Seattle Public Utilities

# 1998/99 Residential Waste Stream Composition Study

## Final Report

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# 1 OVERVIEW

## 1.1 Introduction

Effective solid waste management begins with knowing what is in the waste stream - how much of which types of material is disposed by each generator type. This basic information is essential to all aspects of policy and program implementation. Thus, the City of Seattle Public Utilities (formerly Solid Waste Utility) first launched an ongoing waste composition study in 1988. The objectives of this study include:

- Obtaining information for characterizing the total waste stream
- Establishing a baseline for continued long-term measurement of system performance
- Obtaining specific information about various waste substreams to enable the City to estimate the recycling potential within each one
- Understanding the differences between substreams so that targeted recycling programs can be designed, implemented, and monitored
- Creating and maintaining a database for ongoing evaluation and analysis of waste composition data

This report summarizes the results of the waste samples taken during 1998/99 waste composition study. Table 1-1 below shows the number waste samples obtained since the start of this project.

**Table 1-1 Samples per Study Period, by Substream**

| | *Number of Samples* | | | |
|---|---|---|---|---|
| **Year** | **Commercial** | **Residential** | **Self-Haul** | **Overall** |
| 1988-89 | 121 | 212 | 217 | 550 |
| 1990 | 0 | 114 | 203 | 317 |
| 1992 | 251 | 0 | 197 | 448 |
| 1994-95 | 0 | 368 | 0 | 368 |
| 1996 | 348 | 0 | 199 | 547 |
| 1998-99 | 0 | 360 | 0 | 360 |
| **Study to date** | **720** | **1,054** | **816** | **2,590** |

This report provides composition estimates for Seattle's residential waste stream based on sampling conducted from May 1998 through April 1999. Cascadia Consulting Group served as the prime contractor for this research. Sky Valley Associates conducted the fieldwork, and E. Ashley Steel provided the statistical analysis.

This report is organized into four sections. Section 1 briefly summarizes the project and Section 2 provides an overview of the results obtained during the 1998/99 sampling period. In Section 3, findings from this year's study are compared to the results obtained four and ten years ago. Complete results of the residential waste sampling by generator type, service area, season, and demographics are presented in Section 4. Detailed appendices follow the main body of the report.

## 1.2 Sources of Disposed Waste

For any specific geographic area, the total waste stream is composed of various substreams. A "waste substream" is determined by the particular generation and collection characteristics which make it a unique portion of the total waste stream. The City of Seattle has three substreams: commercial, residential, and self-haul. In 1998/99, only the residential substream was studied. No self-haul or commercial loads were sampled.

For comparison purposes, the residential substream was divided into four sectors by residence type and service area: single-family north, single-family south, multi-family north, and multi-family south. In Seattle, these four sectors are defined as follows:

- ***Single-family north:*** Primarily detached single-family, duplex, triplex, and four-plex homes located north of Yesler Way. Waste is collected from trashcans by a city-contracted hauler.
- ***Single-family south***: Primarily detached single-family, duplex, triplex, and four-plex homes located south of Yesler Way. Waste is collected from trashcans by a city-contracted hauler.
- ***Multi-family north:*** Primarily apartments and condominiums with five or more units located north of Yesler Way. Waste is collected from dumpsters by a city-contracted hauler.
- ***Multi-family south:*** Primarily apartments and condominiums with five or more units located south of Yesler Way. Waste is collected from dumpsters by a city-contracted hauler.

It should be noted that this study measures waste disposal, not generation. (Waste generation equals the sum of disposed and recycled amounts.) The samples were taken from loads destined for the landfill and do not include tonnage collected through recycling or yard waste composting programs.

For a full account of the project's methodology, please see Appendix B.

# 2 SUMMARY OF 1998/99 SAMPLING RESULTS

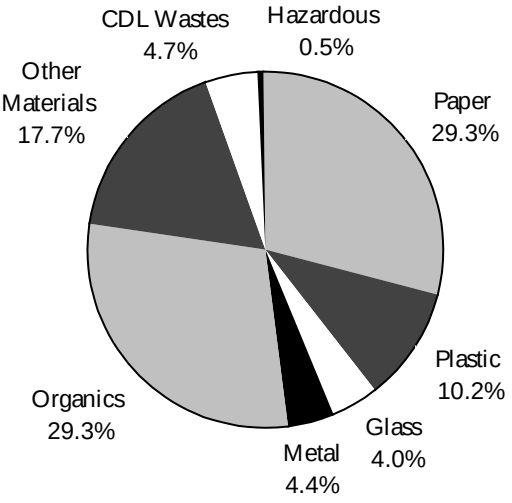
## 2.1 Overall Residential Waste

The 1998/99 phase of Seattle's waste study focused on the residential substream. Samples were allocated to the north and south service areas, and to the single- and multi-family sectors. Thus, in order to accurately characterize the overall residential waste stream, composition estimates were calculated by performing a weighted average based on residence type and service area. Please see Appendix D for more detail regarding the weighted average calculations.

The composition results, by weight, are illustrated in Figure 2-1.[1] Paper and organics categories accounted for more than half (58.6%) of the residential waste stream. The following four components accounted for 49.9% of the overall residential substream. The complete results are presented in Table 2-2.

- Food 26.7% Mean tonnage estimate 39,087
- Mixed Low Grade Paper 10.5% Mean tonnage estimate 15,402
- Animal by-products 6.5% Mean tonnage estimate 9,462
- Compostable/Soiled Paper 6.2% Mean tonnage estimate 9,026

**Figure 2-1 Composition Summary: Overall Residential**
**(May 1998 – April 1999)**




[1] All waste composition estimates were derived using a 90% confidence level. This means that there is a 90% certainty that the actual composition is within the calculated range.

## 2.2 Residential Waste by Subpopulation

Waste composition estimates were also calculated for various subpopulations of Seattle's residential waste stream including:

- *Residence type:* single-family and multi-family
- *Service area:* north and south
- *Residence type combined with service area:* single-family north and single-family south
- *Season:* spring, summer, fall, and winter
- *Household income*: low and high
- *Household size*: small and large

As with the overall estimates, weighted averages were used to calculate composition estimates by residence type, service area, and season. The largest components for each subpopulation (each accounting for more than 5%) are shown in Table 2-1. Food, mixed low grade paper, and compostable/soiled paper are large components in all the subpopulations. Frequently, animal by-products (which includes animal wastes and kitty litter) were also a large component of the waste stream.

**Table 2-1 Largest Waste Components, by Subpopulation**
**(May 1998 – April 1999)**

| Subpopulation | Food | Mixed Low Grade Paper | Compostable/ Soiled Paper | Animal by-Products | Disposable Diapers | Newspaper | OCC/Kraft, unwaxed | Sum of Largest |
|---|---|---|---|---|---|---|---|---|
| Single-family | 30.6% | 9.4% | 6.8% | 6.9% | 5.1% | | | 58.8% |
| Multi-family | 21.0% | 12.1% | 5.2% | 5.8% | | 6.9% | 5.7% | 56.7% |
| North Service Area | 25.0% | 11.1% | 5.9% | 7.4% | | 5.2% | | 54.6% |
| South Service Area | 30.1% | 9.3% | 6.6% | | 5.6% | | | 51.6% |
| Single-family North | 28.7% | 10.0% | 6.7% | 8.3% | | | | 53.7% |
| Single-family South | 33.4% | 8.4% | 7.1% | | 6.3% | | | 55.2% |
| Spring | 24.3% | 10.2% | 6.5% | 7.1% | | 5.3% | | 53.4% |
| Summer | 26.2% | 11.2% | 5.8% | 5.6% | | | | 48.8% |
| Fall | 29.6% | 10.5% | 5.8% | 5.6% | | | | 51.5% |
| Winter | 26.2% | 10.4% | 6.4% | 7.5% | | | | 50.5% |
| Low Income | 32.8% | 8.1% | 6.7% | 5.1% | 5.8% | | | 58.5% |
| High Income | 27.6% | 9.7% | 6.6% | 8.4% | | | | 52.3% |
| Small Households | 28.3% | 10.4% | 6.7% | 8.2% | | | | 53.6% |
| Large Households | 35.5% | 8.5% | 7.2% | | 6.2% | | | 57.4% |
| Overall Residential | 26.7% | 10.5% | 6.2% | 6.5% | | | | 49.9% |

The following conclusions can be drawn from the waste composition estimates of the overall residential substream and for each subpopulation within:

- The broad waste categories of paper and organics typically accounted for about half of the waste stream.
- Food, low-grade paper, and compostable/soiled paper were always among the largest components. Animal by-products (which include animal wastes and kitty litter) were a large component of the waste stream in the overall residential substream and many of its subpopulations.
- The composition estimates of the largest components within each subpopulation were similar. The main differences appear to be the following[2]:
  - single-family residences disposed more food than multi-family; multi-family residences disposed more mixed low grade paper,
  - in the north more mixed low grade paper was disposed than in the south; the south disposed more food,
  - low income residences disposed more food than high income residences,
  - and small households disposed more mixed low grade paper but less food than large households.

[2] No statistical tests were performed to identify differences between subpopulations in the estimated percentage of each component disposed. Therefore, the comparisons mentioned in this paragraph may not be statistically significant.

## Table 2-2 Composition by Weight: Overall Residential
## (May 1998- April 1999)

*Calculated at a 90% confidence interval*

| | Tons | Mean | Low | High | | Tons | Mean | Low | High |
|---|---|---|---|---|---|---|---|---|---|
| ***Paper*** | **42,965** | **29.3%** | | | ***Organics*** | **42,914** | **29.3%** | | |
| Newspaper | 6,885 | 4.7% | 4.4% | 5.0% | Pallets | 39 | 0.0% | 0.0% | 0.1% |
| OCC/Kraft, unwaxed | 6,282 | 4.3% | 4.0% | 4.6% | Crates/Boxes | 35 | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, waxed | 180 | 0.1% | 0.0% | 0.3% | Leaves and Grass | 3,191 | 2.2% | 1.7% | 2.6% |
| Office Paper | 1,218 | 0.8% | 0.7% | 1.0% | Prunings | 562 | 0.4% | 0.3% | 0.5% |
| Computer Paper | 33 | 0.0% | 0.0% | 0.0% | Food | 39,087 | 26.7% | 26.0% | 27.3% |
| Mixed Low Grade | 15,402 | 10.5% | 10.1% | 10.9% | ***Other Materials*** | **25,946** | **17.7%** | | |
| Phone Books | 597 | 0.4% | 0.3% | 0.5% | Textiles/Clothing | 2,992 | 2.0% | 1.9% | 2.2% |
| Milk/Juice Polycoats | 945 | 0.6% | 0.6% | 0.7% | Carpet/Upholstery | 2,106 | 1.4% | 1.2% | 1.7% |
| Frozen Food Polycoats | 431 | 0.3% | 0.3% | 0.3% | Leather | 241 | 0.2% | 0.1% | 0.2% |
| Compostable/Soiled | 9,026 | 6.2% | 5.9% | 6.4% | Disposable Diapers | 5,872 | 4.0% | 3.7% | 4.3% |
| Paper/Other Materials | 1,812 | 1.2% | 1.1% | 1.3% | Animal By-Products | 9,462 | 6.5% | 5.9% | 7.0% |
| Other Paper | 154 | 0.1% | 0.1% | 0.1% | Rubber Products | 274 | 0.2% | 0.1% | 0.2% |
| ***Plastic*** | **14,889** | **10.2%** | | | Tires | 263 | 0.2% | 0.1% | 0.3% |
| PET Pop and Liquor | 591 | 0.4% | 0.4% | 0.4% | Ash | 395 | 0.3% | 0.1% | 0.4% |
| Other PET Bottles | 235 | 0.2% | 0.1% | 0.2% | Furniture | 935 | 0.6% | 0.4% | 0.9% |
| HDPE Milk and Juice | 365 | 0.2% | 0.2% | 0.3% | Mattresses | 165 | 0.1% | 0.0% | 0.3% |
| Other HDPE Bottles | 571 | 0.4% | 0.4% | 0.4% | Small Appliances | 571 | 0.4% | 0.3% | 0.5% |
| Other Plastic Bottles | 246 | 0.2% | 0.2% | 0.2% | A/V Equipment | 640 | 0.4% | 0.2% | 0.6% |
| Jars and Tubs | 741 | 0.5% | 0.5% | 0.5% | Ceramics/Porcelain | 335 | 0.2% | 0.2% | 0.3% |
| Expanded Polystyrene | 926 | 0.6% | 0.5% | 0.8% | Non-distinct Fines | 700 | 0.5% | 0.4% | 0.6% |
| Other Rigid Packaging | 1,420 | 1.0% | 0.9% | 1.0% | Misc. Organics | 534 | 0.4% | 0.2% | 0.5% |
| Grocery/Bread Bags | 2,075 | 1.4% | 1.4% | 1.5% | Misc. Inorganics | 460 | 0.3% | 0.2% | 0.4% |
| Garbage Bags | 1,861 | 1.3% | 1.2% | 1.4% | ***CDL Wastes*** | **6,867** | **4.7%** | | |
| Other Film | 3,578 | 2.4% | 2.3% | 2.6% | Dimension Lumber | 1,318 | 0.9% | 0.6% | 1.2% |
| Plastic Products | 1,244 | 0.8% | 0.8% | 0.9% | Other Untreated Wood | 437 | 0.3% | 0.2% | 0.4% |
| Plastic/Other Materials | 1,036 | 0.7% | 0.6% | 0.8% | Treated Wood | 958 | 0.7% | 0.5% | 0.8% |
| ***Glass*** | **5,926** | **4.0%** | | | Contaminated Wood | 282 | 0.2% | 0.1% | 0.3% |
| Clear Beverage | 1,508 | 1.0% | 0.9% | 1.1% | New Gypsum Scrap | 6 | 0.0% | 0.0% | 0.0% |
| Green Beverage | 1,226 | 0.8% | 0.7% | 0.9% | Demo Gypsum Scrap | 620 | 0.4% | 0.2% | 0.6% |
| Brown Beverage | 1,261 | 0.9% | 0.7% | 1.0% | Fiberglass Insulation | 51 | 0.0% | 0.0% | 0.1% |
| Container Glass | 1,303 | 0.9% | 0.8% | 1.0% | Rock/Concrete/Brick | 948 | 0.6% | 0.2% | 1.1% |
| Fluorescent Tubes | 7 | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 217 | 0.1% | 0.1% | 0.2% |
| Other Glass | 622 | 0.4% | 0.3% | 0.5% | Other Construction Debris | 451 | 0.3% | 0.2% | 0.4% |
| ***Metal*** | **6,461** | **4.4%** | | | Sand/Soil/Dirt | 1,580 | 1.1% | 0.7% | 1.4% |
| Aluminum Cans | 724 | 0.5% | 0.5% | 0.5% | ***Hazardous*** | **692** | **0.5%** | | |
| Alum. Foil/Containers | 359 | 0.2% | 0.2% | 0.3% | Latex Paints | 67 | 0.0% | 0.0% | 0.1% |
| Other Aluminum | 53 | 0.0% | 0.0% | 0.1% | Hazardous Adhesives/Glues | 12 | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 88 | 0.1% | 0.0% | 0.1% | NonHazardous Adhesives/Glues | 49 | 0.0% | 0.0% | 0.1% |
| Tin Food Cans | 1,890 | 1.3% | 1.2% | 1.4% | Oil-based Paints/Solvents | 5 | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 269 | 0.2% | 0.2% | 0.2% | Cleaners | 6 | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 1,697 | 1.2% | 0.8% | 1.6% | Pesticides/Herbicides | 1 | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 1,349 | 0.9% | 0.7% | 1.1% | Dry-Cell Batteries | 153 | 0.1% | 0.1% | 0.2% |
| Motor Oil Filters | 31 | 0.0% | 0.0% | 0.0% | Wet-Cell Batteries | 0 | 0.0% | 0.0% | 0.0% |
| | | | | | Gasoline/Kerosene | 1 | 0.0% | 0.0% | 0.0% |
| | | | | | Motor Oil/Diesel Oil | 41 | 0.0% | 0.0% | 0.1% |
| | | | | | Asbestos | 1 | 0.0% | 0.0% | 0.0% |
| | | | | | Explosives | 0 | 0.0% | 0.0% | 0.0% |
| **Total Tons** | **146,660** | | | | Other Hazardous Chemicals | 178 | 0.1% | 0.0% | 0.3% |
| **Sample Count** | **360** | | | | Other NonHazardous Chemicals | 177 | 0.1% | 0.1% | 0.2% |

# 3 TRENDS IN RESIDENTIAL DISPOSAL: 1988/89 – 1998/99

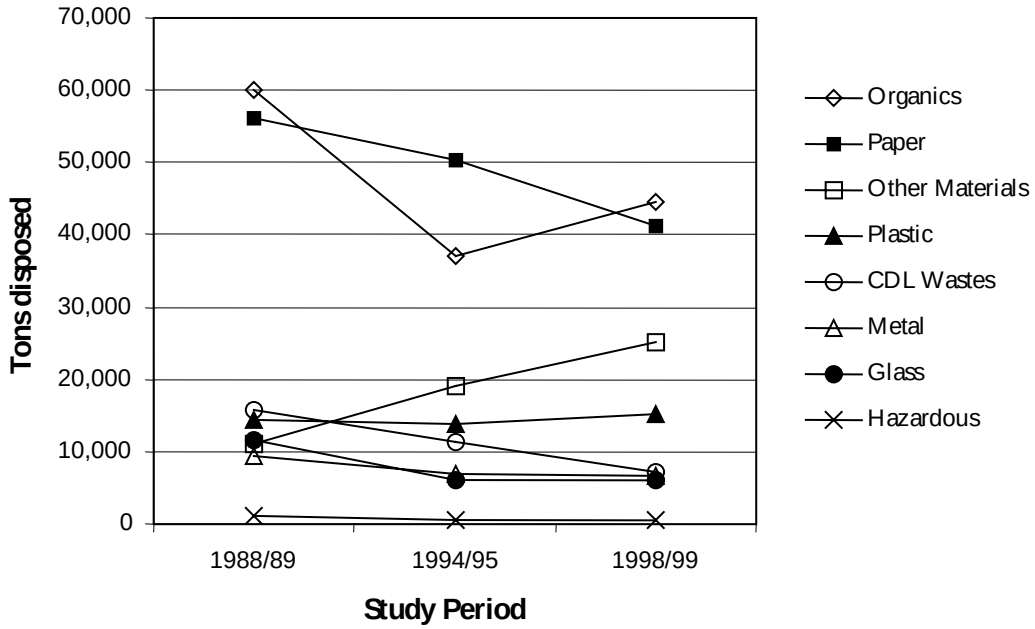
The overall residential results for the 1998/99 study were compared to the 1988/89 and the 1994/95 findings[3]. Comparisons with the 1988/89 study identify trends that have developed since the start of the curbside recycling program ten years ago. Both of the previous studies followed the same basic methodology as the 1998/99 study.[4]

The year-to-year comparisons were made by examining the changes in the total amount of waste disposed and in composition percentages for each of the eight broad waste categories. Statistical t-tests were used to analyze differences in the composition percentages. Section 3.1 provides an overview of the changes in the last ten years and in the last four years. Section 3.2 and Section 3.3 provide the detailed results of the comparisons.

## 3.1 Trends in Waste Disposed Over the Last Ten Years

Figure 3-1 illustrates the changes in disposed tons over the last ten years for each of the eight broad waste categories. The total amount of waste disposed decreased dramatically from 179,968 tons in 1988/89 to 145,591 tons in 1994/95 It then remained steady from 1994/95 to 1998/99 (146,660 tons). Overall, the broad waste categories of paper, organics, and "other materials" (which included animal by-products, disposable diapers, furniture, carpet, etc.) showed the greatest changes.

**Figure 3-1 Changes in Disposed Tons, 1988/89 to 1998/99**




[3] The composition percentages used to analyze the differences in disposed tonnage and to perform statistical tests were calculated using unweighted averages for each of the three study periods.
[4] See Appendix B for more detail regarding the methodology.

The following describes the changes in amount and composition percentages of each commodity over the last ten years (since 1988/89) and over the last four years (since 1994/95).

- ***Paper***: The mean percentage of paper in the waste stream decreased over both the last ten years and the last four years. The total tonnage of paper decreased from an estimated 56,220 tons in 1988/89 to 50,350 tons in 1994/95 and 41,178 tons in 1998/99.
- ***Plastic***. The mean percentage of plastics increased over both the last ten years and the last four years. The estimated tonnage of plastics in the waste stream, however, decreased slightly from 1988/89 (14,508 tons) to 1994/95 (13,941 tons) and then increased by 1998/99 (15,085 tons.)
- ***Glass***. The mean percentage of glass decreased over the last ten years, with container glass showing the sharpest decline. The estimated amount of glass dropped during the last ten years from 11,537 tons to 6,055 tons. Over the last four years, the amount of glass in the waste stream remained steady.
- ***Metal***. The mean percentage of metal in the waste stream remained steady over both the last ten years and the last four years. The total tonnage of metal decreased from 9,491 tons in 1988/89 to 6,819 tons in 1994/95 and 6,541 tons in 1998/99.
- ***Organics***. Over the last ten years, the mean percentage of organics showed a noticeable decrease. The amount disposed also decreased from 60,145 tons in 1988/89 to 44,573 tons in 1998/99. Since 1994/95, however, the estimated percentage of organics has increased, particularly in the amount of food wastes. In 1994/95, approximately 32,219 tons of food waste was disposed as compared to 44,573 tons in 1998/99.
- ***Other Materials***. The mean percentage of other materials in the waste stream has increased over both the last ten years and the last four years. The increase since 1988/89 is difficult to measure because in that study period, animal-by-products, furniture, mattresses, small appliances, and A/V equipment were not sorted individually. The estimated total disposed amount in 1988/89 was 11,046 tons as compared to 25,302 tons in 1998/99.

