0%	0.0%	0.0%
55 Computer Monitors - CRT	2,350	0.1%	0.0%	0.3%
56 Computer Related Electronics	5,182	0.3%	0.1%	0.5%
57 Other Electronic Equip.	8,899	0.5%	0.0%	1.0%
58 Small electrical Appliances	15,402	0.9%	0.4%	1.3%
59 White Gds - Refrig.	4,329	0.2%	0.0%	0.6%
60 White Gds - Non Refrig.	1,992	0.1%	0.0%	0.3%
61 Lead Acid Batteries	0	0.0%	0.0%	0.0%
62 Other Household Batteries (OHB	621	0.0%	0.0%	0.0%
63 Fluorescent Light Tubes	33	0.0%	0.0%	0.0%
64 Compact Fluorescent Light Tube	42	0.0%	0.0%	0.0%
65 Tires	3,558	0.2%	0.0%	0.5%
Subtotal Problem Mtls.	***50,520***	***2.8%***	***1.7%***	***4.0%***
66 Paint	8	0.0%	0.0%	0.0%
67 Auto Used Oil/Filters	653	0.0%	0.0%	0.1%
68 Household Hazardous	886	0.0%	0.0%	0.1%
69 Medical Waste	3,012	0.2%	0.0%	0.3%
Subtotal Hazardous	***4,559***	***0.3%***	***0.0%***	***0.5%***
70 Textiles	45,869	2.6%	2.2%	3.0%
71 Carpet	58,448	3.3%	2.2%	4.4%
72 Carpet Padding	17,062	1.0%	0.4%	1.5%
73 Wood Pallets	39,533	2.2%	1.1%	3.3%
74 Bulky Items	48,726	2.7%	1.7%	3.8%
75 Wood Furniture	38,827	2.2%	1.3%	3.1%
Subtotal Other Wastes	***248,465***	***14.0%***	***11.6%***	***16.3%***
Total	**1,778,964**	**100.0%**		
Number of Samples	**94**			

Note: Subtotals may not sum due to rounding discrepancies.

Table C-2 shows the 10 most prevalent materials in the 2009 Transfer Trailer waste stream.[1] Untreated wood and roofing shingled are at the top of the list, which is indicative of the contribution of C&D wastes. Food Scraps are the second most prevalent single item.

Table C-2 Top 10 Most Prevalent Transfer Trailer Material Categories, 2009

2009 Material Category	2009 Tons	2009 Percent
Wood – untreated [1]	182,765	10.3%
Food Scraps	145,691	8.2%
Roofing Shingles	140,429	7.9%
Composite/Other Plastic [2]	115,391	6.5%
Plastic Film [3]	96,378	5.4%
Compostable Paper	91,019	5.1%
Bulky Items	87,553	4.9%
Bottom Fines/Dirt	64,581	3.6%
Yard Materials - <6"	63,540	3.6%
Uncoated OCC	59,379	3.3%
Total [4]	**1,079,240**	**58.80%**

(1) Wood–untreated includes untreated dimensional lumber, untreated engineered wood, painted/stained wood and other recyclable wood.
(2) Composite/Other Plastic includes other plastic and composite/other plastic.
(3) Plastic Film includes plastic shopping bags, industrial film packaging, agricultural plastic film, and other plastic film.
(4) May not sum due to rounding.

[1] Transfer Trailer wastes were not analyzed separately in the 2002 Study, and therefore no comparisons can be shown.

APPENDIX C

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APPENDIX D

STATISTICAL METHODS

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APPENDIX D – STATISTICAL MEASURES AND METHODS

STATISTICAL MEASURES

The following statistical measures were calculated to determine the overall composition of waste.

- **Sample Mean for Manually Sorted Wastes:** The sample mean, or average, composition is considered the "most likely" fraction for each material category in the aggregate waste stream. The sample mean for physically sorted samples is determined by (i) converting the raw weights of each material category in each sample into a percent-by-weight of that material in that sample; (ii) calculating the average percentage of each of the material categories across all samples. This method in effect normalizes the contribution of each manually sorted sample, which is the intent of establishing a 250 pound target for grab samples.
- **Sample Mean for Visually Surveyed Wastes:** The weight of individual loads of C&D debris varies significantly from load to load. Because the visual surveying process encompasses the entire load, a different method is used to estimate mean composition. The sample mean for C&D debris is determined by (i) converting volumetric estimates to weight based on standard density factors (see Section 2.6.2 for details); (ii) summing the weight of each material across all the samples; (iii) summing the total weight of all samples, and (iv) dividing the first value by the second value to determine the percent-by-weight composition.