  The components in the "other materials" waste category in the 1994/95 and the 1998/99 studies, however, were more comparable. As with the composition percentages, the tonnage also increased (by approximately 6,033 tons). Most of this increase can be attributed to animal-by-products.
- ***CDL Wastes***. The mean percentage of CDL wastes decreased over both the last ten years and the last four years. The estimated tonnage also decreased from 15,830 tons in 1988/89 to 11,277 in 1994/95 and then to 7,280 in 1998/99.
- ***Hazardous***. The mean percentage of hazardous materials remained steady over both the last ten years and the last four years. The estimated amount of hazardous materials decreased however, from 1988/89 (1,192 tons) to 1994/95 (667 tons). It then remained steady to 1998/99 (646 tons).

## 3.2 Changes in Disposed Tons

### 3.2.1 Changes in Disposed Tons, 1988/89 vs. 1998/99

The overall amount of waste disposed in the residential substream has decreased over the last ten years (see Table 3-1.) CDL wastes, glass, and hazardous materials experienced the largest decreases, followed by metal, paper, and organics. The amount of "other materials" disposed in the waste stream increased dramatically, but at least part of this increase is due to the addition of various sorting categories such as furniture, small appliances, and AV equipment, which in the 1988/89 study were classified according to their dominant material type[5].

**Table 3-1 Tonnage Disposed by Material Class for the 1988/99 and 1998/99 Study Periods**

| | Estimated Disposed Tons | | | |
|---|---|---|---|---|
| | **1988/89** | **1998/99** | ***Difference*** | **% Change** |
| CDL Wastes | 15,830 | 7,280 | -8,551 | -54% |
| Glass | 11,537 | 6,055 | -5,482 | -48% |
| Hazardous | 1,192 | 646 | -545 | -46% |
| Metal | 9,491 | 6,541 | -2,950 | -31% |
| Paper | 56,220 | 41,178 | -15,042 | -27% |
| Organics | 60,145 | 44,573 | -15,572 | -26% |
| Plastic | 14,508 | 15,085 | 577 | 4% |
| Other Materials | 11,046 | 25,302 | 14,256 | 129% |
| Total Residential | 179,968 | 146,660 | -33,308 | -19% |

[5] The change in sorting categories may have also affected the estimated proportions of plastic, metal, and glass causing them to be slightly higher in the 1988/89 study. The exact amount of this difference cannot be calculated.

### 3.2.2 Changes in Disposed Tons, 1994/95 vs. 1998/99

The overall amount of residential waste disposed remained steady between the 1994/95 and 1998/99 study periods[6]. CDL waste and paper showed the most dramatic decreases, by 35% and 18%, respectively. "Other materials" appeared to increase the most (32%) followed by organics (20%). Differences in tonnage between study periods for each of the broad material categories are presented in Table 3-2.

**Table 3-2 Tonnage Disposed by Material Class for the 1994/95 and 1998/99 Study Periods**

| | Estimated Disposed Tons | | | |
|---|---|---|---|---|
| | **1994/95** | **1998/99** | ***Difference*** | **% Change** |
| CDL Wastes | 11,277 | 7,280 | -3,998 | -35% |
| Paper | 50,350 | 41,178 | -9,173 | -18% |
| Metal | 6,819 | 6,541 | -278 | -4% |
| Hazardous | 666 | 646 | -19 | -3% |
| Glass | 6,204 | 6,055 | -149 | -2% |
| Plastic | 13,941 | 15,085 | 1,144 | 8% |
| Organics | 37,113 | 44,573 | 7,460 | 20% |
| Other Materials | 19,221 | 25,302 | 6,081 | 32% |
| Total Residential | 145,591 | 146,660 | 1,069 | 1% |

## 3.3 Changes in Composition Percentages

Composition estimates obtained in this study period were compared to the findings of the 1988/89 and 1994/95 studies using t-tests. A t-test is a standard statistical test used to assess whether the differences between two groups are significant. In this case, t-tests were used to determine if the percentage of each of the eight broad material categories disposed in 1998/99 differed from the percentage disposed in 1988/89 and 1994/95[7]. The results of the t-tests can be used to indicate trends occurring in the waste stream over time. (Please see Appendix E for the calculation formulae.)

From the t-test, a p-value can be calculated. A p-value is a measure of the difference between the two groups. For the year-to-year comparisons, p-values below 0.0125 are considered to be statistically significant.

[6] In March 1997, the Seattle Housing Authority began collecting residential waste that was previously collected by City of Seattle's contracted haulers. This difference caused a decrease in the amount of waste collected in the south service area.

[7] In order to control for population changes and other factors that may influence the total amount of waste disposed from year to year, statistical tests were applied to the waste proportions, not the actual tonnage. For example, say that paper accounts for 30% of the residential substream's disposed waste each year, and that the substream disposed of 1,000 tons of waste in one year and 2,000 tons of waste in the next. While the amount of paper increased from 300 to 600 tons, the percentage remained the same. Therefore, the statistical tests would indicate that there had been no change.

### 3.3.1 Changes in Composition, 1988/89 to 1998/99

Comparisons made between the estimated composition percentages in 1988/89 and 1998/99 indicate that the proportion of paper, glass, organics, and CDL waste has decreased over the last ten years. The percentages of plastic and other materials appeared to have increased.

In Table 3-3, the arrows indicate increases or decreases in the percentage of the broad waste category disposed between study periods. The percentage highlighted in bold is the greater of the two. P-values highlighted with an "*" indicate significant differences.

**Table 3-3 Changes in Waste Composition, 1988/89 vs. 1998/99**

| | Mean Ratio (Material Wt/Total Wt) | | t-Statistic | p-Value (Cut-off for statistically valid difference = 0.0125) |
|---|---|---|---|---|
| | *1988/89* | *1998/99* | | |
| ↓ Organics | **33.42%** | 30.39% | 2.7731 | 0.0057 * |
| ↓ Paper | **31.24%** | 28.08% | 3.7744 | 0.0002 * |
| ↓ CDL Wastes | **8.80%** | 4.96% | 5.3033 | 0.0000 * |
| ↓ Glass | **6.41%** | 4.13% | 7.8050 | 0.0000 * |
| ↑ Other Materials | 6.14% | **17.25%** | 19.0123 | 0.0000 * |
| ↑ Plastic | 8.06% | **10.29%** | 7.6070 | 0.0000 * |
| Metal | 5.27% | 4.46% | 2.3289 | 0.0202 |
| Hazardous | 0.66% | 0.44% | 2.1545 | 0.0316 |
| *Number of Samples* | *212* | *360* | | |

### 3.3.2 Changes in Composition, 1994/95 vs. 1998/99

Comparisons made between the 1994/95 and the 1998/99 studies indicate decreases in the proportions of paper and CDL wastes disposed (see Table 3-4.) The proportions of organics, other materials, and plastics increased[8].

Table 3-4 Changes in Waste Composition, 1994/95 vs. 1998/99

| | Mean Ratio (Material Wt/Total Wt) | | t-Statistic | p-Value (Cut-off for statistically valid difference = 0.0125) |
|---|---|---|---|---|
| | *1994/95* | *1998/99* | | |
| ↓ Paper | **34.58%** | 28.08% | 9.6978 | 0.0000 * |
| ↓ CDL Wastes | **7.75%** | 4.96% | 4.7050 | 0.0000 * |
| ↑ Organics | 25.49% | **30.39%** | 6.6875 | 0.0000 * |
| ↑ Other Materials | 13.20% | **17.25%** | 7.0250 | 0.0000 * |
| ↑ Plastic | 9.58% | **10.29%** | 3.0118 | 0.0027 * |
| Metal | 4.68% | 4.46% | 0.6896 | 0.4907 |
| Glass | 4.26% | 4.13% | 0.5852 | 0.5586 |
| Hazardous | 0.46% | 0.44% | 0.1852 | 0.8531 |
| *Number of Samples* | *368* | *360* | | |

[8] In Table 3-4, the arrows indicate increases or decreases in the percentage of the broad waste category disposed between study periods. The percentage highlighted in bold is the greater of the two. P-values highlighted with an "*" indicate significant differences.

# 4 COMPOSITION RESULTS: BY SUBPOPULATION

## 4.1 Overview

A total of 360 waste samples were sorted from May 1998 to April 1999. Descriptive data about each subpopulation's samples are summarized in Table 4-1.

**Table 4-1 Number, Sum and Average Size of Samples, and Average Net Load Weight, by Subpopulation**

| Subpopulation | Number of Samples | *(All weights in pounds)* Sum of Sample Weights | Average Sample Size | Average Vehicle Net Weight |
|---|---|---|---|---|
| Single-family | 241 | 57,038 | 236.7 | 14,278 |
| Multi-family | 119 | 28,767 | 241.7 | 17,462 |
| North | 180 | 42,689 | 237.2 | 14,679 |
| South | 180 | 43,117 | 239.5 | 15,959 |
| Single-family North | 121 | 28,411 | 234.8 | 13,710 |
| Single-family South | 120 | 28,628 | 238.6 | 14,726 |
| Spring | 92 | 21,196 | 230.4 | 13,614 |
| Summer | 85 | 17,498 | 205.9 | 16,656 |
| Fall | 88 | 22,445 | 255.1 | 16,632 |
| Winter | 95 | 24,666 | 259.6 | 14,719 |
| Low Income | 56 | 13,502 | 241.1 | 14,572 |
| High Income | 59 | 13,768 | 233.4 | 13,638 |
| Small Household | 48 | 11,168 | 232.7 | 11,604 |
| Large Household | 73 | 17,675 | 242.1 | 16,023 |
| **Overall** | **360** | **85,805** | **238.3** | **15,405** |

## 4.2 Comparisons Among Subpopulations

Composition estimates by generator type and service area were compared using t-tests. The subpopulations compared included: single-family vs. multi-family, north vs. south, and single-family north vs. single-family south.

Eleven waste categories were used to detect the differences between the subpopulations: newspaper, OCC/kraft paper, curbside paper, curbside plastic, non-curbside plastic, aluminum, curbside glass, tin, yard debris, food, and household hazardous wastes. The materials included in each of the waste comparison categories are outlined in Table 4-2. The categories for the comparisons were chosen in order to:

- Measure the degree to which residents are removing recyclables from the disposed waste stream. (Comprehensive recycling programs, available to single and multi-family homes throughout the city, collect all the materials listed in Table 4-2, except those in the non-curbside plastic, household hazardous, and food categories.)

- Gauge the amount of other plastic products (that are not accepted in current recycling programs) present in the waste stream of different subpopulations.
- Examine the potential variations in the amount of household hazardous and food wastes disposed by different sectors.

For the comparisons between subpopulations, a p-value lower than 0.0091 indicates a significant difference. The results of these comparisons are provided in Sections 4.3.2, 4.4.2, and 4.5.2.

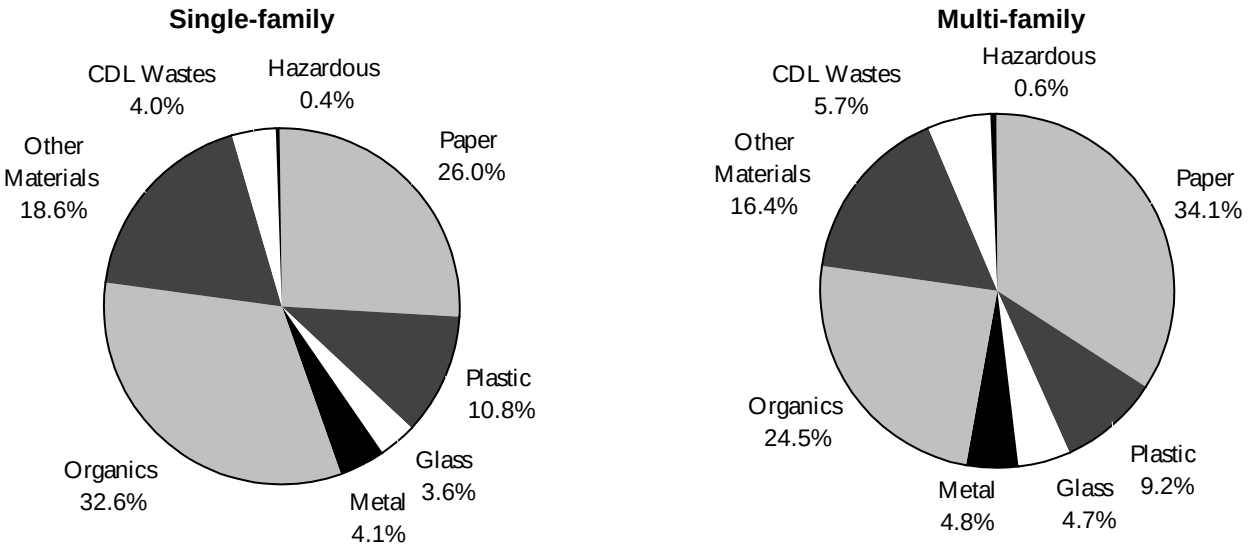
**Table 4-2 Material Groupings used for Comparisons**

| Comparison Label | Sampling Component | Comparison Label | Sampling Component |
|---|---|---|---|
| Newspaper | Newspaper | Aluminum | Aluminum Cans |
| OCC/Kraft | OCC/Kraft unwaxed | | Alum. Foil/Containers |
| | OCC/Kraft waxed | Curbside Glass | Clear Beverage |
| Curbside Paper | Office Paper | | Green Beverage |
| | Computer Paper | | Brown Beverage |
| | Mixed Low Grade | | Container Glass |
| | Phone Books | Yard Debris | Leaves and Grass |
| Curbside Plastic | PET Pop & Liquor | | Prunings |
| | Other PET Bottles | Food | Food |
| | HDPE Milk & Juice | Household Hazardous | Latex Paints |
| | Other HDPE Bottles | | Hazardous Adhesives/Glues |
| Non-Curbside Plastic | Other Plastic Bottles | | Oil-based Paints/Solvents |
| | Jars and Tubs | | Cleaners |
| | Expanded Polystyrene | | Pesticides/Herbicides |
| | Other Rigid Packaging | | Dry-Cell Batteries |
| | Grocery/Bread Bags | | Wet-Cell Batteries |
| | Garbage Bags | | Gasoline/Kerosene |
| | Other Film | | Motor Oil/Diesel Oil |
| | Plastic Products | | Asbestos |
| | Plastic/Other Materials | | Explosives |
| Tin | Tin Food Cans | | Other Hazardous Chemicals |

## 4.3 By Residence Type

A total of 241 samples were sorted from single-family residences and 119 samples were sorted from multi-family residences. Figure 4-1 summarizes the percentage of each of the broad waste categories disposed by both the single- and multi-family subpopulations. Paper and organics comprised the bulk of the waste stream of both the single- and the multi-family subpopulations (a combined total of 58.6% in each). Organics accounted for 32.6% of the waste in the single-family subpopulation, as compared to 24.5% in the multi-family subpopulation. Paper accounted for 34.1% of the multi-family waste stream as compared to 26.0% in the single-family waste stream.

**Figure 4-1 Composition Summary: by Residence Type**
**(May 1998 – April 1999)**




### 4.3.1 Largest Components

Food, mixed low grade paper, compostable/soiled paper, and animal by-products are among the largest waste components disposed in both the single-family and the multi-family waste streams (see Table 4-3). Newspaper and unwaxed OCC/kraft paper were among the largest components in the multi-family subpopulation, and disposable diapers were among the largest components disposed in the single-family subpopulation.

**Table 4-3 Largest Components by Residence Type**
**(May 1998 – April 1999)**

| | Single-family | Multi-family |
|---|---|---|
| Food | 30.6% | 21.0% |
| Mixed Low Grade Paper | 9.4% | 12.1% |
| Compostable/soiled Paper | 6.8% | 5.2% |
| Animal by-products | 6.9% | 5.8% |
| Newspaper | | 6.9% |
| OCC/Kraft, Unwaxed Paper | | 5.7% |
| Disposable Diapers | 5.1% | |
| **Sum of largest components** | **58.8%** | **56.7%** |

The full composition results by residence type are presented in Table 4-5 and Table 4-6.

### 4.3.2 Comparisons Between Single and Multi-family Residences

The eleven waste category groups (as outlined in Table 4-2 above) were compared between single- and multi-family dwellings. The results are presented in Table 4-4. In the table, the composition percentage that is higher between the two residence types is highlighted in bold. P-values highlighted with an "*" indicate significant differences.

A greater percentage of curbside paper, newspaper, OCC/Kraft, curbside glass, yard debris, curbside plastic, and aluminum was disposed in the multi-family waste stream[9]. In the single-family waste stream, greater percentages of non-curbside plastic and food were disposed. Variations in the relative amount of tin and household hazardous materials were not statistically significant. (Please see Appendix E for the calculation formulae.)

**Table 4-4 Statistically Significant Differences, by Residence Type**
**(May 1998- April 1999)**

| | Mean Ratio (Material Wt/Total Wt) | | t-Statistic | p-Value (Cut-off for statistically valid difference = 0.0091) |
|---|---|---|---|---|
| | *Single-family* | *Multi-family* | | |
| Food | **31.09%** | 21.40% | 10.8863 | 0.0000 * |
| Non-Curbside Plastic | **9.66%** | 7.96% | 4.4872 | 0.0000 * |
| Curbside Paper | 9.98% | **13.75%** | 8.0339 | 0.0000 * |
| Newspaper | 3.10% | **6.55%** | 10.4997 | 0.0000 * |
| OCC/Kraft | 3.18% | **5.76%** | 8.8735 | 0.0000 * |
| Curbside Glass | 3.38% | **4.33%** | 3.0210 | 0.0027 * |
| Yard Debris | 2.04% | **3.54%** | 2.7258 | 0.0067 * |
| Curbside Plastic | 1.13% | **1.33%** | 3.1282 | 0.0019 * |
| Aluminum | 0.68% | **0.91%** | 4.5023 | 0.0000 * |
| Tin | 1.35% | 1.26% | 1.0268 | 0.3052 |
| Household Hazardous | 0.24% | 0.34% | 0.7957 | 0.4267 |
| *Number of Samples* | *241* | *119* | | |

[9] These figures measure disposed waste only, and do not include tonnage collected through recycling programs. Also, comparisons between single- and multi-family waste proportions were calculated using unweighted composition percentages.

## Table 4-5 Composition by Weight: Single-family
## (May 1998 – April 1999)

*Calculated at a 90% confidence interval*

| | Tons | Mean | Low | High | | Tons | Mean | Low | High |
|---|---|---|---|---|---|---|---|---|---|
| ***Paper*** | **22,394** | **26.0%** | | | ***Organics*** | **28,063** | **32.6%** | | |
| Newspaper | 2,743 | 3.2% | 2.9% | 3.5% | Pallets | 0 | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, unwaxed | 2,812 | 3.3% | 3.1% | 3.4% | Crates/Boxes | 19 | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, waxed | 18 | 0.0% | 0.0% | 0.0% | Leaves and Grass | 1,387 | 1.6% | 1.2% | 2.0% |
| Office Paper | 567 | 0.7% | 0.6% | 0.7% | Prunings | 306 | 0.4% | 0.3% | 0.5% |
| Computer Paper | 12 | 0.0% | 0.0% | 0.0% | Food | 26,351 | 30.6% | 29.7% | 31.4% |
| Mixed Low Grade | 8,085 | 9.4% | 9.0% | 9.8% | ***Other Materials*** | **16,037** | **18.6%** | | |
| Phone Books | 128 | 0.1% | 0.1% | 0.2% | Textiles/Clothing | 1,569 | 1.8% | 1.7% | 2.0% |
| Milk/Juice Polycoats | 601 | 0.7% | 0.7% | 0.7% | Carpet/Upholstery | 1,212 | 1.4% | 1.1% | 1.7% |
| Frozen Food Polycoats | 285 | 0.3% | 0.3% | 0.4% | Leather | 155 | 0.2% | 0.1% | 0.2% |
| Compostable/Soiled | 5,898 | 6.8% | 6.6% | 7.1% | Disposable Diapers | 4,390 | 5.1% | 4.7% | 5.5% |
| Paper/Other Materials | 1,163 | 1.3% | 1.2% | 1.5% | Animal By-Products | 5,944 | 6.9% | 6.3% | 7.5% |
| Other Paper | 83 | 0.1% | 0.1% | 0.1% | Rubber Products | 184 | 0.2% | 0.2% | 0.3% |
| ***Plastic*** | **9,337** | **10.8%** | | | Tires | 165 | 0.2% | 0.0% | 0.4% |
| PET Pop and Liquor | 293 | 0.3% | 0.3% | 0.4% | Ash | 299 | 0.3% | 0.2% | 0.5% |
| Other PET Bottles | 125 | 0.1% | 0.1% | 0.2% | Furniture | 364 | 0.4% | 0.1% | 0.8% |
| HDPE Milk and Juice | 180 | 0.2% | 0.2% | 0.2% | Mattresses | 0 | 0.0% | 0.0% | 0.0% |
| Other HDPE Bottles | 358 | 0.4% | 0.4% | 0.5% | Small Appliances | 233 | 0.3% | 0.2% | 0.4% |
| Other Plastic Bottles | 159 | 0.2% | 0.2% | 0.2% | A/V Equipment | 295 | 0.3% | 0.1% | 0.5% |
| Jars and Tubs | 476 | 0.6% | 0.5% | 0.6% | Ceramics/Porcelain | 188 | 0.2% | 0.2% | 0.3% |
| Expanded Polystyrene | 689 | 0.8% | 0.5% | 1.1% | Non-distinct Fines | 411 | 0.5% | 0.4% | 0.6% |
| Other Rigid Packaging | 958 | 1.1% | 1.0% | 1.2% | Misc. Organics | 311 | 0.4% | 0.3% | 0.5% |
| Grocery/Bread Bags | 1,286 | 1.5% | 1.4% | 1.6% | Misc. Inorganics | 319 | 0.4% | 0.3% | 0.5% |
| Garbage Bags | 1,074 | 1.2% | 1.2% | 1.3% | ***CDL Wastes*** | **3,415** | **4.0%** | | |
| Other Film | 2,336 | 2.7% | 2.6% | 2.8% | Dimension Lumber | 714 | 0.8% | 0.5% | 1.2% |
| Plastic Products | 743 | 0.9% | 0.8% | 1.0% | Other Untreated Wood | 189 | 0.2% | 0.1% | 0.3% |
| Plastic/Other Materials | 658 | 0.8% | 0.6% | 0.9% | Treated Wood | 451 | 0.5% | 0.4% | 0.7% |
| ***Glass*** | **3,071** | **3.6%** | | | Contaminated Wood | 205 | 0.2% | 0.1% | 0.3% |
| Clear Beverage | 857 | 1.0% | 0.9% | 1.1% | New Gypsum Scrap | 3 | 0.0% | 0.0% | 0.0% |
| Green Beverage | 544 | 0.6% | 0.5% | 0.7% | Demo Gypsum Scrap | 231 | 0.3% | 0.2% | 0.4% |
| Brown Beverage | 514 | 0.6% | 0.5% | 0.7% | Fiberglass Insulation | 3 | 0.0% | 0.0% | 0.0% |
| Container Glass | 829 | 1.0% | 0.9% | 1.0% | Rock/Concrete/Brick | 677 | 0.8% | 0.0% | 1.6% |
| Fluorescent Tubes | 7 | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 193 | 0.2% | 0.1% | 0.4% |
| Other Glass | 320 | 0.4% | 0.3% | 0.4% | Other Construction Debris | 269 | 0.3% | 0.1% | 0.5% |
| ***Metal*** | **3,535** | **4.1%** | | | Sand/Soil/Dirt | 481 | 0.6% | 0.3% | 0.8% |
| Aluminum Cans | 310 | 0.4% | 0.3% | 0.4% | ***Hazardous*** | **353** | **0.4%** | | |
| Alum. Foil/Containers | 252 | 0.3% | 0.3% | 0.3% | Latex Paints | 46 | 0.1% | 0.0% | 0.1% |
| Other Aluminum | 31 | 0.0% | 0.0% | 0.1% | Hazardous Adhesives/Glues | 5 | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 49 | 0.1% | 0.0% | 0.1% | NonHazardous Adhesives/Gl | 49 | 0.1% | 0.0% | 0.1% |
| Tin Food Cans | 1,122 | 1.3% | 1.2% | 1.4% | Oil-based Paints/Solvents | 3 | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 169 | 0.2% | 0.2% | 0.2% | Cleaners | 5 | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 796 | 0.9% | 0.6% | 1.2% | Pesticides/Herbicides | 1 | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 791 | 0.9% | 0.6% | 1.2% | Dry-Cell Batteries | 66 | 0.1% | 0.1% | 0.1% |
| Motor Oil Filters | 17 | 0.0% | 0.0% | 0.0% | Wet-Cell Batteries | 0 | 0.0% | 0.0% | 0.0% |
| | | | | | Gasoline/Kerosene | 1 | 0.0% | 0.0% | 0.0% |
| | | | | | Motor Oil/Diesel Oil | 41 | 0.0% | 0.0% | 0.1% |
| | | | | | Asbestos | 1 | 0.0% | 0.0% | 0.0% |
| | | | | | Explosives | 0 | 0.0% | 0.0% | 0.0% |
| **Total Tons** | **86,205** | | | | Other Hazardous Chemicals | 31 | 0.0% | 0.0% | 0.1% |
| **Sample Count** | **241** | | | | Other NonHazardous Chemi | 104 | 0.1% | 0.1% | 0.2% |

## Table 4-6 Composition by Weight: Multi-family (May 1998 – April 1999)

*Calculated at a 90% confidence interval*

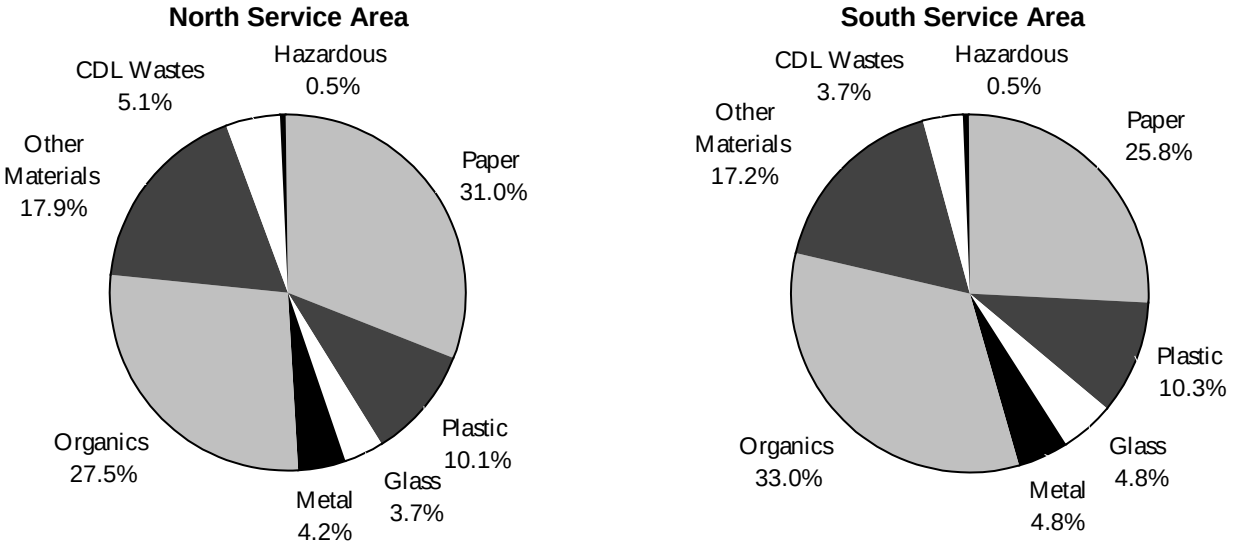
| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Paper*** | **20,587** | **34.1%** | | |
| Newspaper | 4,150 | 6.9% | 6.2% | 7.5% |
| OCC/Kraft, unwaxed | 3,475 | 5.7% | 5.1% | 6.4% |
| OCC/Kraft, waxed | 162 | 0.3% | 0.0% | 0.6% |
| Office Paper | 652 | 1.1% | 0.8% | 1.4% |
| Computer Paper | 21 | 0.0% | 0.0% | 0.1% |
| Mixed Low Grade | 7,323 | 12.1% | 11.4% | 12.9% |
| Phone Books | 470 | 0.8% | 0.5% | 1.1% |
| Milk/Juice Polycoats | 343 | 0.6% | 0.5% | 0.7% |
| Frozen Food Polycoats | 146 | 0.2% | 0.2% | 0.3% |
| Compostable/Soiled | 3,125 | 5.2% | 4.8% | 5.6% |
| Paper/Other Materials | 649 | 1.1% | 0.9% | 1.2% |
| Other Paper | 71 | 0.1% | 0.1% | 0.2% |
| ***Plastic*** | **5,549** | **9.2%** | | |
| PET Pop and Liquor | 298 | 0.5% | 0.4% | 0.6% |
| Other PET Bottles | 109 | 0.2% | 0.1% | 0.2% |
| HDPE Milk and Juice | 185 | 0.3% | 0.3% | 0.3% |
| Other HDPE Bottles | 213 | 0.4% | 0.3% | 0.4% |
| Other Plastic Bottles | 87 | 0.1% | 0.1% | 0.2% |
| Jars and Tubs | 265 | 0.4% | 0.4% | 0.5% |
| Expanded Polystyrene | 236 | 0.4% | 0.3% | 0.4% |
| Other Rigid Packaging | 461 | 0.8% | 0.7% | 0.8% |
| Grocery/Bread Bags | 789 | 1.3% | 1.2% | 1.4% |
| Garbage Bags | 786 | 1.3% | 1.1% | 1.5% |
| Other Film | 1,240 | 2.1% | 1.8% | 2.3% |
| Plastic Products | 502 | 0.8% | 0.7% | 1.0% |
| Plastic/Other Materials | 378 | 0.6% | 0.4% | 0.8% |
| ***Glass*** | **2,857** | **4.7%** | | |
| Clear Beverage | 651 | 1.1% | 0.9% | 1.2% |
| Green Beverage | 684 | 1.1% | 0.9% | 1.4% |
| Brown Beverage | 748 | 1.2% | 0.8% | 1.6% |
| Container Glass | 473 | 0.8% | 0.7% | 0.9% |
| Fluorescent Tubes | 0 | 0.0% | 0.0% | 0.0% |
| Other Glass | 302 | 0.5% | 0.3% | 0.7% |
| ***Metal*** | **2,927** | **4.8%** | | |
| Aluminum Cans | 415 | 0.7% | 0.6% | 0.8% |
| Alum. Foil/Containers | 107 | 0.2% | 0.1% | 0.2% |
| Other Aluminum | 23 | 0.0% | 0.0% | 0.1% |
| Other Nonferrous | 39 | 0.1% | 0.0% | 0.1% |
| Tin Food Cans | 769 | 1.3% | 1.1% | 1.4% |
| Empty Aerosol Cans | 101 | 0.2% | 0.1% | 0.2% |
| Other Ferrous | 902 | 1.5% | 0.6% | 2.4% |
| Mixed Metals/Materials | 558 | 0.9% | 0.6% | 1.3% |
| Motor Oil Filters | 14 | 0.0% | 0.0% | 0.0% |
| **Total Tons** | **60,455** | | | |
| **Sample Count** | **119** | | | |

| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Organics*** | **14,836** | **24.5%** | | |
| Pallets | 39 | 0.1% | 0.0% | 0.2% |
| Crates/Boxes | 16 | 0.0% | 0.0% | 0.1% |
| Leaves and Grass | 1,807 | 3.0% | 2.0% | 4.0% |
| Prunings | 256 | 0.4% | 0.2% | 0.6% |
| Food | 12,717 | 21.0% | 19.9% | 22.2% |
| ***Other Materials*** | **9,905** | **16.4%** | | |
| Textiles/Clothing | 1,424 | 2.4% | 2.1% | 2.6% |
| Carpet/Upholstery | 895 | 1.5% | 1.0% | 2.0% |
| Leather | 86 | 0.1% | 0.1% | 0.2% |
| Disposable Diapers | 1,477 | 2.4% | 2.0% | 2.8% |
| Animal By-Products | 3,516 | 5.8% | 4.8% | 6.8% |
| Rubber Products | 90 | 0.1% | 0.1% | 0.2% |
| Tires | 98 | 0.2% | 0.0% | 0.3% |
| Ash | 95 | 0.2% | 0.0% | 0.3% |
| Furniture | 572 | 0.9% | 0.4% | 1.4% |
| Mattresses | 166 | 0.3% | 0.0% | 0.7% |
| Small Appliances | 339 | 0.6% | 0.4% | 0.8% |
| A/V Equipment | 346 | 0.6% | 0.2% | 1.0% |
| Ceramics/Porcelain | 148 | 0.2% | 0.1% | 0.4% |
| Non-distinct Fines | 289 | 0.5% | 0.3% | 0.6% |
| Misc. Organics | 223 | 0.4% | 0.1% | 0.6% |
| Misc. Inorganics | 141 | 0.2% | 0.1% | 0.3% |
| ***CDL Wastes*** | **3,456** | **5.7%** | | |
| Dimension Lumber | 604 | 1.0% | 0.6% | 1.4% |
| Other Untreated Wood | 248 | 0.4% | 0.2% | 0.6% |
| Treated Wood | 508 | 0.8% | 0.5% | 1.1% |
| Contaminated Wood | 77 | 0.1% | 0.1% | 0.2% |
| New Gypsum Scrap | 3 | 0.0% | 0.0% | 0.0% |
| Demo Gypsum Scrap | 389 | 0.6% | 0.2% | 1.1% |
| Fiberglass Insulation | 48 | 0.1% | 0.0% | 0.2% |
| Rock/Concrete/Brick | 270 | 0.4% | 0.1% | 0.8% |
| Asphaltic Roofing | 24 | 0.0% | 0.0% | 0.1% |
| Other Construction Debris | 182 | 0.3% | 0.1% | 0.5% |
| Sand/Soil/Dirt | 1,101 | 1.8% | 1.1% | 2.6% |
| ***Hazardous*** | **339** | **0.6%** | | |
| Latex Paints | 21 | 0.0% | 0.0% | 0.1% |
| Hazardous Adhesives/Glues | 7 | 0.0% | 0.0% | 0.0% |
| NonHazardous Adhesives/Gl | 0 | 0.0% | 0.0% | 0.0% |
| Oil-based Paints/Solvents | 3 | 0.0% | 0.0% | 0.0% |
| Cleaners | 1 | 0.0% | 0.0% | 0.0% |
| Pesticides/Herbicides | 0 | 0.0% | 0.0% | 0.0% |
| Dry-Cell Batteries | 87 | 0.1% | 0.0% | 0.3% |
| Wet-Cell Batteries | 0 | 0.0% | 0.0% | 0.0% |
| Gasoline/Kerosene | 0 | 0.0% | 0.0% | 0.0% |
| Motor Oil/Diesel Oil | 0 | 0.0% | 0.0% | 0.0% |
| Asbestos | 0 | 0.0% | 0.0% | 0.0% |
| Explosives | 0 | 0.0% | 0.0% | 0.0% |
| Other Hazardous Chemicals | 148 | 0.2% | 0.0% | 0.6% |
| Other NonHazardous Chemi | 73 | 0.1% | 0.0% | 0.2% |

## 4.4 By Service Area

A total of 180 samples were sorted in both the north and south service areas. On a broad waste category level, paper and organics accounted for the highest percentage of waste in the north and south service areas. Combined, these two categories accounted for 58.5% of the waste in the north and 58.8% of the waste in the south. In the north, paper accounted for a greater percentage of the composition than organics; in the south, organics accounted for a greater percentage than paper. Very little differences existed between the other broad waste categories.

**Figure 4-2 Composition Summary: by Service Area**
**(May 1998 – April 1999)**




### 4.4.1 Largest Components

Food, mixed low grade paper, and soiled/compostable paper accounted for a large percentage of the waste stream in both the north and south service areas (see Table 4-7). In addition, the north service area had a high percentage of animal by-products and newspaper, while the south service area had a high proportion of disposable diapers. The full composition results for the north and south service areas are presented in Table 4-9 and Table 4-10.

**Table 4-7 Largest Components by Service Area**
**(May 1998 – April 1999)**

| | North | South |
|---|---|---|
| Food | 25.0% | 30.1% |
| Mixed low grade paper | 11.1% | 9.3% |
| Soiled/Compostable paper | 5.9% | 6.6% |
| Animal by-products | 7.4% | |
| Disposable diapers | | 5.6% |
| Newspaper | 5.2% | |
| **Sum of largest components** | **54.6%** | **51.6%** |

### 4.4.2 Comparisons Between North and South Service Areas

Eleven waste category groups (listed in Table 4-2 above) were compared between the two service areas. As shown in Table 4-8, there was a greater percentage of curbside paper and OCC/Kraft in the waste stream of the north service area. In the south service area, there were greater percentages of food, curbside glass, tin, and aluminum than in the north service area[10]. Variations in the relative amount of non-curbside plastic, newspaper, yard debris, curbside plastic, and household hazardous materials were not statistically significant[11]. (Please see Appendix E for the calculation formulae.)

**Table 4-8 Statistically Significant Differences, by Service Area**
**(May 1998 – April 1999)**

| | Mean Ratio (Material Wt/Total Wt) | | t-Statistic | p-Value (Cut-off for statistically valid difference = 0.0091 |
|---|---|---|---|---|
| | *North* | *South* | | |
| Curbside Paper | **12.05%** | 10.44% | 3.4358 | 0.0007 * |
| OCC/Kraft | **4.51%** | 3.58% | 3.0920 | 0.0021 * |
| Food | 26.06% | **29.61%** | 3.7458 | 0.0002 * |
| Curbside Glass | 3.04% | **4.35%** | 4.4989 | 0.0000 * |
| Tin | 1.18% | **1.46%** | 3.3816 | 0.0008 * |
| Aluminum | 0.63% | **0.88%** | 5.3652 | 0.0000 * |
| Non-Curbside Plastic | 9.21% | 8.97% | 0.6284 | 0.5301 |
| Newspaper | 4.69% | 3.82% | 2.4519 | 0.0147 |
| Yard Debris | 2.23% | 2.86% | 1.2107 | 0.2268 |
| Curbside Plastic | 1.14% | 1.25% | 1.7281 | 0.0848 |
| Household Hazardous | 0.30% | 0.26% | 0.3236 | 0.7464 |
| *Number of Samples* | *180* | *180* | | |

[10] These figures measure disposed waste only, and do not include tonnage collected through recycling programs. Also, comparisons between north and south waste proportions were calculated using unweighted composition percentages.

[11] In Table 4-8, the composition percentage that is higher between the two service areas is highlighted in bold. P-values highlighted with an "*" indicate significant differences.

## Table 4-9 Composition by Weight: North Service Area
### (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Paper*** | **30,952** | **31.0%** | | |
| Newspaper | 5,181 | 5.2% | 4.7% | 5.6% |
| OCC/Kraft, unwaxed | 4,679 | 4.7% | 4.3% | 5.1% |
| OCC/Kraft, waxed | 176 | 0.2% | 0.0% | 0.4% |
| Office Paper | 990 | 1.0% | 0.8% | 1.2% |
| Computer Paper | 29 | 0.0% | 0.0% | 0.0% |
| Mixed Low Grade | 11,065 | 11.1% | 10.5% | 11.6% |
| Phone Books | 399 | 0.4% | 0.2% | 0.6% |
| Milk/Juice Polycoats | 729 | 0.7% | 0.7% | 0.8% |
| Frozen Food Polycoats | 297 | 0.3% | 0.3% | 0.3% |
| Compostable/Soiled | 5,946 | 5.9% | 5.6% | 6.3% |
| Paper/Other Materials | 1,333 | 1.3% | 1.2% | 1.5% |
| Other Paper | 129 | 0.1% | 0.1% | 0.2% |
| ***Plastic*** | **10,085** | **10.1%** | | |
| PET Pop and Liquor | 397 | 0.4% | 0.4% | 0.4% |
| Other PET Bottles | 161 | 0.2% | 0.1% | 0.2% |
| HDPE Milk and Juice | 230 | 0.2% | 0.2% | 0.3% |
| Other HDPE Bottles | 392 | 0.4% | 0.3% | 0.4% |
| Other Plastic Bottles | 162 | 0.2% | 0.1% | 0.2% |
| Jars and Tubs | 540 | 0.5% | 0.5% | 0.6% |
| Expanded Polystyrene | 612 | 0.6% | 0.4% | 0.8% |
| Other Rigid Packaging | 1,022 | 1.0% | 1.0% | 1.1% |
| Grocery/Bread Bags | 1,338 | 1.3% | 1.3% | 1.4% |
| Garbage Bags | 1,284 | 1.3% | 1.2% | 1.4% |
| Other Film | 2,408 | 2.4% | 2.3% | 2.6% |
| Plastic Products | 772 | 0.8% | 0.7% | 0.9% |
| Plastic/Other Materials | 767 | 0.8% | 0.6% | 1.0% |
| ***Glass*** | **3,688** | **3.7%** | | |
| Clear Beverage | 790 | 0.8% | 0.7% | 0.9% |
| Green Beverage | 825 | 0.8% | 0.7% | 1.0% |
| Brown Beverage | 889 | 0.9% | 0.6% | 1.1% |
| Container Glass | 759 | 0.8% | 0.7% | 0.8% |
| Fluorescent Tubes | 3 | 0.0% | 0.0% | 0.0% |
| Other Glass | 422 | 0.4% | 0.3% | 0.5% |
| ***Metal*** | **4,222** | **4.2%** | | |
| Aluminum Cans | 446 | 0.4% | 0.4% | 0.5% |
| Alum. Foil/Containers | 227 | 0.2% | 0.2% | 0.3% |
| Other Aluminum | 17 | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 28 | 0.0% | 0.0% | 0.0% |
| Tin Food Cans | 1,198 | 1.2% | 1.1% | 1.3% |
| Empty Aerosol Cans | 174 | 0.2% | 0.1% | 0.2% |
| Other Ferrous | 1,154 | 1.2% | 0.6% | 1.7% |
| Mixed Metals/Materials | 972 | 1.0% | 0.7% | 1.3% |
| Motor Oil Filters | 8 | 0.0% | 0.0% | 0.0% |
| **Total Tons** | **99,930** | | | |
| **Sample Count** | **180** | | | |

| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Organics*** | **27,469** | **27.5%** | | |
| Pallets | 39 | 0.0% | 0.0% | 0.1% |
| Crates/Boxes | 17 | 0.0% | 0.0% | 0.0% |
| Leaves and Grass | 2,057 | 2.1% | 1.5% | 2.7% |
| Prunings | 387 | 0.4% | 0.3% | 0.5% |
| Food | 24,969 | 25.0% | 24.1% | 25.9% |
| ***Other Materials*** | **17,914** | **17.9%** | | |
| Textiles/Clothing | 1,887 | 1.9% | 1.7% | 2.1% |
| Carpet/Upholstery | 1,430 | 1.4% | 1.1% | 1.8% |
| Leather | 150 | 0.2% | 0.1% | 0.2% |
| Disposable Diapers | 3,264 | 3.3% | 2.9% | 3.6% |
| Animal By-Products | 7,407 | 7.4% | 6.7% | 8.2% |
| Rubber Products | 175 | 0.2% | 0.1% | 0.2% |
| Tires | 113 | 0.1% | 0.0% | 0.2% |
| Ash | 255 | 0.3% | 0.1% | 0.4% |
| Misc. Organics | 380 | 0.4% | 0.2% | 0.5% |
| Furniture | 646 | 0.6% | 0.3% | 1.0% |
| Mattresses | 166 | 0.2% | 0.0% | 0.4% |
| Small Appliances | 379 | 0.4% | 0.3% | 0.5% |
| A/V Equipment | 569 | 0.6% | 0.3% | 0.9% |
| Ceramics/Porcelain | 257 | 0.3% | 0.2% | 0.4% |
| Non-distinct Fines | 540 | 0.5% | 0.4% | 0.7% |
| Misc. Inorganics | 296 | 0.3% | 0.2% | 0.4% |
| ***CDL Wastes*** | **5,123** | **5.1%** | | |
| Dimension Lumber | 1,057 | 1.1% | 0.7% | 1.4% |
| Other Untreated Wood | 274 | 0.3% | 0.2% | 0.4% |
| Treated Wood | 712 | 0.7% | 0.5% | 0.9% |
| Contaminated Wood | 160 | 0.2% | 0.1% | 0.2% |
| New Gypsum Scrap | 3 | 0.0% | 0.0% | 0.0% |
| Demo Gypsum Scrap | 449 | 0.4% | 0.1% | 0.8% |
| Fiberglass Insulation | 32 | 0.0% | 0.0% | 0.1% |
| Rock/Concrete/Brick | 805 | 0.8% | 0.1% | 1.5% |
| Asphaltic Roofing | 151 | 0.2% | 0.0% | 0.3% |
| Other Construction Debris | 325 | 0.3% | 0.1% | 0.5% |
| Sand/Soil/Dirt | 1,156 | 1.2% | 0.7% | 1.6% |
| ***Hazardous*** | **477** | **0.5%** | | |
| Latex Paints | 50 | 0.0% | 0.0% | 0.1% |
| Hazardous Adhesives/Glues | 10 | 0.0% | 0.0% | 0.0% |
| NonHazardous Adhesives/Gl | 19 | 0.0% | 0.0% | 0.0% |
| Oil-based Paints/Solvents | 3 | 0.0% | 0.0% | 0.0% |
| Cleaners | 1 | 0.0% | 0.0% | 0.0% |
| Pesticides/Herbicides | 1 | 0.0% | 0.0% | 0.0% |
| Dry-Cell Batteries | 117 | 0.1% | 0.0% | 0.2% |
| Wet-Cell Batteries | 0 | 0.0% | 0.0% | 0.0% |
| Gasoline/Kerosene | 0 | 0.0% | 0.0% | 0.0% |
| Motor Oil/Diesel Oil | 5 | 0.0% | 0.0% | 0.0% |
| Asbestos | 1 | 0.0% | 0.0% | 0.0% |
| Explosives | 0 | 0.0% | 0.0% | 0.0% |
| Other Hazardous Chemicals | 154 | 0.2% | 0.0% | 0.4% |
| Other NonHazardous Chemi | 116 | 0.1% | 0.0% | 0.2% |