Note that the *sample mean*, while a good estimate, is unlikely to be identical to the *population mean* value. The meaningfulness of the sample mean is enhanced by the following statistical measures.

- **Standard Deviation**: The standard deviation measures how widely values within the data set are dispersed from the sample mean. A higher standard deviation denotes higher variation in the underlying samples for each material, while a lower standard deviation reflects lower variation among the individual samples. The standard deviation is stated in the same unit as the sample mean, which in this case is percent by weight.
- **Confidence Intervals**: When a sample of data is obtained, it is analyzed in an attempt to determine certain values that describe the entire population of data under analysis. For example, in a poll of likely voters, the intent of the poll is to determine the percentage of *all* voters who support a given candidate, not simply the percentage of voters *in the poll* who support that candidate. The percentage of voters who support a given candidate in the poll can easily vary from sample to sample; but the percentage of *all* voters who support that candidate is a fixed value. In our sample of incoming loads of waste, we are not primarily interested in the percentage composition of the *sampled* loads, but rather in trying to determine what the composition of the sampled loads tells us about the composition of *all* waste generated in Wisconsin. A confidence interval is a statistical concept that attempts to indicate the likely range within which the true value lies. The confidence intervals reflect the upper and lower range within which the population mean can be expected to fall. Confidence intervals require the following "inputs":
  - The "level of confidence", or how sure one wants to be that the interval being constructed will actually encompass the population mean;
  - The sample mean, around which the confidence interval will be constructed;

- The sample standard deviation, which is used as a measure of the variability of the population from which the sample was obtained; and
- The number of sampling units that comprised the sample (a.k.a. sample size).

In both the 2002 and 2009 Studies, confidence intervals were calculated at a 90 percent level of confidence, meaning that we can be 90 percent sure that the population mean falls within the upper and lower confidence intervals shown. (The converse is also true: that there is a 10 percent chance that the population mean falls outside of the sample mean.) In general, as the number of samples increases, the width of the confidence intervals decreases, although the more variable the underlying waste stream composition, the less noticeable the improvement for adding incremental samples.

VOLUME-TO-WEIGHT CONVERSION

All of the C&D debris visual surveying relied on volumetric estimates of the composition of each incoming load of C&D waste that was representatively selected for sampling. For each load, the container volume, percent full, and estimated fraction of each C&D material category was estimated and recorded. While the methodology used for visual surveying was performed consistently and accurately, and relied on quantitative measurements for some portion of the estimate, in practice there is potential for error to be introduced because certain steps of visual characterization are, by nature, somewhat imprecise. For example, two well trained solid waste professionals with field experience may observe a fraction of drywall in the same sample, yet their estimate of the percent of that drywall may vary, in some cases by five percent (or more if there is a lot of drywall). Human judgment is a necessary obstacle of precise visual surveying.

Fortunately, for the vast majority of loads surveyed, it was possible in this study to obtain a copy of the weigh ticket from the scalehouse at each host facility. Because landfill scales must be calibrated on a regular basis to assure accurate reporting of incoming waste flows, the measured weight of each load from the scalehouse are highly defensible data points.

The first step toward tabulating the results was therefore to convert volumetric estimates for each sample into weight-based estimates. Doing so required the following process:

1. Researching and compiling the raw density factors for all of the material categories defined for the study. Raw density factors were compiled based on available literature (primarily other C&D characterization studies and various recycled material manuals) as well as on Project Team member MSW Consultants' experience in conducting prior waste characterization studies;
2. Converting volumetric estimates to weight-based estimates by applying the raw density factors;
3. Comparing the weight of the raw volume-to-weight conversion against the actual weight of each load as shown on the weigh tickets;
4. Applying targeted statistical analysis to identify the density factors that contribute to the variance between the calculated (item 2) and the actual (item 3) weights; and
5. Developing adjusted density factors that, when applied to the volumetric estimates observed in the field, yield calculated weights that are, in the aggregate, within acceptable tolerances of the actual weights.

Table D-1 presents the resulting density factors compiled for this analysis.