## Table 4-10 Composition by Weight: South Service Area
### (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Paper*** | **12,042** | **25.8%** | | |
| Newspaper | 1,713 | 3.7% | 3.4% | 4.0% |
| OCC/Kraft, unwaxed | 1,610 | 3.4% | 3.2% | 3.7% |
| OCC/Kraft, waxed | 5 | 0.0% | 0.0% | 0.0% |
| Office Paper | 231 | 0.5% | 0.4% | 0.6% |
| Computer Paper | 4 | 0.0% | 0.0% | 0.0% |
| Mixed Low Grade | 4,348 | 9.3% | 8.9% | 9.7% |
| Phone Books | 198 | 0.4% | 0.3% | 0.6% |
| Milk/Juice Polycoats | 217 | 0.5% | 0.4% | 0.5% |
| Frozen Food Polycoats | 134 | 0.3% | 0.3% | 0.3% |
| Compostable/Soiled | 3,077 | 6.6% | 6.3% | 6.9% |
| Paper/Other Materials | 481 | 1.0% | 1.0% | 1.1% |
| Other Paper | 25 | 0.1% | 0.0% | 0.1% |
| ***Plastic*** | **4,802** | **10.3%** | | |
| PET Pop and Liquor | 194 | 0.4% | 0.4% | 0.4% |
| Other PET Bottles | 74 | 0.2% | 0.1% | 0.2% |
| HDPE Milk and Juice | 134 | 0.3% | 0.3% | 0.3% |
| Other HDPE Bottles | 179 | 0.4% | 0.3% | 0.4% |
| Other Plastic Bottles | 84 | 0.2% | 0.2% | 0.2% |
| Jars and Tubs | 202 | 0.4% | 0.4% | 0.5% |
| Expanded Polystyrene | 313 | 0.7% | 0.6% | 0.7% |
| Other Rigid Packaging | 399 | 0.9% | 0.8% | 0.9% |
| Grocery/Bread Bags | 736 | 1.6% | 1.5% | 1.7% |
| Garbage Bags | 577 | 1.2% | 1.2% | 1.3% |
| Other Film | 1,169 | 2.5% | 2.3% | 2.7% |
| Plastic Products | 471 | 1.0% | 0.9% | 1.2% |
| Plastic/Other Materials | 270 | 0.6% | 0.5% | 0.7% |
| ***Glass*** | **2,232** | **4.8%** | | |
| Clear Beverage | 714 | 1.5% | 1.3% | 1.7% |
| Green Beverage | 401 | 0.9% | 0.7% | 1.0% |
| Brown Beverage | 372 | 0.8% | 0.7% | 0.9% |
| Container Glass | 542 | 1.2% | 1.1% | 1.3% |
| Fluorescent Tubes | 4 | 0.0% | 0.0% | 0.0% |
| Other Glass | 199 | 0.4% | 0.4% | 0.5% |
| ***Metal*** | **2,236** | **4.8%** | | |
| Aluminum Cans | 277 | 0.6% | 0.5% | 0.6% |
| Alum. Foil/Containers | 132 | 0.3% | 0.3% | 0.3% |
| Other Aluminum | 36 | 0.1% | 0.0% | 0.1% |
| Other Nonferrous | 60 | 0.1% | 0.1% | 0.2% |
| Tin Food Cans | 691 | 1.5% | 1.4% | 1.6% |
| Empty Aerosol Cans | 95 | 0.2% | 0.2% | 0.2% |
| Other Ferrous | 543 | 1.2% | 0.6% | 1.7% |
| Mixed Metals/Materials | 378 | 0.8% | 0.6% | 1.0% |
| Motor Oil Filters | 23 | 0.0% | 0.0% | 0.1% |
| **Total Tons** | **46,729** | | | |
| **Sample Count** | **180** | | | |

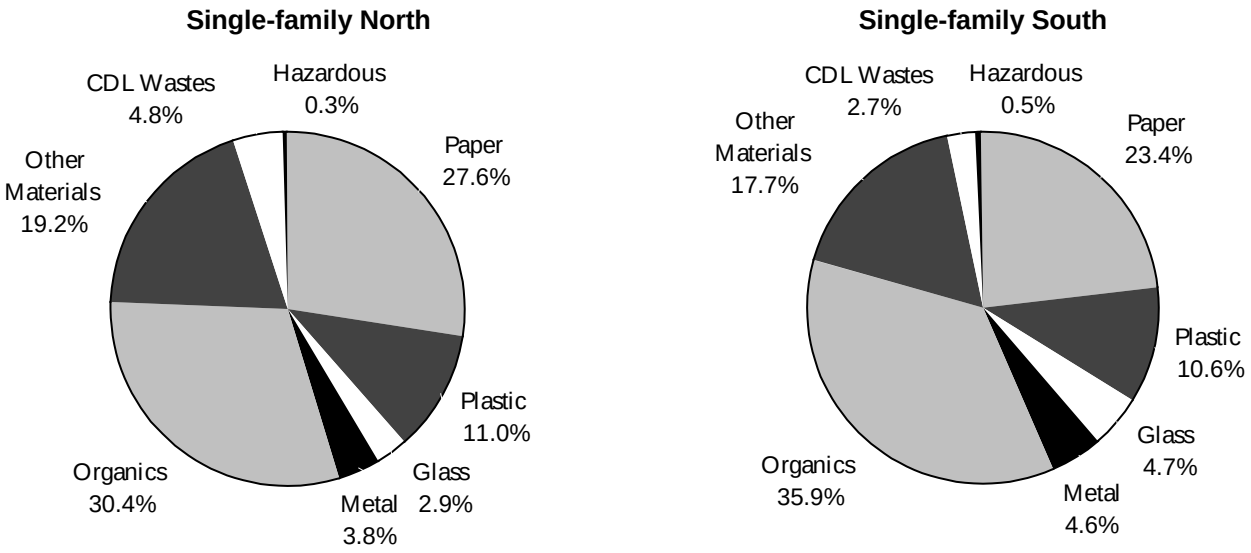
| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Organics*** | **15,414** | **33.0%** | | |
| Pallets | 0 | 0.0% | 0.0% | 0.0% |
| Crates/Boxes | 18 | 0.0% | 0.0% | 0.1% |
| Leaves and Grass | 1,132 | 2.4% | 1.7% | 3.1% |
| Prunings | 175 | 0.4% | 0.2% | 0.5% |
| Food | 14,088 | 30.1% | 29.1% | 31.2% |
| ***Other Materials*** | **8,036** | **17.2%** | | |
| Textiles/Clothing | 1,102 | 2.4% | 2.2% | 2.5% |
| Carpet/Upholstery | 677 | 1.4% | 1.1% | 1.8% |
| Leather | 90 | 0.2% | 0.1% | 0.2% |
| Disposable Diapers | 2,594 | 5.6% | 5.1% | 6.0% |
| Animal By-Products | 2,073 | 4.4% | 3.9% | 5.0% |
| Rubber Products | 99 | 0.2% | 0.1% | 0.3% |
| Tires | 150 | 0.3% | 0.0% | 0.6% |
| Ash | 140 | 0.3% | 0.1% | 0.4% |
| Furniture | 289 | 0.6% | 0.3% | 1.0% |
| Mattresses | 0 | 0.0% | 0.0% | 0.0% |
| Small Appliances | 192 | 0.4% | 0.3% | 0.5% |
| A/V Equipment | 73 | 0.2% | 0.1% | 0.2% |
| Ceramics/Porcelain | 79 | 0.2% | 0.1% | 0.2% |
| Non-distinct Fines | 161 | 0.3% | 0.2% | 0.4% |
| Misc. Organics | 155 | 0.3% | 0.3% | 0.4% |
| Misc. Inorganics | 164 | 0.4% | 0.2% | 0.5% |
| ***CDL Wastes*** | **1,752** | **3.7%** | | |
| Dimension Lumber | 264 | 0.6% | 0.4% | 0.8% |
| Other Untreated Wood | 162 | 0.3% | 0.2% | 0.5% |
| Treated Wood | 247 | 0.5% | 0.4% | 0.7% |
| Contaminated Wood | 121 | 0.3% | 0.1% | 0.4% |
| New Gypsum Scrap | 3 | 0.0% | 0.0% | 0.0% |
| Demo Gypsum Scrap | 172 | 0.4% | 0.2% | 0.5% |
| Fiberglass Insulation | 19 | 0.0% | 0.0% | 0.1% |
| Rock/Concrete/Brick | 146 | 0.3% | 0.1% | 0.5% |
| Asphaltic Roofing | 66 | 0.1% | 0.0% | 0.2% |
| Other Construction Debris | 127 | 0.3% | 0.1% | 0.4% |
| Sand/Soil/Dirt | 426 | 0.9% | 0.5% | 1.3% |
| ***Hazardous*** | **215** | **0.5%** | | |
| Latex Paints | 17 | 0.0% | 0.0% | 0.1% |
| Hazardous Adhesives/Glues | 2 | 0.0% | 0.0% | 0.0% |
| NonHazardous Adhesives/Gl | 30 | 0.1% | 0.0% | 0.2% |
| Oil-based Paints/Solvents | 3 | 0.0% | 0.0% | 0.0% |
| Cleaners | 5 | 0.0% | 0.0% | 0.0% |
| Pesticides/Herbicides | 0 | 0.0% | 0.0% | 0.0% |
| Dry-Cell Batteries | 36 | 0.1% | 0.1% | 0.1% |
| Wet-Cell Batteries | 0 | 0.0% | 0.0% | 0.0% |
| Gasoline/Kerosene | 1 | 0.0% | 0.0% | 0.0% |
| Motor Oil/Diesel Oil | 35 | 0.1% | 0.0% | 0.2% |
| Asbestos | 0 | 0.0% | 0.0% | 0.0% |
| Explosives | 0 | 0.0% | 0.0% | 0.0% |
| Other Hazardous Chemicals | 25 | 0.1% | 0.0% | 0.1% |
| Other NonHazardous Chemi | 61 | 0.1% | 0.1% | 0.2% |

## 4.5 By Service Area and Generator Type

Waste composition estimates were calculated for the single-family residences in both the north and the south. A total of 121 single-family samples were obtained in the north and a total of 120 samples were obtained in the south.

As shown in Figure 4-3, paper and organics comprise the bulk of the waste stream for both the single-family residences in the north (58.0%) and in the south (59.3%).

**Figure 4-3 Composition Summary: by Service Area and Generator Type**
**(May 1998 – April 1999)**




### 4.5.1 Largest Components

Four components accounted for approximately half of the waste stream for both the single-family north and the single-family south subpopulations as shown in Table 4-11.

**Table 4-11 Largest Components by Service Area and Residence Type**
**(May 1998 – April 1999)**

| | Single-family North | Single-family South |
|---|---|---|
| Food | 28.7% | 33.4% |
| Mixed Low Grade Paper | 10.0% | 8.4% |
| Compostable/soiled Paper | 6.7% | 7.1% |
| Animal by-products | 8.3% | |
| Disposable Diapers | | 6.3% |
| **Sum of largest components** | **53.7%** | **55.2%** |

Table 4-13 and Table 4-14 present the detailed composition results for both the north and south single-family subpopulations.

### 4.5.2 Comparisons Between Single-family North and Single-family South

Eleven waste category groups (listed in Table 4-2 above) were compared between the single-family north and the single-family south subpopulations. As shown in Table 4-12, single-family residences in the north service area disposed significantly more curbside paper and OCC/kraft paper than did single-family residences in the south. South single-family residences, however, disposed more aluminum, curbside glass, food, and tin than residents in the north did. Variations on the amount of newspaper, curbside plastic, non-curbside plastic, yard debris, or household hazardous materials disposed by the two groups were not significant[12]. (Please see Appendix E for the calculation formulae.)

**Table 4-12 Statistically Significant Differences Among Single-family Residences, by Service Area**

| | **Mean Ratio** *(Material Wt/Total Wt)* | | **t-Statistic** | **p-Value** *(Cut-off for statistically valid difference = 0.0091)* |
|---|---|---|---|---|
| | *SF North* | *SF South* | | |
| Curbside Paper | **10.97%** | 8.99% | 3.9877 | 0.0001 * |
| OCC/Kraft | **3.65%** | 2.70% | 4.5124 | 0.0000 * |
| Food | 28.74% | **33.43%** | 4.4796 | 0.0000 * |
| Curbside Glass | 2.49% | **4.27%** | 5.9488 | 0.0000 * |
| Tin | 1.13% | **1.58%** | 4.3409 | 0.0000 * |
| Aluminum | 0.54% | **0.83%** | 5.5809 | 0.0000 * |
| Non-Curbside Plastic | 9.93% | 9.39% | 1.1500 | 0.2513 |
| Newspaper | 3.48% | 2.72% | 2.3902 | 0.0176 |
| Yard Debris | 1.69% | 2.40% | 1.3607 | 0.1749 |
| Curbside Plastic | 1.05% | 1.21% | 2.1487 | 0.0327 |
| Household Hazardous | 0.19% | 0.30% | 1.1788 | 0.2396 |
| *Number of Samples* | *121* | *120* | | |

**(May 1998 – April 1999)**

[12] In Table 4-12, the higher composition percentage between the single-family north and south subpopulations is highlighted in bold. P-values highlighted with an "*" indicate significant differences.

## Table 4-13 Composition by Weight: Single-family North
### (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Paper*** | **14,060** | **27.6%** | | |
| Newspaper | 1,770 | 3.5% | 3.0% | 3.9% |
| OCC/Kraft, unwaxed | 1,844 | 3.6% | 3.4% | 3.9% |
| OCC/Kraft, waxed | 16 | 0.0% | 0.0% | 0.1% |
| Office Paper | 404 | 0.8% | 0.7% | 0.9% |
| Computer Paper | 8 | 0.0% | 0.0% | 0.0% |
| Mixed Low Grade | 5,104 | 10.0% | 9.4% | 10.6% |
| Phone Books | 66 | 0.1% | 0.1% | 0.2% |
| Milk/Juice Polycoats | 414 | 0.8% | 0.7% | 0.9% |
| Frozen Food Polycoats | 176 | 0.3% | 0.3% | 0.4% |
| Compostable/Soiled | 3,401 | 6.7% | 6.3% | 7.0% |
| Paper/Other Materials | 792 | 1.6% | 1.3% | 1.8% |
| Other Paper | 66 | 0.1% | 0.1% | 0.2% |
| ***Plastic*** | **5,589** | **11.0%** | | |
| PET Pop and Liquor | 154 | 0.3% | 0.3% | 0.3% |
| Other PET Bottles | 69 | 0.1% | 0.1% | 0.2% |
| HDPE Milk and Juice | 92 | 0.2% | 0.2% | 0.2% |
| Other HDPE Bottles | 218 | 0.4% | 0.4% | 0.5% |
| Other Plastic Bottles | 95 | 0.2% | 0.2% | 0.2% |
| Jars and Tubs | 312 | 0.6% | 0.6% | 0.7% |
| Expanded Polystyrene | 425 | 0.8% | 0.4% | 1.3% |
| Other Rigid Packaging | 630 | 1.2% | 1.1% | 1.3% |
| Grocery/Bread Bags | 700 | 1.4% | 1.3% | 1.5% |
| Garbage Bags | 622 | 1.2% | 1.1% | 1.4% |
| Other Film | 1,407 | 2.8% | 2.6% | 2.9% |
| Plastic Products | 409 | 0.8% | 0.7% | 0.9% |
| Plastic/Other Materials | 454 | 0.9% | 0.7% | 1.1% |
| ***Glass*** | **1,458** | **2.9%** | | |
| Clear Beverage | 333 | 0.7% | 0.5% | 0.8% |
| Green Beverage | 280 | 0.6% | 0.4% | 0.7% |
| Brown Beverage | 260 | 0.5% | 0.4% | 0.6% |
| Container Glass | 395 | 0.8% | 0.7% | 0.9% |
| Fluorescent Tubes | 3 | 0.0% | 0.0% | 0.0% |
| Other Glass | 188 | 0.4% | 0.3% | 0.5% |
| ***Metal*** | **1,928** | **3.8%** | | |
| Aluminum Cans | 134 | 0.3% | 0.2% | 0.3% |
| Alum. Foil/Containers | 141 | 0.3% | 0.2% | 0.3% |
| Other Aluminum | 8 | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 21 | 0.0% | 0.0% | 0.1% |
| Tin Food Cans | 573 | 1.1% | 1.0% | 1.3% |
| Empty Aerosol Cans | 92 | 0.2% | 0.2% | 0.2% |
| Other Ferrous | 409 | 0.8% | 0.7% | 0.9% |
| Mixed Metals/Materials | 550 | 1.1% | 0.6% | 1.5% |
| Motor Oil Filters | 0 | 0.0% | 0.0% | 0.0% |
| **Total Tons** | **50,898** | | | |
| **Sample Total** | **121** | | | |

| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Organics*** | **15,488** | **30.4%** | | |
| Pallets | 0 | 0.0% | 0.0% | 0.0% |
| Crates/Boxes | 1 | 0.0% | 0.0% | 0.0% |
| Leaves and Grass | 658 | 1.3% | 0.9% | 1.7% |
| Prunings | 200 | 0.4% | 0.2% | 0.5% |
| Food | 14,630 | 28.7% | 27.6% | 29.9% |
| ***Other Materials*** | **9,767** | **19.2%** | | |
| Textiles/Clothing | 863 | 1.7% | 1.5% | 1.9% |
| Carpet/Upholstery | 696 | 1.4% | 1.0% | 1.7% |
| Leather | 81 | 0.2% | 0.1% | 0.2% |
| Disposable Diapers | 2,187 | 4.3% | 3.8% | 4.8% |
| Animal By-Products | 4,215 | 8.3% | 7.4% | 9.2% |
| Rubber Products | 118 | 0.2% | 0.2% | 0.3% |
| Tires | 55 | 0.1% | 0.0% | 0.3% |
| Ash | 182 | 0.4% | 0.1% | 0.6% |
| Furniture | 213 | 0.4% | 0.0% | 0.9% |
| Mattresses | 0 | 0.0% | 0.0% | 0.0% |
| Small Appliances | 121 | 0.2% | 0.1% | 0.3% |
| A/V Equipment | 251 | 0.5% | 0.2% | 0.8% |
| Ceramics/Porcelain | 131 | 0.3% | 0.2% | 0.4% |
| Non-distinct Fines | 292 | 0.6% | 0.4% | 0.8% |
| Misc. Organics | 178 | 0.3% | 0.2% | 0.5% |
| Misc. Inorganics | 184 | 0.4% | 0.3% | 0.5% |
| ***CDL Wastes*** | **2,440** | **4.8%** | | |
| Dimension Lumber | 566 | 1.1% | 0.6% | 1.6% |
| Other Untreated Wood | 128 | 0.3% | 0.1% | 0.4% |
| Treated Wood | 316 | 0.6% | 0.4% | 0.8% |
| Contaminated Wood | 145 | 0.3% | 0.1% | 0.4% |
| New Gypsum Scrap | 0 | 0.0% | 0.0% | 0.0% |
| Demo Gypsum Scrap | 101 | 0.2% | 0.1% | 0.3% |
| Fiberglass Insulation | 1 | 0.0% | 0.0% | 0.0% |
| Rock/Concrete/Brick | 558 | 1.1% | 0.0% | 2.4% |
| Asphaltic Roofing | 128 | 0.3% | 0.0% | 0.5% |
| Other Construction Debris | 175 | 0.3% | 0.1% | 0.6% |
| Sand/Soil/Dirt | 322 | 0.6% | 0.3% | 1.0% |
| ***Hazardous*** | **167** | **0.3%** | | |
| Latex Paints | 32 | 0.1% | 0.0% | 0.1% |
| Hazardous Adhesives/Glues | 4 | 0.0% | 0.0% | 0.0% |
| NonHazardous Adhesives/Gl | 18 | 0.0% | 0.0% | 0.1% |
| Oil-based Paints/Solvents | 0 | 0.0% | 0.0% | 0.0% |
| Cleaners | 1 | 0.0% | 0.0% | 0.0% |
| Pesticides/Herbicides | 1 | 0.0% | 0.0% | 0.0% |
| Dry-Cell Batteries | 35 | 0.1% | 0.0% | 0.1% |
| Wet-Cell Batteries | 0 | 0.0% | 0.0% | 0.0% |
| Gasoline/Kerosene | 0 | 0.0% | 0.0% | 0.0% |
| Motor Oil/Diesel Oil | 5 | 0.0% | 0.0% | 0.0% |
| Asbestos | 1 | 0.0% | 0.0% | 0.0% |
| Explosives | 0 | 0.0% | 0.0% | 0.0% |
| Other Hazardous Chemicals | 16 | 0.0% | 0.0% | 0.1% |
| Other NonHazardous Chemi | 54 | 0.1% | 0.1% | 0.1% |

## Table 4-14 Composition by Weight: Single-family South
## (May 1998 – April 1999)

*Calculated at the 90% confidence interval*

| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Paper*** | **7,599** | **23.4%** | | |
| Newspaper | 883 | 2.7% | 2.4% | 3.0% |
| OCC/Kraft, unwaxed | 876 | 2.7% | 2.5% | 2.9% |
| OCC/Kraft, waxed | 2 | 0.0% | 0.0% | 0.0% |
| Office Paper | 144 | 0.4% | 0.4% | 0.5% |
| Computer Paper | 3 | 0.0% | 0.0% | 0.0% |
| Mixed Low Grade | 2,716 | 8.4% | 7.9% | 8.9% |
| Phone Books | 59 | 0.2% | 0.1% | 0.3% |
| Milk/Juice Polycoats | 168 | 0.5% | 0.5% | 0.6% |
| Frozen Food Polycoats | 99 | 0.3% | 0.3% | 0.3% |
| Compostable/Soiled | 2,303 | 7.1% | 6.8% | 7.4% |
| Paper/Other Materials | 332 | 1.0% | 0.9% | 1.1% |
| Other Paper | 14 | 0.0% | 0.0% | 0.1% |
| ***Plastic*** | **3,441** | **10.6%** | | |
| PET Pop and Liquor | 130 | 0.4% | 0.4% | 0.4% |
| Other PET Bottles | 52 | 0.2% | 0.1% | 0.2% |
| HDPE Milk and Juice | 82 | 0.3% | 0.2% | 0.3% |
| Other HDPE Bottles | 128 | 0.4% | 0.4% | 0.4% |
| Other Plastic Bottles | 59 | 0.2% | 0.2% | 0.2% |
| Jars and Tubs | 148 | 0.5% | 0.4% | 0.5% |
| Expanded Polystyrene | 241 | 0.7% | 0.7% | 0.8% |
| Other Rigid Packaging | 296 | 0.9% | 0.8% | 1.0% |
| Grocery/Bread Bags | 544 | 1.7% | 1.6% | 1.8% |
| Garbage Bags | 417 | 1.3% | 1.2% | 1.4% |
| Other Film | 852 | 2.6% | 2.5% | 2.8% |
| Plastic Products | 309 | 1.0% | 0.8% | 1.1% |
| Plastic/Other Materials | 182 | 0.6% | 0.4% | 0.7% |
| ***Glass*** | **1,512** | **4.7%** | | |
| Clear Beverage | 496 | 1.5% | 1.3% | 1.8% |
| Green Beverage | 246 | 0.8% | 0.6% | 0.9% |
| Brown Beverage | 238 | 0.7% | 0.6% | 0.9% |
| Container Glass | 407 | 1.3% | 1.1% | 1.4% |
| Fluorescent Tubes | 4 | 0.0% | 0.0% | 0.0% |
| Other Glass | 121 | 0.4% | 0.3% | 0.4% |
| ***Metal*** | **1,491** | **4.6%** | | |
| Aluminum Cans | 166 | 0.5% | 0.5% | 0.6% |
| Alum. Foil/Containers | 103 | 0.3% | 0.3% | 0.4% |
| Other Aluminum | 21 | 0.1% | 0.0% | 0.1% |
| Other Nonferrous | 26 | 0.1% | 0.0% | 0.1% |
| Tin Food Cans | 512 | 1.6% | 1.5% | 1.7% |
| Empty Aerosol Cans | 71 | 0.2% | 0.2% | 0.2% |
| Other Ferrous | 360 | 1.1% | 0.3% | 1.9% |
| Mixed Metals/Materials | 215 | 0.7% | 0.4% | 0.9% |
| Motor Oil Filters | 16 | 0.1% | 0.0% | 0.1% |
| **Total Tons** | **32,477** | | | |
| **Sample Total** | **120** | | | |

| | Tons | Mean | Low | High |
|---|---|---|---|---|
| ***Organics*** | **11,653** | **35.9%** | | |
| Pallets | 0 | 0.0% | 0.0% | 0.0% |
| Crates/Boxes | 17 | 0.1% | 0.0% | 0.1% |
| Leaves and Grass | 684 | 2.1% | 1.3% | 2.9% |
| Prunings | 96 | 0.3% | 0.2% | 0.4% |
| Food | 10,856 | 33.4% | 32.1% | 34.7% |
| ***Other Materials*** | **5,743** | **17.7%** | | |
| Textiles/Clothing | 654 | 2.0% | 1.8% | 2.2% |
| Carpet/Upholstery | 475 | 1.5% | 1.0% | 1.9% |
| Leather | 68 | 0.2% | 0.1% | 0.3% |
| Disposable Diapers | 2,058 | 6.3% | 5.8% | 6.9% |
| Animal By-Products | 1,534 | 4.7% | 4.0% | 5.5% |
| Rubber Products | 60 | 0.2% | 0.1% | 0.3% |
| Tires | 105 | 0.3% | 0.0% | 0.7% |
| Ash | 108 | 0.3% | 0.2% | 0.5% |
| Furniture | 139 | 0.4% | 0.0% | 0.8% |
| Mattresses | 0 | 0.0% | 0.0% | 0.0% |
| Small Appliances | 104 | 0.3% | 0.2% | 0.5% |
| A/V Equipment | 34 | 0.1% | 0.1% | 0.1% |
| Ceramics/Porcelain | 51 | 0.2% | 0.1% | 0.2% |
| Non-distinct Fines | 105 | 0.3% | 0.2% | 0.4% |
| Misc. Organics | 123 | 0.4% | 0.3% | 0.5% |
| Misc. Inorganics | 124 | 0.4% | 0.2% | 0.6% |
| ***CDL Wastes*** | **863** | **2.7%** | | |
| Dimension Lumber | 125 | 0.4% | 0.3% | 0.5% |
| Other Untreated Wood | 54 | 0.2% | 0.1% | 0.3% |
| Treated Wood | 120 | 0.4% | 0.2% | 0.5% |
| Contaminated Wood | 53 | 0.2% | 0.0% | 0.3% |
| New Gypsum Scrap | 3 | 0.0% | 0.0% | 0.0% |
| Demo Gypsum Scrap | 122 | 0.4% | 0.2% | 0.6% |
| Fiberglass Insulation | 2 | 0.0% | 0.0% | 0.0% |
| Rock/Concrete/Brick | 97 | 0.3% | 0.0% | 0.6% |
| Asphaltic Roofing | 58 | 0.2% | 0.0% | 0.3% |
| Other Construction Debris | 85 | 0.3% | 0.1% | 0.4% |
| Sand/Soil/Dirt | 143 | 0.4% | 0.2% | 0.7% |
| ***Hazardous*** | **174** | **0.5%** | | |
| Latex Paints | 13 | 0.0% | 0.0% | 0.1% |
| Hazardous Adhesives/Glues | 1 | 0.0% | 0.0% | 0.0% |
| NonHazardous Adhesives/Gl | 29 | 0.1% | 0.0% | 0.2% |
| Oil-based Paints/Solvents | 2 | 0.0% | 0.0% | 0.0% |
| Cleaners | 3 | 0.0% | 0.0% | 0.0% |
| Pesticides/Herbicides | 0 | 0.0% | 0.0% | 0.0% |
| Dry-Cell Batteries | 29 | 0.1% | 0.1% | 0.1% |
| Wet-Cell Batteries | 0 | 0.0% | 0.0% | 0.0% |
| Gasoline/Kerosene | 1 | 0.0% | 0.0% | 0.0% |
| Motor Oil/Diesel Oil | 35 | 0.1% | 0.0% | 0.2% |
| Asbestos | 0 | 0.0% | 0.0% | 0.0% |
| Explosives | 0 | 0.0% | 0.0% | 0.0% |
| Other Hazardous Chemicals | 14 | 0.0% | 0.0% | 0.1% |
| Other NonHazardous Chemi | 46 | 0.1% | 0.1% | 0.2% |

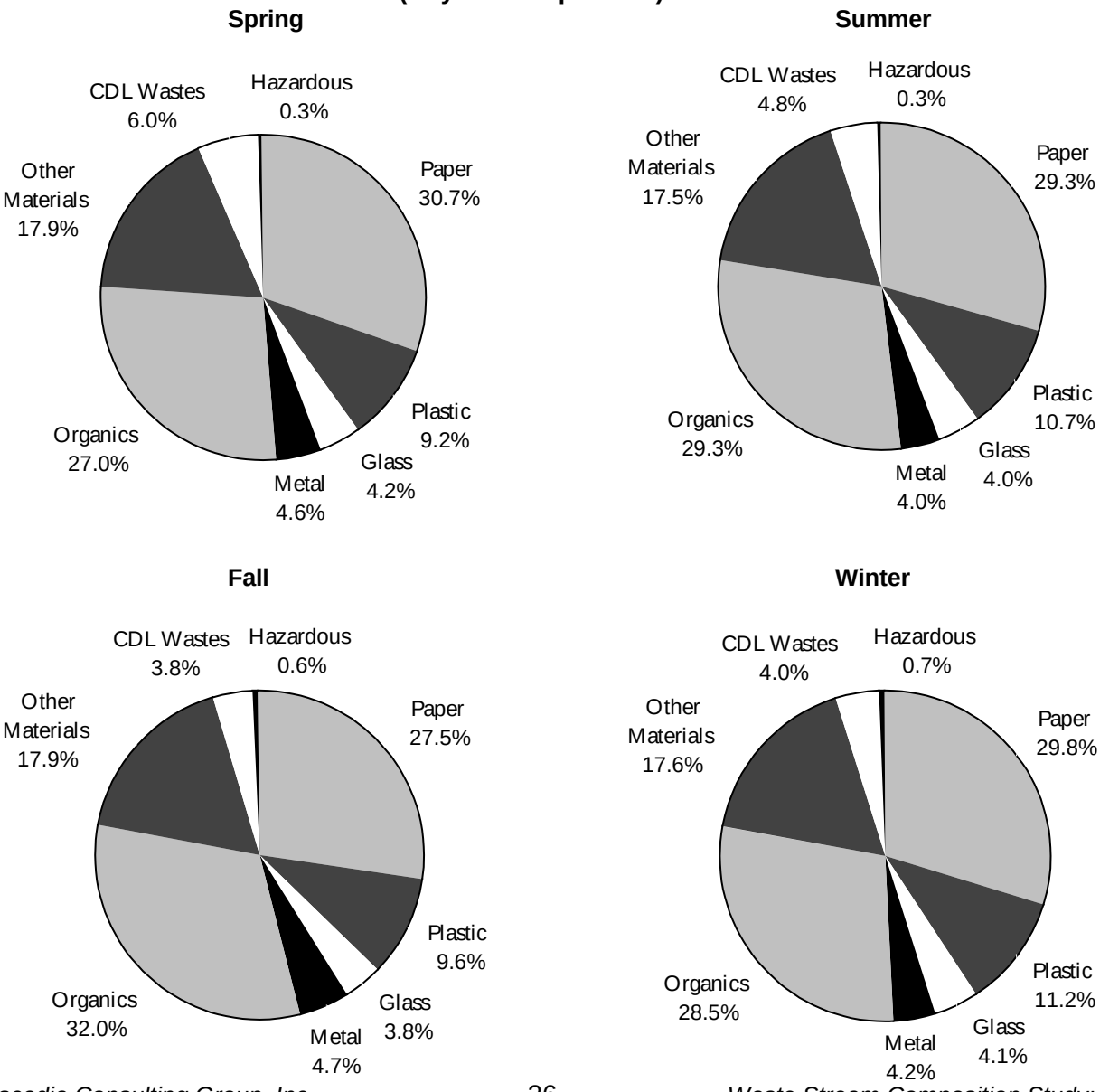
## 4.6 By Season

Waste composition results were examined for seasonal variations. Samples were classified into four seasons according to the month in which they were collected. The groupings and number of samples obtained in each were as follows:

- *Spring*: May 1998, March – April 1999 92 samples
- *Summer*: June – August 1999 85 samples
- *Fall*: September – November 1999 88 samples
- *Winter*: December 1998 – February 1999 95 samples

Although no tests for significance were performed on the composition results by season, the results appear to be quite similar across the seasons for both the broad waste categories and the largest components disposed. Figure 4-4 summarizes the results of the broad waste categories by season.

**Figure 4-4 Composition Summary: by Season**
**(May 1998 – April 1999)**



### 4.6.1 Largest Components

Food, mixed low grade paper, compostable/soiled paper, and animal by-products accounted for about half the waste stream each season, as illustrated in Table 4-15. The combined percentages of these four components ranged from 48.1% to 51.5%. In the spring, a high percentage of newspaper was also disposed (5.3%).

**Table 4-15 Largest Components by Season**
**(May 1998 – April 1999)**

| | Spring | Summer | Fall | Winter |
|---|---|---|---|---|
| Food | 24.3% | 26.2% | 29.6% | 26.2% |
| Mixed Low Grade Paper | 10.2% | 11.2% | 10.5% | 10.4% |
| Compostable/soiled Paper | 6.5% | 5.8% | 5.8% | 6.4% |
| Animal by-products | 7.1% | 5.6% | 5.6% | 7.5% |
| Newspaper | 5.3% | | | |
| **Sum of largest components** | **53.4%** | **48.8%** | **51.5%** | **50.5%** |

The tables presenting the detailed composition results for each season are presented in Table 4-16 through Table 4-19.

## Table 4-16 Composition by Weight: Spring
## (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Mean | Low | High | | Mean | Low | High |
|---|---|---|---|---|---|---|---|
| ***Paper*** | **30.7%** | | | ***Organics*** | **27.0%** | | |
| Newspaper | 5.3% | 4.6% | 6.0% | Pallets | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, unwaxed | 4.3% | 3.5% | 5.1% | Crates/Boxes | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, waxed | 0.3% | 0.0% | 0.9% | Leaves and Grass | 2.2% | 1.5% | 2.9% |
| Office Paper | 0.8% | 0.6% | 1.0% | Prunings | 0.5% | 0.3% | 0.7% |
| Computer Paper | 0.0% | 0.0% | 0.1% | Food | 24.3% | 22.9% | 25.7% |
| Mixed Low Grade | 10.2% | 9.5% | 10.9% | ***Other Materials*** | **17.9%** | | |
| Phone Books | 0.8% | 0.5% | 1.1% | Textiles/Clothing | 2.0% | 1.7% | 2.2% |
| Milk/Juice Polycoats | 0.6% | 0.5% | 0.7% | Carpet/Upholstery | 0.8% | 0.6% | 1.0% |
| Frozen Food Polycoats | 0.3% | 0.2% | 0.3% | Leather | 0.1% | 0.1% | 0.2% |
| Compostable/Soiled | 6.5% | 6.0% | 7.0% | Disposable Diapers | 3.6% | 3.1% | 4.2% |
| Paper/Other Materials | 1.4% | 1.2% | 1.6% | Animal By-Products | 7.1% | 6.0% | 8.2% |
| Other Paper | 0.2% | 0.1% | 0.2% | Rubber Products | 0.7% | 0.2% | 1.2% |
| ***Plastic*** | **9.2%** | | | Tires | 0.2% | 0.0% | 0.5% |
| PET Pop and Liquor | 0.3% | 0.2% | 0.3% | Ash | 0.2% | 0.1% | 0.3% |
| Other PET Bottles | 0.3% | 0.3% | 0.4% | Furniture | 0.3% | 0.2% | 0.4% |
| HDPE Milk and Juice | 0.2% | 0.2% | 0.3% | Mattresses | 0.9% | 0.1% | 1.7% |
| Other HDPE Bottles | 0.5% | 0.4% | 0.5% | Small Appliances | 0.0% | 0.0% | 0.0% |
| Other Plastic Bottles | 0.1% | 0.1% | 0.2% | A/V Equipment | 0.3% | 0.2% | 0.5% |
| Jars and Tubs | 0.5% | 0.5% | 0.6% | Ceramics/Porcelain | 0.4% | 0.0% | 0.7% |
| Expanded Polystyrene | 0.4% | 0.4% | 0.5% | Non-distinct Fines | 0.3% | 0.2% | 0.4% |
| Other Rigid Packaging | 0.9% | 0.8% | 1.0% | Misc. Organics | 0.7% | 0.4% | 0.9% |
| Grocery/Bread Bags | 1.2% | 1.1% | 1.3% | Misc. Inorganics | 0.4% | 0.2% | 0.6% |
| Garbage Bags | 1.4% | 1.2% | 1.6% | ***CDL Wastes*** | **6.0%** | | |
| Other Film | 2.1% | 1.9% | 2.3% | Dimension Lumber | 1.2% | 0.6% | 1.7% |
| Plastic Products | 0.9% | 0.7% | 1.1% | Other Untreated Wood | 0.1% | 0.0% | 0.1% |
| Plastic/Other Materials | 0.3% | 0.2% | 0.5% | Treated Wood | 0.6% | 0.4% | 0.9% |
| ***Glass*** | **4.2%** | | | Contaminated Wood | 0.3% | 0.1% | 0.4% |
| Clear Beverage | 1.2% | 1.0% | 1.5% | New Gypsum Scrap | 0.0% | 0.0% | 0.0% |
| Green Beverage | 0.9% | 0.7% | 1.1% | Demo Gypsum Scrap | 0.6% | 0.1% | 1.2% |
| Brown Beverage | 0.7% | 0.6% | 0.9% | Fiberglass Insulation | 0.1% | 0.0% | 0.2% |
| Container Glass | 0.9% | 0.7% | 1.0% | Rock/Concrete/Brick | 0.6% | 0.1% | 1.1% |
| Fluorescent Tubes | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 0.2% | 0.1% | 0.3% |
| Other Glass | 0.5% | 0.3% | 0.7% | Other Construction Debris | 0.4% | 0.2% | 0.7% |
| ***Metal*** | **4.6%** | | | Sand/Soil/Dirt | 1.9% | 1.1% | 2.6% |
| Aluminum Cans | 0.4% | 0.4% | 0.5% | ***Hazardous*** | **0.3%** | | |
| Alum. Foil/Containers | 0.3% | 0.2% | 0.3% | Latex Paints | 0.0% | 0.0% | 0.0% |
| Other Aluminum | 0.0% | 0.0% | 0.0% | Hazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 0.1% | 0.0% | 0.1% | NonHazardous Adhesives/Glues | 0.0% | 0.0% | 0.1% |
| Tin Food Cans | 1.1% | 1.0% | 1.2% | Oil-based Paints/Solvents | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 0.2% | 0.2% | 0.2% | Cleaners | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 1.3% | 0.5% | 2.0% | Pesticides/Herbicides | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 1.3% | 0.7% | 1.8% | Dry-Cell Batteries | 0.1% | 0.1% | 0.1% |
| Motor Oil Filters | 0.0% | 0.0% | 0.0% | Wet-Cell Batteries | 0.0% | 0.0% | 0.0% |
| | | | | Gasoline/Kerosene | 0.0% | 0.0% | 0.0% |
| | | | | Motor Oil/Diesel Oil | 0.0% | 0.0% | 0.0% |
| | | | | Asbestos | 0.0% | 0.0% | 0.0% |
| | | | | Explosives | 0.0% | 0.0% | 0.0% |
| | | | | Other Hazardous Chemicals | 0.0% | 0.0% | 0.1% |
| **Sample Count** | **92** | | | Other NonHazardous Chemical | 0.1% | 0.0% | 0.1% |