Table D-1 C&D Material Density Factors (Lbs/Cubic Yard)

Material Group	Material	Density
Paper	Uncoated OCC - recyclable	100
	Other Paper	157
Plastic	Film Plastic	40
	HDPE Buckets	50
	Other plastic	50
Metal	Aluminum	270
	Ferrous scrap	570
	Non-ferrous metal	520
Glass	Glass	600
Organic	Yard Waste	225
	Dirt/Sand	1,500
Wood	Treated wood	400
	Untreated clean dimensional lumber	364
	Untreated clean engineered wood	364
	Painted / Stained Wood	364
	Other recyclable wood	364
C&D Material	Rock, concrete, brick	1,500
	Gypsum wallboard - demo	426
	Gypsum wallboard – clean scrap	426
	Roofing shingles	1,100
	PVC	80
	Ceramics/porcelain fixtures	600
	Other C&D	200
Other Waste	Carpet	150
	Carpet padding	84
	Wood Pallets	200
	Bulky items	250
	Wood furniture	166
	Mixed MSW	200

It should be noted that many of the densities in the table above are lower than can be found in the industry literature. They have been adjusted over time based on prior visual characterization studies performed by the Project Team. It is likely that such adjustment is necessary because either (a) the industry literature seems to overestimate the density of many material types (perhaps because such

density can only be achieved in a relatively organized stack or pile, rather than in a jumble of material like that found in tipped loads of C&D), or (b) in the judgment of the field surveyor, the volume of these more dense materials was routinely overestimated.

Finally, it should be noted that some materials that were targeted in the C&D visual surveying could not be reasonably estimated using strictly a volume-based approach. For example, the DNR indicated an interest in measuring the incidence of recyclable beverage containers contained in C&D waste. Rather than attempt to estimate what fraction of the total load was beverage containers, the Field Supervisor counted (or estimated) the number of beverage containers, the weight of which could then be estimated based on industry weight estimates. Table D-2 summarizes the materials that were counted, rather than estimated by volume, during the visual survey, as well as the unit weights used to calculate the contribution of each material to the overall load weight.

Table D-2 Other Material Weight Conversion Factors

Material Category	Published Weights	Weight per Unit (lbs) {1]
PET Bottles	15 containers per pound	0.067
Glass Bottles	2 containers per pound	0.500
Aluminum Cans	33 containers per pound	0.030
CRTs - Monitors	15 inch = 30 Lbs. 17 inch = 37.50 Lbs. 19 inch = 50 Lbs.	39.166
CRTs – TVs	60 to 80 Lbs.	70.000
Cell phones	4 oz	0.250
Lead Acid Batteries	20 Lbs.	20.000
Tires	20 Lbs.	20.000
Fluorescent bulbs	4 Foot bulb = 0.75 Lbs.	0.750
Sharps	0.155 oz per sharp	0.010
Automotive Filters	14-18 oz	1.000

[1] Sources include: waste industry trade publications, state agencies, private recyclers, and trade associations.

While it is not possible to assert that the data shown in Tables D-1 and D-2 assure complete accuracy of the results, the Project Team believes that the step of normalizing the volumetric estimates to align closely with the known weight of the samples improves the accuracy of the overall study results.

AGGREGATION OF SAMPLES

In the 2002 Study, a roughly equal number of samples were obtained from each region and for each of the targeted generator sectors. The regionally equal distribution of samples was necessary because of the specific requirements for that Study, which included development of regional waste composition estimates, and also results shown separately for each generator sector.

The 2009 Study did not require that results be generated separately for each region of the state. This negated the requirement for a statistically significant number of samples to be obtained from each region in Wisconsin, and instead allowed samples to be allocated across regions in proportion to the generation of wastes by region.

As described in the main body of the report, the sampling plan for this study was developed such that the results could be calculated for each generator sector directly from the samples that were obtained for that generator sector across all of the host landfills with no special weighting. The exception to this is C&D wastes, which were sampled more extensively because of the higher variation of C&D loads. Consequently, composition estimates were developed through straight averaging of wastes from the residential, ICI and transfer trailer generator sectors, with a final weighting used to combine C&D wastes.

Table D-3 summarizes the resulting weighting factors used to estimate state-wide waste composition. These weighting factors are described in the main body of this report.