## Table 4-17 Composition by Weight: Summer
## (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Mean | Low | High | | Mean | Low | High |
|---|---|---|---|---|---|---|---|
| ***Paper*** | **29.3%** | | | ***Organics*** | **29.3%** | | |
| Newspaper | 4.2% | 3.6% | 4.8% | Pallets | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, unwaxed | 4.6% | 4.0% | 5.1% | Crates/Boxes | 0.1% | 0.0% | 0.2% |
| OCC/Kraft, waxed | 0.1% | 0.0% | 0.2% | Leaves and Grass | 2.9% | 2.0% | 3.9% |
| Office Paper | 0.7% | 0.5% | 0.8% | Prunings | 0.1% | 0.0% | 0.2% |
| Computer Paper | 0.0% | 0.0% | 0.0% | Food | 26.2% | 24.7% | 27.7% |
| Mixed Low Grade | 11.2% | 10.2% | 12.2% | ***Other Materials*** | **17.5%** | | |
| Phone Books | 0.5% | 0.2% | 0.9% | Textiles/Clothing | 2.2% | 1.8% | 2.6% |
| Milk/Juice Polycoats | 0.6% | 0.4% | 0.8% | Carpet/Upholstery | 2.5% | 1.6% | 3.4% |
| Frozen Food Polycoats | 0.3% | 0.3% | 0.4% | Leather | 0.1% | 0.1% | 0.2% |
| Compostable/Soiled | 5.8% | 5.3% | 6.3% | Disposable Diapers | 3.3% | 2.6% | 4.0% |
| Paper/Other Materials | 1.2% | 1.1% | 1.4% | Animal By-Products | 5.6% | 4.6% | 6.6% |
| Other Paper | 0.1% | 0.0% | 0.1% | Rubber Products | 0.2% | 0.1% | 0.3% |
| ***Plastic*** | **10.7%** | | | Tires | 0.0% | 0.0% | 0.1% |
| PET Pop and Liquor | 0.5% | 0.4% | 0.5% | Ash | 0.4% | 0.1% | 0.7% |
| Other PET Bottles | 0.1% | 0.1% | 0.1% | Furniture | 0.7% | 0.2% | 1.2% |
| HDPE Milk and Juice | 0.3% | 0.2% | 0.3% | Mattresses | 0.0% | 0.0% | 0.0% |
| Other HDPE Bottles | 0.4% | 0.3% | 0.4% | Small Appliances | 0.3% | 0.1% | 0.4% |
| Other Plastic Bottles | 0.2% | 0.2% | 0.2% | A/V Equipment | 0.5% | 0.2% | 0.9% |
| Jars and Tubs | 0.5% | 0.4% | 0.6% | Ceramics/Porcelain | 0.3% | 0.1% | 0.6% |
| Expanded Polystyrene | 1.1% | 0.2% | 2.0% | Non-distinct Fines | 0.5% | 0.3% | 0.7% |
| Other Rigid Packaging | 1.0% | 0.9% | 1.1% | Misc. Organics | 0.3% | 0.2% | 0.4% |
| Grocery/Bread Bags | 1.7% | 1.5% | 1.9% | Misc. Inorganics | 0.5% | 0.4% | 0.7% |
| Garbage Bags | 1.3% | 1.1% | 1.6% | ***CDL Wastes*** | **4.8%** | | |
| Other Film | 2.4% | 2.2% | 2.6% | Dimension Lumber | 1.5% | 0.6% | 2.4% |
| Plastic Products | 0.9% | 0.8% | 1.1% | Other Untreated Wood | 0.3% | 0.1% | 0.5% |
| Plastic/Other Materials | 0.4% | 0.3% | 0.6% | Treated Wood | 0.9% | 0.4% | 1.3% |
| ***Glass*** | **4.0%** | | | Contaminated Wood | 0.3% | 0.1% | 0.5% |
| Clear Beverage | 1.1% | 0.8% | 1.3% | New Gypsum Scrap | 0.0% | 0.0% | 0.0% |
| Green Beverage | 0.8% | 0.6% | 1.0% | Demo Gypsum Scrap | 0.7% | 0.0% | 1.3% |
| Brown Beverage | 1.1% | 0.4% | 1.7% | Fiberglass Insulation | 0.0% | 0.0% | 0.0% |
| Container Glass | 0.8% | 0.6% | 0.9% | Rock/Concrete/Brick | 0.5% | 0.1% | 0.9% |
| Fluorescent Tubes | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 0.1% | 0.0% | 0.2% |
| Other Glass | 0.2% | 0.2% | 0.3% | Other Construction Debris | 0.2% | 0.0% | 0.3% |
| ***Metal*** | **4.0%** | | | Sand/Soil/Dirt | 0.3% | 0.1% | 0.6% |
| Aluminum Cans | 0.6% | 0.5% | 0.6% | ***Hazardous*** | **0.3%** | | |
| Alum. Foil/Containers | 0.2% | 0.1% | 0.2% | Latex Paints | 0.1% | 0.0% | 0.1% |
| Other Aluminum | 0.0% | 0.0% | 0.0% | Hazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 0.0% | 0.0% | 0.1% | NonHazardous Adhesives/Glue | 0.0% | 0.0% | 0.0% |
| Tin Food Cans | 1.2% | 1.0% | 1.3% | Oil-based Paints/Solvents | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 0.2% | 0.1% | 0.2% | Cleaners | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 0.8% | 0.6% | 1.0% | Pesticides/Herbicides | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 1.1% | 0.5% | 1.7% | Dry-Cell Batteries | 0.1% | 0.1% | 0.1% |
| Motor Oil Filters | 0.0% | 0.0% | 0.1% | Wet-Cell Batteries | 0.0% | 0.0% | 0.0% |
| | | | | Gasoline/Kerosene | 0.0% | 0.0% | 0.0% |
| | | | | Motor Oil/Diesel Oil | 0.0% | 0.0% | 0.0% |
| | | | | Asbestos | 0.0% | 0.0% | 0.0% |
| | | | | Explosives | 0.0% | 0.0% | 0.0% |
| | | | | Other Hazardous Chemicals | 0.1% | 0.0% | 0.1% |
| **Sample Count** | **85** | | | Other NonHazardous Chemical | 0.1% | 0.0% | 0.1% |

## Table 4-18 Composition by Weight: Fall
## (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Mean | Low | High | | Mean | Low | High |
|---|---|---|---|---|---|---|---|
| ***Paper*** | **27.5%** | | | ***Organics*** | **32.0%** | | |
| Newspaper | 4.6% | 3.9% | 5.3% | Pallets | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, unwaxed | 4.0% | 3.7% | 4.2% | Crates/Boxes | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, waxed | 0.1% | 0.0% | 0.1% | Leaves and Grass | 2.3% | 1.2% | 3.3% |
| Office Paper | 0.6% | 0.4% | 0.8% | Prunings | 0.1% | 0.1% | 0.2% |
| Computer Paper | 0.0% | 0.0% | 0.0% | Food | 29.6% | 28.3% | 30.8% |
| Mixed Low Grade | 10.5% | 9.7% | 11.2% | ***Other Materials*** | **17.9%** | | |
| Phone Books | 0.1% | 0.0% | 0.2% | Textiles/Clothing | 2.1% | 1.8% | 2.4% |
| Milk/Juice Polycoats | 0.6% | 0.5% | 0.7% | Carpet/Upholstery | 1.7% | 1.3% | 2.2% |
| Frozen Food Polycoats | 0.3% | 0.2% | 0.3% | Leather | 0.1% | 0.0% | 0.2% |
| Compostable/Soiled | 5.8% | 5.5% | 6.2% | Disposable Diapers | 4.5% | 4.0% | 5.1% |
| Paper/Other Materials | 0.9% | 0.7% | 1.1% | Animal By-Products | 5.6% | 4.7% | 6.5% |
| Other Paper | 0.1% | 0.0% | 0.1% | Rubber Products | 0.2% | 0.1% | 0.2% |
| ***Plastic*** | **9.6%** | | | Tires | 0.0% | 0.0% | 0.0% |
| PET Pop and Liquor | 0.4% | 0.4% | 0.5% | Ash | 0.4% | 0.1% | 0.7% |
| Other PET Bottles | 0.1% | 0.1% | 0.1% | Furniture | 0.5% | 0.0% | 0.9% |
| HDPE Milk and Juice | 0.3% | 0.2% | 0.3% | Mattresses | 0.0% | 0.0% | 0.0% |
| Other HDPE Bottles | 0.4% | 0.3% | 0.5% | Small Appliances | 0.6% | 0.4% | 0.9% |
| Other Plastic Bottles | 0.1% | 0.1% | 0.2% | A/V Equipment | 0.6% | 0.0% | 1.2% |
| Jars and Tubs | 0.4% | 0.3% | 0.4% | Ceramics/Porcelain | 0.1% | 0.0% | 0.2% |
| Expanded Polystyrene | 0.5% | 0.4% | 0.5% | Non-distinct Fines | 0.7% | 0.5% | 0.9% |
| Other Rigid Packaging | 0.8% | 0.7% | 0.9% | Misc. Organics | 0.6% | 0.3% | 1.0% |
| Grocery/Bread Bags | 1.2% | 1.1% | 1.3% | Misc. Inorganics | 0.1% | 0.1% | 0.2% |
| Garbage Bags | 1.1% | 1.0% | 1.2% | ***CDL Wastes*** | **3.8%** | | |
| Other Film | 2.7% | 2.5% | 2.9% | Dimension Lumber | 0.5% | 0.2% | 0.8% |
| Plastic Products | 0.7% | 0.6% | 0.8% | Other Untreated Wood | 0.5% | 0.2% | 0.7% |
| Plastic/Other Materials | 0.8% | 0.5% | 1.2% | Treated Wood | 0.8% | 0.4% | 1.1% |
| ***Glass*** | **3.8%** | | | Contaminated Wood | 0.2% | 0.1% | 0.3% |
| Clear Beverage | 0.9% | 0.7% | 1.1% | New Gypsum Scrap | 0.0% | 0.0% | 0.0% |
| Green Beverage | 0.7% | 0.5% | 0.9% | Demo Gypsum Scrap | 0.1% | 0.0% | 0.3% |
| Brown Beverage | 1.0% | 0.7% | 1.3% | Fiberglass Insulation | 0.0% | 0.0% | 0.1% |
| Container Glass | 0.9% | 0.8% | 1.0% | Rock/Concrete/Brick | 0.2% | 0.1% | 0.3% |
| Fluorescent Tubes | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 0.3% | 0.0% | 0.6% |
| Other Glass | 0.3% | 0.2% | 0.4% | Other Construction Debris | 0.3% | 0.0% | 0.5% |
| ***Metal*** | **4.7%** | | | Sand/Soil/Dirt | 1.0% | 0.1% | 1.8% |
| Aluminum Cans | 0.5% | 0.4% | 0.6% | ***Hazardous*** | **0.6%** | | |
| Alum. Foil/Containers | 0.2% | 0.2% | 0.2% | Latex Paints | 0.0% | 0.0% | 0.1% |
| Other Aluminum | 0.1% | 0.0% | 0.1% | Hazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 0.1% | 0.0% | 0.2% | NonHazardous Adhesives/Glue | 0.1% | 0.0% | 0.2% |
| Tin Food Cans | 1.2% | 1.1% | 1.4% | Oil-based Paints/Solvents | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 0.2% | 0.2% | 0.2% | Cleaners | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 1.5% | 0.3% | 2.7% | Pesticides/Herbicides | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 0.8% | 0.4% | 1.3% | Dry-Cell Batteries | 0.2% | 0.0% | 0.3% |
| Motor Oil Filters | 0.0% | 0.0% | 0.1% | Wet-Cell Batteries | 0.0% | 0.0% | 0.0% |
| | | | | Gasoline/Kerosene | 0.0% | 0.0% | 0.0% |
| | | | | Motor Oil/Diesel Oil | 0.1% | 0.0% | 0.2% |
| | | | | Asbestos | 0.0% | 0.0% | 0.0% |
| | | | | Explosives | 0.0% | 0.0% | 0.0% |
| | | | | Other Hazardous Chemicals | 0.0% | 0.0% | 0.0% |
| **Sample Count** | **88** | | | Other NonHazardous Chemical | 0.2% | 0.0% | 0.4% |

## Table 4-19 Composition by Weight: Winter
## (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Mean | Low | High | | Mean | Low | High |
|---|---|---|---|---|---|---|---|
| ***Paper*** | **29.8%** | | | ***Organics*** | **28.5%** | | |
| Newspaper | 4.6% | 4.1% | 5.1% | Pallets | 0.1% | 0.0% | 0.3% |
| OCC/Kraft, unwaxed | 4.4% | 3.8% | 5.0% | Crates/Boxes | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, waxed | 0.0% | 0.0% | 0.0% | Leaves and Grass | 1.5% | 0.6% | 2.4% |
| Office Paper | 1.2% | 0.8% | 1.5% | Prunings | 0.7% | 0.5% | 1.0% |
| Computer Paper | 0.0% | 0.0% | 0.1% | Food | 26.2% | 25.0% | 27.4% |
| Mixed Low Grade | 10.4% | 9.6% | 11.1% | ***Other Materials*** | **17.6%** | | |
| Phone Books | 0.2% | 0.1% | 0.3% | Textiles/Clothing | 1.9% | 1.7% | 2.2% |
| Milk/Juice Polycoats | 0.7% | 0.7% | 0.8% | Carpet/Upholstery | 1.0% | 0.5% | 1.4% |
| Frozen Food Polycoats | 0.3% | 0.2% | 0.3% | Leather | 0.3% | 0.2% | 0.4% |
| Compostable/Soiled | 6.4% | 6.0% | 6.8% | Disposable Diapers | 4.2% | 3.7% | 4.7% |
| Paper/Other Materials | 1.4% | 1.2% | 1.6% | Animal By-Products | 7.5% | 6.1% | 8.9% |
| Other Paper | 0.1% | 0.0% | 0.1% | Rubber Products | 0.2% | 0.1% | 0.3% |
| ***Plastic*** | **11.2%** | | | Tires | 0.0% | 0.0% | 0.0% |
| PET Pop and Liquor | 0.4% | 0.3% | 0.5% | Ash | 0.1% | 0.0% | 0.1% |
| Other PET Bottles | 0.1% | 0.1% | 0.1% | Furniture | 0.5% | 0.0% | 1.1% |
| HDPE Milk and Juice | 0.3% | 0.2% | 0.3% | Mattresses | 0.5% | 0.0% | 1.2% |
| Other HDPE Bottles | 0.3% | 0.2% | 0.3% | Small Appliances | 0.3% | 0.2% | 0.5% |
| Other Plastic Bottles | 0.2% | 0.2% | 0.2% | A/V Equipment | 0.2% | 0.1% | 0.3% |
| Jars and Tubs | 0.6% | 0.6% | 0.7% | Ceramics/Porcelain | 0.2% | 0.1% | 0.4% |
| Expanded Polystyrene | 0.7% | 0.6% | 0.7% | Non-distinct Fines | 0.1% | 0.0% | 0.2% |
| Other Rigid Packaging | 1.2% | 1.1% | 1.3% | Misc. Organics | 0.2% | 0.1% | 0.2% |
| Grocery/Bread Bags | 1.6% | 1.5% | 1.7% | Misc. Inorganics | 0.3% | 0.2% | 0.4% |
| Garbage Bags | 1.2% | 1.1% | 1.4% | ***CDL Wastes*** | **4.0%** | | |
| Other Film | 2.6% | 2.3% | 2.8% | Dimension Lumber | 0.6% | 0.3% | 0.9% |
| Plastic Products | 0.9% | 0.8% | 1.1% | Other Untreated Wood | 0.3% | 0.1% | 0.5% |
| Plastic/Other Materials | 1.1% | 0.8% | 1.3% | Treated Wood | 0.4% | 0.2% | 0.5% |
| ***Glass*** | **4.1%** | | | Contaminated Wood | 0.0% | 0.0% | 0.1% |
| Clear Beverage | 0.9% | 0.7% | 1.1% | New Gypsum Scrap | 0.0% | 0.0% | 0.0% |
| Green Beverage | 0.9% | 0.6% | 1.1% | Demo Gypsum Scrap | 0.3% | 0.1% | 0.5% |
| Brown Beverage | 0.7% | 0.5% | 0.9% | Fiberglass Insulation | 0.0% | 0.0% | 0.0% |
| Container Glass | 1.0% | 0.9% | 1.1% | Rock/Concrete/Brick | 1.2% | 0.0% | 2.7% |
| Fluorescent Tubes | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 0.0% | 0.0% | 0.0% |
| Other Glass | 0.6% | 0.4% | 0.8% | Other Construction Debris | 0.3% | 0.0% | 0.5% |
| ***Metal*** | **4.2%** | | | Sand/Soil/Dirt | 0.9% | 0.5% | 1.4% |
| Aluminum Cans | 0.5% | 0.4% | 0.6% | ***Hazardous*** | **0.7%** | | |
| Alum. Foil/Containers | 0.3% | 0.3% | 0.4% | Latex Paints | 0.1% | 0.0% | 0.2% |
| Other Aluminum | 0.0% | 0.0% | 0.0% | Hazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 0.1% | 0.0% | 0.1% | NonHazardous Adhesives/Glue | 0.0% | 0.0% | 0.0% |
| Tin Food Cans | 1.6% | 1.4% | 1.8% | Oil-based Paints/Solvents | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 0.2% | 0.1% | 0.2% | Cleaners | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 0.9% | 0.6% | 1.3% | Pesticides/Herbicides | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 0.5% | 0.4% | 0.7% | Dry-Cell Batteries | 0.1% | 0.1% | 0.1% |
| Motor Oil Filters | 0.0% | 0.0% | 0.0% | Wet-Cell Batteries | 0.0% | 0.0% | 0.0% |
| | | | | Gasoline/Kerosene | 0.0% | 0.0% | 0.0% |
| | | | | Motor Oil/Diesel Oil | 0.0% | 0.0% | 0.0% |
| | | | | Asbestos | 0.0% | 0.0% | 0.0% |
| | | | | Explosives | 0.0% | 0.0% | 0.0% |
| | | | | Other Hazardous Chemicals | 0.4% | 0.0% | 1.0% |
| **Sample Count** | **95** | | | Other NonHazardous Chemical | 0.1% | 0.0% | 0.1% |

## 4.7 By Demographics

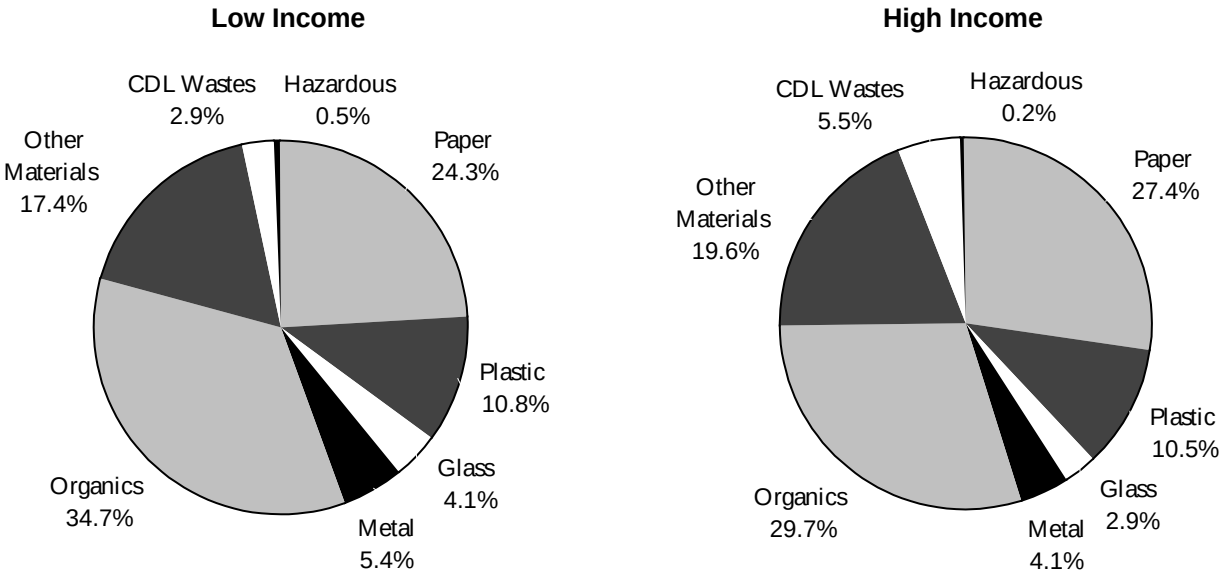
The single-family samples were grouped according to household income and size using Census tract information corresponding to the collection routes. The median income and the average household size was calculated for each route by first determining the proportion of each census block group area incorporated in the route. Then, the median household income and the average household size of each block group within the routes were identified, and a weighted average based on the population of each block group was used to calculate the median income and average household size for each route.

### 4.7.1 Income

The broad material categories for the low and high income households are shown below in Figure 4-5. The income levels were determined by first identifying the median household income for each route, then dividing the routes into quartiles. The low income group represents samples obtained from routes in the lowest quartile and the high income group represents samples obtained from routes in the uppermost quartile. A total of 56 samples were obtained from the low income routes and 59 samples were obtained from the high income routes.

The waste composition of both the low and the high income groups consisted mostly of paper and organics. Combined, these two categories accounted for 59.0% of the waste among the low income routes and 57.1% of the waste among the high income groups. Although no tests for significance were performed between the two subpopulations, a higher percentage of organics appears to be disposed among the low income routes while more CDL waste and paper were disposed among the high income routes.

**Figure 4-5 Composition Summary: by Household Income**
**(May 1998- April 1999)**



#### 4.7.1.1 Largest Components

Table 4-20 below shows the largest components for both the low and high income groupings. Food, mixed low grade paper, composatable/soiled paper, and animal by-products accounted for about half of the waste stream for both the low (58.5%) and the high (52.3%) income groups. The waste stream of the low income subpopulation also included a large percentage of disposable diapers.

**Table 4-20 Largest Components by Income**
**(May 1998 – April 1999)**

| | Low | High |
|---|---|---|
| Food | 32.8% | 27.6% |
| Mixed Low Grade Paper | 8.1% | 9.7% |
| Compostable/soiled Paper | 6.7% | 6.6% |
| Animal by-products | 5.1% | 8.4% |
| Disposable Diapers | 5.8% | |
| **Sum of largest components** | **58.5%** | **52.3%** |

Table 4-21 and Table 4-22 present the detailed composition results for the low and high income subpopulations.

## Table 4-21 Composition by Weight: Low Income (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Mean | Low | High | | Mean | Low | High |
|---|---|---|---|---|---|---|---|
| ***Paper*** | **24.3%** | | | ***Organics*** | **34.7%** | | |
| Newspaper | 3.3% | 2.8% | 3.9% | Pallets | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, unwaxed | 3.0% | 2.6% | 3.3% | Crates/Boxes | 0.1% | 0.0% | 0.3% |
| OCC/Kraft, waxed | 0.0% | 0.0% | 0.0% | Leaves and Grass | 1.5% | 0.9% | 2.1% |
| Office Paper | 0.6% | 0.5% | 0.7% | Prunings | 0.2% | 0.1% | 0.4% |
| Computer Paper | 0.0% | 0.0% | 0.0% | Food | 32.8% | 30.7% | 35.0% |
| Mixed Low Grade | 8.1% | 7.4% | 8.8% | ***Other Materials*** | **17.4%** | | |
| Phone Books | 0.2% | 0.0% | 0.4% | Textiles/Clothing | 1.9% | 1.6% | 2.2% |
| Milk/Juice Polycoats | 0.6% | 0.5% | 0.7% | Carpet/Upholstery | 1.1% | 0.6% | 1.5% |
| Frozen Food Polycoats | 0.3% | 0.3% | 0.4% | Leather | 0.2% | 0.1% | 0.3% |
| Compostable/Soiled | 6.7% | 6.2% | 7.1% | Disposable Diapers | 5.8% | 4.9% | 6.6% |
| Paper/Other Materials | 1.3% | 1.1% | 1.5% | Animal By-Products | 5.1% | 3.9% | 6.2% |
| Other Paper | 0.1% | 0.0% | 0.1% | Rubber Products | 0.3% | 0.1% | 0.5% |
| ***Plastic*** | **10.8%** | | | Tires | 0.2% | 0.0% | 0.6% |
| PET Pop and Liquor | 0.4% | 0.4% | 0.5% | Ash | 0.2% | 0.0% | 0.4% |
| Other PET Bottles | 0.2% | 0.1% | 0.2% | Furniture | 0.9% | 0.0% | 2.0% |
| HDPE Milk and Juice | 0.3% | 0.2% | 0.3% | Mattresses | 0.0% | 0.0% | 0.0% |
| Other HDPE Bottles | 0.4% | 0.3% | 0.4% | Small Appliances | 0.4% | 0.2% | 0.6% |
| Other Plastic Bottles | 0.2% | 0.1% | 0.2% | A/V Equipment | 0.1% | 0.0% | 0.2% |
| Jars and Tubs | 0.5% | 0.4% | 0.6% | Ceramics/Porcelain | 0.1% | 0.1% | 0.2% |
| Expanded Polystyrene | 0.8% | 0.7% | 0.9% | Non-distinct Fines | 0.5% | 0.2% | 0.8% |
| Other Rigid Packaging | 1.0% | 0.9% | 1.1% | Misc. Organics | 0.4% | 0.3% | 0.6% |
| Grocery/Bread Bags | 1.7% | 1.5% | 1.9% | Misc. Inorganics | 0.3% | 0.1% | 0.4% |
| Garbage Bags | 1.3% | 1.1% | 1.4% | ***CDL Wastes*** | **2.9%** | | |
| Other Film | 2.5% | 2.3% | 2.7% | Dimension Lumber | 0.6% | 0.3% | 0.8% |
| Plastic Products | 0.9% | 0.7% | 1.1% | Other Untreated Wood | 0.1% | 0.0% | 0.2% |
| Plastic/Other Materials | 0.8% | 0.4% | 1.2% | Treated Wood | 0.3% | 0.1% | 0.6% |
| ***Glass*** | **4.1%** | | | Contaminated Wood | 0.2% | 0.0% | 0.5% |
| Clear Beverage | 1.3% | 0.9% | 1.7% | New Gypsum Scrap | 0.0% | 0.0% | 0.0% |
| Green Beverage | 0.7% | 0.5% | 0.8% | Demo Gypsum Scrap | 0.2% | 0.1% | 0.4% |
| Brown Beverage | 0.7% | 0.5% | 0.8% | Fiberglass Insulation | 0.0% | 0.0% | 0.0% |
| Container Glass | 1.0% | 0.8% | 1.2% | Rock/Concrete/Brick | 0.3% | 0.0% | 0.6% |
| Fluorescent Tubes | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 0.3% | 0.0% | 0.6% |
| Other Glass | 0.4% | 0.3% | 0.6% | Other Construction Debris | 0.4% | 0.0% | 0.9% |
| ***Metal*** | **5.4%** | | | Sand/Soil/Dirt | 0.4% | 0.1% | 0.7% |
| Aluminum Cans | 0.4% | 0.4% | 0.5% | ***Hazardous*** | **0.5%** | | |
| Alum. Foil/Containers | 0.4% | 0.3% | 0.4% | Latex Paints | 0.0% | 0.0% | 0.1% |
| Other Aluminum | 0.0% | 0.0% | 0.1% | Hazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 0.1% | 0.0% | 0.2% | NonHazardous Adhesives/Glues | 0.2% | 0.0% | 0.5% |
| Tin Food Cans | 1.5% | 1.3% | 1.6% | Oil-based Paints/Solvents | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 0.1% | 0.1% | 0.2% | Cleaners | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 1.6% | 0.0% | 3.1% | Pesticides/Herbicides | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 1.2% | 0.6% | 1.8% | Dry-Cell Batteries | 0.1% | 0.1% | 0.1% |
| Motor Oil Filters | 0.0% | 0.0% | 0.1% | Wet-Cell Batteries | 0.0% | 0.0% | 0.0% |
| | | | | Gasoline/Kerosene | 0.0% | 0.0% | 0.0% |
| | | | | Motor Oil/Diesel Oil | 0.0% | 0.0% | 0.1% |
| | | | | Asbestos | 0.0% | 0.0% | 0.0% |
| | | | | Explosives | 0.0% | 0.0% | 0.0% |
| | | | | Other Hazardous Chemicals | 0.1% | 0.0% | 0.1% |
| **Sample Count** | **56** | | | Other NonHazardous Chemicals | 0.1% | 0.0% | 0.1% |

## Table 4-22 Composition by Weight: High Income
## (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

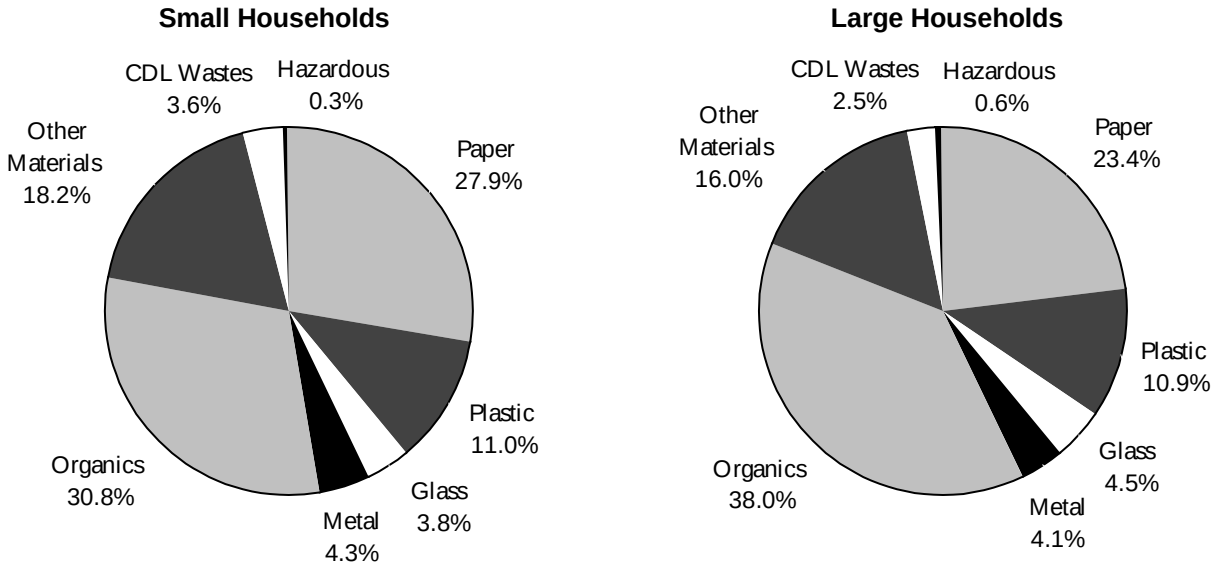
| | Mean | Low | High | | Mean | Low | High |
|---|---|---|---|---|---|---|---|
| ***Paper*** | **27.4%** | | | ***Organics*** | **29.7%** | | |
| Newspaper | 3.6% | 2.9% | 4.2% | Pallets | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, unwaxed | 3.9% | 3.5% | 4.3% | Crates/Boxes | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, waxed | 0.0% | 0.0% | 0.1% | Leaves and Grass | 1.7% | 1.0% | 2.4% |
| Office Paper | 0.9% | 0.7% | 1.1% | Prunings | 0.4% | 0.2% | 0.6% |
| Computer Paper | 0.0% | 0.0% | 0.0% | Food | 27.6% | 25.7% | 29.5% |
| Mixed Low Grade | 9.7% | 9.0% | 10.5% | ***Other Materials*** | **19.6%** | | |
| Phone Books | 0.2% | 0.0% | 0.3% | Textiles/Clothing | 1.8% | 1.5% | 2.0% |
| Milk/Juice Polycoats | 0.8% | 0.7% | 0.9% | Carpet/Upholstery | 1.9% | 1.2% | 2.6% |
| Frozen Food Polycoats | 0.3% | 0.3% | 0.4% | Leather | 0.2% | 0.1% | 0.2% |
| Compostable/Soiled | 6.6% | 6.1% | 7.2% | Disposable Diapers | 4.2% | 3.3% | 5.0% |
| Paper/Other Materials | 1.2% | 1.0% | 1.4% | Animal By-Products | 8.4% | 7.1% | 9.7% |
| Other Paper | 0.1% | 0.1% | 0.2% | Rubber Products | 0.3% | 0.2% | 0.4% |
| ***Plastic*** | **10.5%** | | | Tires | 0.0% | 0.0% | 0.0% |
| PET Pop and Liquor | 0.3% | 0.3% | 0.3% | Ash | 0.9% | 0.3% | 1.5% |
| Other PET Bottles | 0.1% | 0.1% | 0.2% | Furniture | 0.2% | 0.0% | 0.3% |
| HDPE Milk and Juice | 0.2% | 0.1% | 0.2% | Mattresses | 0.0% | 0.0% | 0.0% |
| Other HDPE Bottles | 0.5% | 0.3% | 0.6% | Small Appliances | 0.2% | 0.1% | 0.3% |
| Other Plastic Bottles | 0.2% | 0.1% | 0.2% | A/V Equipment | 0.3% | 0.1% | 0.6% |
| Jars and Tubs | 0.6% | 0.5% | 0.7% | Ceramics/Porcelain | 0.3% | 0.1% | 0.4% |
| Expanded Polystyrene | 1.0% | 0.1% | 1.9% | Non-distinct Fines | 0.3% | 0.2% | 0.5% |
| Other Rigid Packaging | 1.1% | 1.0% | 1.3% | Misc. Organics | 0.4% | 0.1% | 0.6% |
| Grocery/Bread Bags | 1.2% | 1.1% | 1.4% | Misc. Inorganics | 0.4% | 0.2% | 0.5% |
| Garbage Bags | 1.1% | 1.0% | 1.3% | ***CDL Wastes*** | **5.5%** | | |
| Other Film | 2.6% | 2.4% | 2.8% | Dimension Lumber | 0.8% | 0.5% | 1.0% |
| Plastic Products | 0.8% | 0.6% | 0.9% | Other Untreated Wood | 0.4% | 0.1% | 0.7% |
| Plastic/Other Materials | 0.7% | 0.5% | 1.0% | Treated Wood | 0.5% | 0.3% | 0.8% |
| ***Glass*** | **2.9%** | | | Contaminated Wood | 0.3% | 0.0% | 0.5% |
| Clear Beverage | 0.5% | 0.4% | 0.7% | New Gypsum Scrap | 0.0% | 0.0% | 0.0% |
| Green Beverage | 0.8% | 0.6% | 1.0% | Demo Gypsum Scrap | 0.4% | 0.0% | 0.7% |
| Brown Beverage | 0.5% | 0.3% | 0.6% | Fiberglass Insulation | 0.0% | 0.0% | 0.0% |
| Container Glass | 0.8% | 0.7% | 1.0% | Rock/Concrete/Brick | 1.6% | 0.0% | 4.2% |
| Fluorescent Tubes | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 0.4% | 0.0% | 0.9% |
| Other Glass | 0.3% | 0.2% | 0.4% | Other Construction Debris | 0.4% | 0.1% | 0.8% |
| ***Metal*** | **4.1%** | | | Sand/Soil/Dirt | 0.7% | 0.2% | 1.3% |
| Aluminum Cans | 0.3% | 0.2% | 0.3% | ***Hazardous*** | **0.2%** | | |
| Alum. Foil/Containers | 0.2% | 0.2% | 0.3% | Latex Paints | 0.0% | 0.0% | 0.1% |
| Other Aluminum | 0.1% | 0.0% | 0.2% | Hazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 0.1% | 0.0% | 0.1% | NonHazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Tin Food Cans | 1.2% | 0.9% | 1.4% | Oil-based Paints/Solvents | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 0.2% | 0.2% | 0.2% | Cleaners | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 1.0% | 0.7% | 1.4% | Pesticides/Herbicides | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 1.0% | 0.3% | 1.8% | Dry-Cell Batteries | 0.1% | 0.0% | 0.1% |
| Motor Oil Filters | 0.0% | 0.0% | 0.0% | Wet-Cell Batteries | 0.0% | 0.0% | 0.0% |
| | | | | Gasoline/Kerosene | 0.0% | 0.0% | 0.0% |
| | | | | Motor Oil/Diesel Oil | 0.0% | 0.0% | 0.0% |
| | | | | Asbestos | 0.0% | 0.0% | 0.0% |
| | | | | Explosives | 0.0% | 0.0% | 0.0% |
| | | | | Other Hazardous Chemicals | 0.0% | 0.0% | 0.0% |
| **Sample Count** | **59** | | | Other NonHazardous Chemicals | 0.1% | 0.0% | 0.2% |

### 4.7.2 Household Size

Figure 4-6 summarizes the broad waste categories for small (<2.13 people) and large (>2.56 people) households. The groupings were determined by first identifying the average household size for each route, then by dividing the routes into quartiles. The grouping of small households represents samples obtained from the routes in the lowest quartile and the grouping of large households represents samples obtained in the uppermost quartile. A total of 48 samples were obtained from the small household routes and 73 samples were obtained from the large household routes.

Paper and organics accounted for the majority of waste for both household size groupings (58.7% for the small households and 61.4% for the large households.) Although no statistical tests were performed between the large and small household size subpopulations, smaller households appeared to dispose more paper and less organics than larger households did.

**Figure 4-6 Composition Summary: by Household Size**
**(May 1998 – April 1999)**



#### 4.7.2.1 Largest components

As shown in Table 4-23, food was the largest component disposed by both the small and large households, followed by mixed low grade paper and compostable/soiled paper. For both the small and large households, it is estimated that four components accounted for slightly more than half of their respective waste streams.

**Table 4-23 Largest Components by Household Size**
**(May 1998 – April 1999)**

| | Small | Large |
|---|---|---|
| Food | 28.3% | 35.8% |
| Mixed Low Grade Paper | 10.4% | 8.5% |
| Compostable/soiled Paper | 6.7% | 7.2% |
| Animal by-products | 8.2% | |
| Disposable Diapers | | 6.2% |
| **Sum of largest components** | **53.6%** | **57.7%** |

Table 4-24 and Table 4-25 present the detailed composition results for the small and large households.

## Table 4-24 Composition by Weight: Small Households
## (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Mean | Low | High | | Mean | Low | High |
|---|---|---|---|---|---|---|---|
| ***Paper*** | **27.9%** | | | ***Organics*** | **30.8%** | | |
| Newspaper | 3.7% | 3.0% | 4.4% | Pallets | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, unwaxed | 3.3% | 2.9% | 3.7% | Crates/Boxes | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, waxed | 0.0% | 0.0% | 0.0% | Leaves and Grass | 2.0% | 1.2% | 2.8% |
| Office Paper | 0.6% | 0.5% | 0.8% | Prunings | 0.4% | 0.1% | 0.7% |
| Computer Paper | 0.1% | 0.0% | 0.1% | Food | 28.3% | 26.9% | 29.8% |
| Mixed Low Grade | 10.4% | 9.4% | 11.3% | ***Other Materials*** | **18.2%** | | |
| Phone Books | 0.2% | 0.0% | 0.4% | Textiles/Clothing | 1.7% | 1.3% | 2.0% |
| Milk/Juice Polycoats | 0.8% | 0.7% | 0.9% | Carpet/Upholstery | 1.3% | 0.8% | 1.7% |
| Frozen Food Polycoats | 0.3% | 0.3% | 0.4% | Leather | 0.1% | 0.0% | 0.2% |
| Compostable/Soiled | 6.7% | 6.2% | 7.2% | Disposable Diapers | 3.7% | 3.2% | 4.2% |
| Paper/Other Materials | 1.6% | 1.3% | 2.0% | Animal By-Products | 8.2% | 7.0% | 9.4% |
| Other Paper | 0.2% | 0.1% | 0.3% | Rubber Products | 0.2% | 0.1% | 0.3% |
| ***Plastic*** | **11.0%** | | | Tires | 0.3% | 0.0% | 0.7% |
| PET Pop and Liquor | 0.3% | 0.3% | 0.4% | Ash | 0.1% | 0.0% | 0.1% |
| Other PET Bottles | 0.2% | 0.2% | 0.2% | Furniture | 0.8% | 0.0% | 2.0% |
| HDPE Milk and Juice | 0.2% | 0.2% | 0.2% | Mattresses | 0.0% | 0.0% | 0.0% |
| Other HDPE Bottles | 0.4% | 0.3% | 0.5% | Small Appliances | 0.3% | 0.1% | 0.5% |
| Other Plastic Bottles | 0.2% | 0.1% | 0.2% | A/V Equipment | 0.3% | 0.0% | 0.7% |
| Jars and Tubs | 0.6% | 0.5% | 0.7% | Ceramics/Porcelain | 0.3% | 0.1% | 0.4% |
| Expanded Polystyrene | 0.6% | 0.5% | 0.7% | Non-distinct Fines | 0.5% | 0.3% | 0.8% |
| Other Rigid Packaging | 1.1% | 1.0% | 1.2% | Misc. Organics | 0.2% | 0.1% | 0.2% |
| Grocery/Bread Bags | 1.5% | 1.3% | 1.6% | Misc. Inorganics | 0.4% | 0.2% | 0.6% |
| Garbage Bags | 1.4% | 1.2% | 1.7% | ***CDL Wastes*** | **3.6%** | | |
| Other Film | 2.7% | 2.4% | 2.9% | Dimension Lumber | 1.0% | 0.4% | 1.6% |
| Plastic Products | 0.8% | 0.7% | 0.9% | Other Untreated Wood | 0.2% | 0.0% | 0.3% |
| Plastic/Other Materials | 1.0% | 0.5% | 1.6% | Treated Wood | 0.6% | 0.2% | 0.9% |
| ***Glass*** | **3.8%** | | | Contaminated Wood | 0.1% | 0.0% | 0.3% |
| Clear Beverage | 0.9% | 0.7% | 1.1% | New Gypsum Scrap | 0.0% | 0.0% | 0.0% |
| Green Beverage | 0.8% | 0.6% | 1.0% | Demo Gypsum Scrap | 0.2% | 0.0% | 0.3% |
| Brown Beverage | 0.8% | 0.6% | 1.0% | Fiberglass Insulation | 0.0% | 0.0% | 0.0% |
| Container Glass | 0.9% | 0.7% | 1.1% | Rock/Concrete/Brick | 0.1% | 0.0% | 0.1% |
| Fluorescent Tubes | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 0.1% | 0.0% | 0.3% |
| Other Glass | 0.5% | 0.3% | 0.6% | Other Construction Debris | 0.7% | 0.1% | 1.2% |
| ***Metal*** | **4.3%** | | | Sand/Soil/Dirt | 0.7% | 0.2% | 1.1% |
| Aluminum Cans | 0.4% | 0.3% | 0.4% | ***Hazardous*** | **0.3%** | | |
| Alum. Foil/Containers | 0.2% | 0.2% | 0.3% | Latex Paints | 0.0% | 0.0% | 0.1% |
| Other Aluminum | 0.0% | 0.0% | 0.0% | Hazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 0.0% | 0.0% | 0.1% | NonHazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Tin Food Cans | 1.3% | 1.2% | 1.5% | Oil-based Paints/Solvents | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 0.2% | 0.1% | 0.2% | Cleaners | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 0.9% | 0.7% | 1.1% | Pesticides/Herbicides | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 1.2% | 0.6% | 1.9% | Dry-Cell Batteries | 0.1% | 0.0% | 0.1% |
| Motor Oil Filters | 0.0% | 0.0% | 0.0% | Wet-Cell Batteries | 0.0% | 0.0% | 0.0% |
| | | | | Gasoline/Kerosene | 0.0% | 0.0% | 0.0% |
| | | | | Motor Oil/Diesel Oil | 0.0% | 0.0% | 0.0% |
| | | | | Asbestos | 0.0% | 0.0% | 0.0% |
| | | | | Explosives | 0.0% | 0.0% | 0.0% |
| | | | | Other Hazardous Chemicals | 0.0% | 0.0% | 0.0% |
| **Sample Count** | **48** | | | Other NonHazardous Chemicals | 0.1% | 0.0% | 0.2% |