Table D-3 Weighting Factors Used to Aggregate Statewide Waste Composition (2009)

Generator Sector	Weighting Factor	Tons of Waste
Residential	33.6%	1,485,113
ICI	49.3%	2,174,928
C&D	17.1%	754,501
Total	**100.0%**	**4,414,541**

APPORTIONMENT OF TRANSFER TRAILER WASTE

INTRODUCTION

This study captured a statistically significant number of samples from transfer trailers to capture their contribution to landfilled wastes in Wisconsin. However, based on feedback received by DNR, this report focuses only on the statewide composition, and corresponding disposed tons, individually by generator sector.

To develop such statewide results, it was necessary to apportion transfer trailer disposed tons into each of the three generator sectors. One option for doing so would have been to survey some or all of the transfer stations that were reported to deliver wastes to each of the host landfills. However, this step was not anticipated during the study design phase and there was insufficient time and budget to perform such a survey.

Accordingly, the Project Team relied on a regression analysis of the observed waste composition of residential, ICI, and C&D wastes to estimate the likely contribution of each of these three generator sectors to transfer trailer wastes. This exercise makes the following argument:

- We know the percentages of various material categories obtained from the three primary sources: residential, ICI, and C&D, as determined by the waste composition analysis.
- We also know the percentages of these same material categories obtained from the transfer trailer loads, from the same analysis.
- If we assume that these three generator sectors are the *only* "true" contributors, then the transfer trailer loads must come from these three primary sources.
- If we then assume that each generator sector material category percentage is the same, whether it is delivered directly to a landfill or whether it goes via a transfer trailer intermediary, then we are effectively seeking to find the percentage of transfer trailer waste that must have come from

each generator sector in order to result in the observed transfer trailer waste composition percentages.

- Thus, we can analyze the observed generator sector composition percentages along with the observed transfer trailer waste composition percentages in order to determine a single overall percentage of each generator contained in the transfer trailer numbers.

As an example: we know that 37.3% of residential waste is organic, that 21.6% of ICI waste is organic, and that 4.2% of C&D waste is organic. Transfer trailer waste is observed to be 20.1% organic. So what percent of each of the three primary sources, when multiplied by their respective waste composition percentages for organic waste, will result in this 20.1% observed value? If only one observation was available, there are an infinite number of combinations that would work. But the three percentages we are searching for must also work for every other material category. If there were only three waste categories, we could determine a unique answer through linear programming techniques; but with a richer, larger dataset, we can use regression analysis to estimate these three percentage values.

To perform this analysis, the Project Team set up a regression analysis that included the requirement for the sum of the residential, ICI and C&D results to be 100 percent. Two separate regressions were run: the first looking only at the nine material groups (paper, plastic, metal, etc.) and the second looking at all 75 individual material categories. Table D-4 summarizes the results of both regressions and includes the upper and lower boundaries of a 95% confidence interval for each estimate.

Table D-4 results of Transfer Trailer Regression Analysis (95% conf interval)

	RESIDENTIAL **Lower-Mean-Upper**	**ICI** **Lower-Mean-Upper**	**C&D** **Lower-Mean-Upper**
Material Groups	0.0% - **17.6%** - 35.2%	42.2% - **60.4%** - 78.6%	18.0% - **22.0%** - 26.0%
Material Categories	22.0% - **31.4%** - 40.8%	33.7% - **45.5%** - 53.3%	22.1% - **25.13%** - 28.1%
Combined	**26.6%**	**49.6%**	**23.8%**

As seen in this table, there is considerable overlap in the results for each generator sector whether relying on the regression by material groups or by material categories. For example, in the Residential sector, the material group results show that the "true" percentage could be from 0% to 35%, while the material categories results show that the "true" percentage could be from 22% to 41%. Since both results describe the same parameter, combining the analyses should yield a more robust result than either analysis alone. Taking into account both results (including the probability distribution of each parameter around its central estimated value) results in the percentages shown on the bottom row of Table D-4.

In summary, the statewide transfer trailer waste quantities of 1,834,225 tons was apportioned to the residential, ICI and C&D waste streams according to the results shown in the bottom row of Table D-4. This exercise was performed solely to estimate the statewide quantity by generator sector. All of the reported waste composition data contained in the body of this report was not impacted by this analysis.

The Project Team believes that this analysis appears to provide a reasonable estimate, although a more precise answer may have been obtained had further direct surveying been performed.