## Table 4-25 Composition by Weight: Large Households
## (May 1998 – April 1999)

*Calculated with a 90% confidence interval*

| | Mean | Low | High | | Mean | Low | High |
|---|---|---|---|---|---|---|---|
| ***Paper*** | **23.4%** | | | ***Organics*** | **38.0%** | | |
| Newspaper | 2.8% | 2.4% | 3.1% | Pallets | 0.0% | 0.0% | 0.0% |
| OCC/Kraft, unwaxed | 2.5% | 2.3% | 2.7% | Crates/Boxes | 0.1% | 0.0% | 0.2% |
| OCC/Kraft, waxed | 0.0% | 0.0% | 0.0% | Leaves and Grass | 1.9% | 0.8% | 3.0% |
| Office Paper | 0.5% | 0.4% | 0.6% | Prunings | 0.2% | 0.1% | 0.4% |
| Computer Paper | 0.0% | 0.0% | 0.0% | Food | 35.8% | 34.2% | 37.4% |
| Mixed Low Grade | 8.5% | 7.8% | 9.2% | ***Other Materials*** | **16.0%** | | |
| Phone Books | 0.1% | 0.0% | 0.2% | Textiles/Clothing | 1.9% | 1.7% | 2.2% |
| Milk/Juice Polycoats | 0.5% | 0.5% | 0.6% | Carpet/Upholstery | 1.4% | 0.9% | 2.0% |
| Frozen Food Polycoats | 0.3% | 0.2% | 0.3% | Leather | 0.2% | 0.1% | 0.3% |
| Compostable/Soiled | 7.2% | 6.7% | 7.6% | Disposable Diapers | 6.2% | 5.5% | 7.0% |
| Paper/Other Materials | 1.1% | 0.9% | 1.2% | Animal By-Products | 3.8% | 3.0% | 4.6% |
| Other Paper | 0.0% | 0.0% | 0.1% | Rubber Products | 0.1% | 0.0% | 0.1% |
| ***Plastic*** | **10.9%** | | | Tires | 0.0% | 0.0% | 0.0% |
| PET Pop and Liquor | 0.4% | 0.4% | 0.5% | Ash | 0.4% | 0.1% | 0.6% |
| Other PET Bottles | 0.2% | 0.1% | 0.2% | Furniture | 0.4% | 0.1% | 0.7% |
| HDPE Milk and Juice | 0.3% | 0.2% | 0.3% | Mattresses | 0.0% | 0.0% | 0.0% |
| Other HDPE Bottles | 0.4% | 0.3% | 0.4% | Small Appliances | 0.3% | 0.2% | 0.5% |
| Other Plastic Bottles | 0.2% | 0.1% | 0.2% | A/V Equipment | 0.1% | 0.1% | 0.2% |
| Jars and Tubs | 0.5% | 0.4% | 0.5% | Ceramics/Porcelain | 0.2% | 0.1% | 0.2% |
| Expanded Polystyrene | 0.8% | 0.8% | 0.9% | Non-distinct Fines | 0.3% | 0.1% | 0.4% |
| Other Rigid Packaging | 0.9% | 0.8% | 1.0% | Misc. Organics | 0.4% | 0.3% | 0.5% |
| Grocery/Bread Bags | 1.9% | 1.7% | 2.0% | Misc. Inorganics | 0.3% | 0.2% | 0.4% |
| Garbage Bags | 1.3% | 1.2% | 1.4% | ***CDL Wastes*** | **2.5%** | | |
| Other Film | 2.6% | 2.4% | 2.8% | Dimension Lumber | 0.3% | 0.1% | 0.4% |
| Plastic Products | 0.9% | 0.7% | 1.2% | Other Untreated Wood | 0.3% | 0.1% | 0.5% |
| Plastic/Other Materials | 0.6% | 0.4% | 0.8% | Treated Wood | 0.4% | 0.1% | 0.6% |
| ***Glass*** | **4.5%** | | | Contaminated Wood | 0.2% | 0.0% | 0.3% |
| Clear Beverage | 1.6% | 1.2% | 1.9% | New Gypsum Scrap | 0.0% | 0.0% | 0.0% |
| Green Beverage | 0.7% | 0.6% | 0.9% | Demo Gypsum Scrap | 0.6% | 0.2% | 0.9% |
| Brown Beverage | 0.7% | 0.5% | 0.8% | Fiberglass Insulation | 0.0% | 0.0% | 0.0% |
| Container Glass | 1.1% | 1.0% | 1.3% | Rock/Concrete/Brick | 0.3% | 0.0% | 0.7% |
| Fluorescent Tubes | 0.0% | 0.0% | 0.0% | Asphaltic Roofing | 0.2% | 0.0% | 0.4% |
| Other Glass | 0.4% | 0.3% | 0.4% | Other Construction Debris | 0.2% | 0.0% | 0.4% |
| ***Metal*** | **4.1%** | | | Sand/Soil/Dirt | 0.1% | 0.0% | 0.2% |
| Aluminum Cans | 0.5% | 0.5% | 0.6% | ***Hazardous*** | **0.6%** | | |
| Alum. Foil/Containers | 0.3% | 0.3% | 0.4% | Latex Paints | 0.0% | 0.0% | 0.1% |
| Other Aluminum | 0.0% | 0.0% | 0.1% | Hazardous Adhesives/Glues | 0.0% | 0.0% | 0.0% |
| Other Nonferrous | 0.1% | 0.0% | 0.2% | NonHazardous Adhesives/Glues | 0.1% | 0.0% | 0.4% |
| Tin Food Cans | 1.5% | 1.4% | 1.7% | Oil-based Paints/Solvents | 0.0% | 0.0% | 0.0% |
| Empty Aerosol Cans | 0.2% | 0.1% | 0.2% | Cleaners | 0.0% | 0.0% | 0.0% |
| Other Ferrous | 0.5% | 0.3% | 0.7% | Pesticides/Herbicides | 0.0% | 0.0% | 0.0% |
| Mixed Metals/Materials | 0.8% | 0.5% | 1.2% | Dry-Cell Batteries | 0.1% | 0.1% | 0.1% |
| Motor Oil Filters | 0.0% | 0.0% | 0.1% | Wet-Cell Batteries | 0.0% | 0.0% | 0.0% |
| | | | | Gasoline/Kerosene | 0.0% | 0.0% | 0.0% |
| | | | | Motor Oil/Diesel Oil | 0.2% | 0.0% | 0.4% |
| | | | | Asbestos | 0.0% | 0.0% | 0.0% |
| | | | | Explosives | 0.0% | 0.0% | 0.0% |
| | | | | Other Hazardous Chemicals | 0.1% | 0.0% | 0.1% |
| **Sample Count** | **73** | | | Other NonHazardous Chemicals | 0.1% | 0.0% | 0.2% |

# Appendix A Waste Components

Waste samples were sorted by hand into 85 component categories. The waste categories for the 1998/99 study are nearly identical to those used in Seattle's last waste composition project (the 1996 commercial/self-haul study). The one exception is that oil filters have been added as a separate category in the 1998/99 study.

Medical wastes were excluded from sorting; virtually everything else was weighed and recorded. A list of component categories and definitions follows:

## Paper

*NEWSPAPER*: Printed newsprint. (Advertising "slicks" (glossy paper) were included in this category if found mixed with newspaper; otherwise, ad slicks are included with mixed low grade paper.)

*PLAIN OCC/KRAFT PAPER*: Unwaxed/uncoated old corrugated container boxes and Kraft paper, and brown paper bags.

*WAXED OCC/KRAFT PAPER*: Waxed/coated old corrugated container boxes and Kraft paper, and brown paper bags.

*OFFICE PAPER*: White or lightly colored sulfite/sulfate bond, copy papers, and envelopes.

*COMPUTER PAPER*: Continuous-feed sulfite/sulfate/ground wood computer printouts and forms of all types, excluding carbonless paper.

*MIXED LOW GRADE*: Low-grade, potentially recyclable papers, including junk mail, magazines, colored papers, bleached Kraft, boxboard, mailing tubes, and paperback books.

*PHONE BOOKS*: Telephone directories.

*MILK/JUICE POLYCOAT*: Bleached polycoated milk, ice cream, and aseptic juice containers.

*FROZEN FOOD POLYCOATS*: Bleached and unbleached polycoated frozen/refrigerator packaging, excluding polycoated milk/ice cream/aseptic containers.

*COMPOSTABLE/SOILED PAPER*: Paper towels, paper plates, waxed paper and tissues.

*PAPER/OTHER MATERIALS*: Predominantly paper with other materials attached, e.g., orange juice cans, spiral notebooks.

*OTHER PAPERS*: Carbon/carbonless copy paper, hardcover books, photographs.

## Plastic

*PET POP & LIQUOR*: Polyethylene terephthalate translucent 2-liter and 16-ounce pop bottles, with base; PET liquor bottles, beverage bottles.

*OTHER PET BOTTLES*: All other PET bottles not included in above.

*HDPE MILK & JUICE*: High-density translucent polyethylene milk, juice, and beverage containers.

*OTHER HDPE BOTTLES*: All other HDPE bottles not included in above.

*OTHER PLASTIC BOTTLES*: Plastic bottles not otherwise classified in the defined PET or HDPE categories, includes #3-#7, unknown bottles, petroleum bottles, and other dark colored bottles.

*JARS & TUBS.* Wide mouth jars and tubs #1-#7 such as yogurt, cottage cheese, margarine.

*EXPANDED POLYSTYRENE*: Includes packaging and finished products made of expanded polystyrene.

*OTHER RIGID PACKAGING*: Rigid plastic packaging #1-#7 and unknown (excluding expanded polystyrene). Includes clamshells, salad trays, lids, cookie tray inserts, plastic spools, toothpaste tubes.

*GROCERY/BREAD BAGS*: Bread, grocery, and dry cleaner plastic film bags.

*GARBAGE BAGS*: Plastic garbage bags.

*OTHER FILM*: Includes film packaging, excluding grocery/bread and garbage bags. Also includes plastic sheeting and shower curtains

*PLASTIC PRODUCTS*: Finished plastic products such as toys, toothbrushes, vinyl hose and photographic negatives. Includes fiberglass resin products and materials.

*PLASTIC/OTHER MATERIALS*: Predominately plastic with other materials attached such as disposable razors, pens, lighters, toys, 3-ring binders.

## Glass

*CLEAR BEVERAGE*: Includes clear pop, liquor, wine, juice, beer, vinegar bottles.

*GREEN BEVERAGE*: Includes green pop, liquor, wine, beer, lemon juice bottles.

*BROWN BEVERAGE*: Includes brown pop, beer, liquor, juice, vanilla extract bottles.

*CONTAINER GLASS*: All glass containers, all colors, holding solid materials such as mayonnaise, non-dairy creamer, facial cream containers.

FLUORESCENT TUBES. Fluorescent light tubes.

*OTHER GLASS*: Window glass, light bulbs (except fluorescent tubes) , glassware, etc.

## Metal

*ALUMINUM CANS*: Aluminum beverage cans (UBC) and bi-metal cans made mostly of aluminum.

*ALUMINUM FOIL/CONTAINERS*: Aluminum food containers, trays, and foil.

*OTHER ALUMINUM*: Aluminum products and scrap such as window frames, cookware.

*OTHER NONFERROUS*: Metals not derived from iron, to which a magnet will not adhere, which are not significantly contaminated with other metals or materials.

*TIN FOOD CANS*: Tinned steel food containers, including bi-metal cans mostly of steel.

*EMPTY AEROSOL CANS:* Empty, mixed material/metal aerosol cans. (Aerosols that still contain product are sorted according to that material—for instance, solvent-based paint.)

*OTHER FERROUS*: Ferrous and alloyed ferrous scrap metals to which a magnet adheres and which are not significantly contaminated with other metals or materials.

*MIXED METALS/MATERIALS*: Motors, insulated wire, and finished products containing a mixture of metals, or metals and other materials, whose weight is derived significantly from the metal portion of its construction. White goods are banned from Seattle's disposal. However, segments of large appliances are occasionally found; they are included in this category.

*OIL FITLERS*. Metal oil filters used in cars and other automobiles.

## Organics

*PALLETS*: Wood pallets.

*CRATES*: Crates, and other packaging lumber/panelboard.

*LEAVES AND GRASS*: Grass clippings, leaves, and weeds.

*PRUNINGS*: Cut prunings, 6" or less in diameter, from bushes, shrubs, and trees.

*FOOD*: Food wastes and scraps, including bone, rinds, etc. Excludes the weight of food containers, except when container weight is not appreciable compared to the food inside.

## Other Materials

*TEXTILES*: Fabric materials including natural and synthetic textiles such as cotton, wool, silk, woven nylon, rayon, polyester, and other materials.

*CARPET/UPHOLSTERY*: General category of flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material.

*LEATHER*: Finished products or scraps of leather.

*DISPOSABLE DIAPERS*: Disposable baby diapers and adult protective undergarments.

*ANIMAL BY-PRODUCTS*: Animal carcasses, wastes, and kitty litter.

*RUBBER PRODUCTS*: Finished products and scrap materials made of rubber, such as bath mats, inner tubes, rubber hose, and foam rubber.

*TIRES*: Vehicle tires of all types.

*ASH*: Fireplace, burn barrel, or fire pit ash.

*FURNITURE*: Mixed-material furniture such as upholstered chairs.

*MATTRESSES*: Mattresses and box springs.

*SMALL APPLIANCES*: Small electric appliances such as toasters, microwave ovens, power tools, curling irons, and light fixtures.

*AUDIO/VISUAL EQUIPMENT*: Televisions, stereos, radios, VCRs, monitors, printers, etc.

*CERAMICS/PORCELAIN*: Finished ceramic or porcelain products such as dishware, toilets, etc.

*NONDISTINCT FINES*: Nondistinct organics.

*MISCELLANEOUS ORGANICS*: Wax, modeling clay, bar soap, cigarette butts, etc.

*MISCELLANEOUS INORGANICS*: Vacuum cleaner bags, other inorganics not classified elsewhere.

## CDL Wastes

*DIMENSION LUMBER:* Milled lumber.

*OTHER UNTREATED WOOD*: Compostable prunings or stumps 6" or greater in diameter.

*TREATED WOOD*: Lumber and wood products which have been painted or treated so as to render them difficult to compost.

*CONTAMINATED WOOD:* Lumber and wood products, often with adhering concrete or other contaminants that would not compost easily.

*NEW GYPSUM SCRAP*: New gypsum wallboard scrap.

*DEMO GYPSUM SCRAP*: Used or demolition gypsum wallboard scrap.

*FIBERGLASS INSULATION*: Fiberglass building and mechanical insulation, batt or rigid.

*ROCK/CONCRETE/BRICKS*: Includes rock gravel larger than 2" diameter, Portland cement mixtures (set or unset), and fired-clay bricks.

*ASPHALTIC ROOFING*: Asphalt shingles, tar paper of built-up roofing.

*OTHER CONSTRUCTION DEBRIS*: Construction debris, other than wood, which can not be classified into other component categories; mixed fine building material scraps.

*SAND/SOIL/DIRT*: Contains mixed fines smaller than 2" in diameter.

## Household Hazardous

*LATEX PAINTS*: Water-based paints and similar products.

*HAZARDOUS ADHESIVES/GLUES*: Oil/resin/volatile solvent-based glues and adhesives, including epoxy, rubber cement, two-part glues and sealers, and auto body fillers.

*NON-HAZARDOUS ADHESIVES/GLUES*: Water-based glues, caulking compounds, grouts, and spackle.

*OIL-BASED PAINT/SOLVENT*: Solvent-based paints, varnishes, and similar products. Various solvents, including chlorinated and flammable solvents, paint strippers, solvents contaminated with other products such as paints, degreasers and some other cleaners if the primary ingredient is (or was) a solvent, or alcohol such as methanol and isopropanol.

*HAZARDOUS CLEANERS:* Various acids and bases whose primary purpose is to clean surfaces, unclog drains, or perform other actions.

*PESTICIDES/HERBICIDES*: Variety of poisons whose purpose is to discourage or kill pests, weeds, or microorganisms. Fungicides and wood preservatives, such as pentachlorophenol, are also included.

*DRY-CELL BATTERIES*: Dry-cell batteries of various sizes and types, as commonly used in households.

*WET-CELL BATTERIES*: Wet-cell batteries of various sizes and types, as commonly used in automobiles.

*GASOLINE/KEROSENE*: Gasoline, diesel fuel, and fuel oils.

*MOTOR OIL/DIESEL OIL*: Lubricating oils, primarily used in vehicles but including other types with similar characteristics.

*ASBESTOS*: Asbestos and asbestos-containing wastes (if this is the primary hazard associated with these wastes).

*EXPLOSIVES*: Gunpowder, unspent ammunition, picric acid and other potentially explosive chemicals.

*OTHER HAZARDOUS CHEMICALS*: Other hazardous wastes that do not fit into the above categories, including unidentifiable materials and medical waste such as I.V. tubing and patient drapes. (Medical wastes that could be considered a bio-hazard were excluded from the sorts.)

*OTHER NON-HAZARDOUS CHEMICALS*: Non-hazardous soaps, cleaners, medicines, cosmetics

## Changes to Waste Component Categories

The material types use to categorize Seattle's waste stream have been refined over the years. Table A-1 tracks these changes. (An "X" signifies that the component remains the same from the previous study period; an outline border reflects how components were split apart or grouped together.)

## Table A-1 Changes to Waste Component Categories, 1988 to present

| *1988-89* | *1990* | *1992* | *1994* | 1996 | 1998 |
|---|---|---|---|---|---|
| **PAPER** | | | | | |
| Newspaper | x | x | x | x | x |
| Corrugated Paper | x | x | OCC/Kraft | OCC/Kraft, Unwaxed | x |
| Office Paper | x | x | x | x | x |
| Computer Paper | x | x | x | x | x |
| Mixed Scrap Paper | x | x | Mixed Low Grade | x | x |
| | | | Phone Books | x | x |
| Other Paper | x | x | Milk/Juice Polycoats | x | x |
| | | | Frozen Food Polycoats | x | x |
| | | | Compostable/Soiled | x | x |
| | | | | OCC/Kraft, Waxed | x |
| | | | Paper/Other Materials | x | x |
| | | | Other Paper | x | x |
| **PLASTIC** | | | | | |
| PET Bottles | x | x | PET Pop & Liquor | x | x |
| | | | Other PET Bottles | x | x |
| HDPE Bottles | x | x | HDPE Milk & Juice | x | x |
| | | | Other HDPE Bottles | x | x |
| Expanded Polystyrene | x | x | x | x | x |
| Plastic Packaging | x | x | | | |
| | Other Plastic Bottles | x | x | x | x |
| | | | Other Rigid Containers | | |
| | | | | Jars & Tubs | x |
| | | | Other Rigid Packaging | x | x |
| | | | Grocery/Bread Bags | x | x |
| | | | | Garbage Bags | x |
| | | | Other Film | x | x |
| Other Plastic Products | x | x | Plastic Products | x | x |
| | | | Plastic/Other Materials | x | x |
| **GLASS** | | | | | |
| Nonrefillable Pop | x | x | Clear Beverage | x | x |
| Refillable Pop | x | x | Green Beverage | x | x |
| Nonrefillable Beer | x | x | Brown Beverage | x | x |
| Refillable Beer | x | x | *(After 1994, characterized according to color)* | | |
| Container Glass | x | x | x | x | x |
| Nonrecyclable Glass | x | x | x | Other Glass | x |
| | | | | Fluorescent Tubes | x |

## Table A-1, continued Changes to Waste Component Categories, 1988 to present

| *1988-89* | *1990* | *1992* | *1994* | 1996 | 1998 |
|---|---|---|---|---|---|
| **METAL** | | | | | |
| Aluminum Cans | x | x | x | x | x |
| Aluminum Foil/Containers | x | x | x | x | x |
| Tinned Cans | x | x | x | x | x |
| Bi-metal Cans | x | x | *(After 1994, characterized according to predominant metal)* | | |
| Ferrous | x | x | x | x | x |
| Nonferrous | x | x | x | Other Nonferrous | x |
| | | | Other Aluminum | x | x |
| | | | | Empty Aerosol Cans | x |
| Mixed Metals/Materials | x | x | x | x | x |
| White Goods | x | x | *(After 1994, banned from disposal. Parts show up in "Mixed Metals")* | | Metal Oil Filters |
| **RUBBER** | | | | | |
| Rubber Products | x | x | *moved to "Other Materials"* | x | x |
| Tires | x | x | *moved to "Other Materials"* | x | x |
| **ORGANICS** | | | | | |
| Wood | x | Untreated Wood | x | Dimension Lumber; *new category CDL Wastes* | x |
| | | | Crates/Pallets | Other Untreated Wood; *new category CDL Wastes* | x |
| | | | | Pallets | x |
| | | | | Crates/Boxes | x |
| | | Treated Wood | x | *Moved to new category CDL Wastes* | *x* |
| | | | | Contaminated Wood; *new category CDL Wastes* | x |
| Leaves and Grass | x | x | x | x | x |
| Prunings | x | x | x | x | x |
| Food | x | x | x | x | x |

## Table A-1, continued Changes to Waste Component Categories, 1988 to present

| *1988-89* | *1990* | *1992* | *1994* | 1996 | 1998 |
|---|---|---|---|---|---|
| **OTHER MATERIALS** | | | | | |
| Textiles | x | x | x | Textiles/Clothing | x |
| | | | Carpet/Upholstery | x | x |
| Leather | x | x | x | x | x |
| Disposable Diapers | x | x | x | x | x |
| *(Discarded from samples prior to 1994)* | | | Animal By-Products | x | x |
| Ash | x | x | x | x | x |
| *(Prior to 1994, split among various materials; Mixed Metal, Textiles, Other Plastics, etc.)* | | | Furniture | x | x |
| *(Prior to 1994, split among various materials; Mixed Metal, Textiles, Other Plastics, etc.)* | | | Mattresses | x | x |
| *(Prior to 1994, split among various materials; Mixed Metal, Textiles, Other Plastics, etc.)* | | | Small Appliances | x | x |
| *(Prior to 1994, split among various materials; Mixed Metal, Textiles, Other Plastics, etc.)* | | | A/V Equipment | x | x |
| Ceramics, Porcelain, China | x | x | x | x | x |
| Gypsum Drywall | x | x | x | New Gypsum Scrap; *new category CDL Wastes* | x |
| | | | | Demo Gypsum Scrap; *new category CDL Wastes* | x |
| Fiberglass Insulation | x | x | x | *Moved to new category CDL Wastes* | *x* |
| Rock/Concrete/Brick | x | x | x | *Moved to new category CDL Wastes* | *x* |
| Other Construction Debris | x | x | x | *Moved to new category CDL Wastes* | *x* |
| | | | | Asphaltic Roofing; *new category CDL Wastes* | x |
| Sand, Dirt, Non-distinct Fines | x | x | Sand/Soil/Dirt | *Moved to new category CDL Wastes* | *x* |
| | | | Non-distinct Fines | x | x |
| *(Prior to 1994, mostly in "Sand, Dirt, Non-distinct Fines; also in various "Mixed" and "Other" categories)* | | | Misc. Organics | | *x* |
| *(Prior to 1994, mostly in "Sand, Dirt, Non-distinct Fines; also in various "Mixed" and "Other" categories)* | | | Misc. Inorganics | | *x* |
| **HOUSEHOLD HAZARDOUS** | | | | | |
| Latex Paints | x | x | x | x | x |
| Adhesives/Glues | x | x | x | Hazardous Glue/Adhesives | x |
| | | | | NonHazardous Glue/Adhesives | x |
| Oil-based Paints/Solvents | x | x | x | x | x |
| Cleaners | x | x | x | x | x |
| Pesticides/Herbicides | x | x | x | x | x |
| Batteries | x | x | Dry-Cell Batteries | x | x |
| | | | Wet-Cell Batteries | x | x |
| Gasoline/Kerosene | x | x | x | x | x |
| Motor Oil/Diesel Oil | x | x | x | x | x |
| Asbestos | x | x | x | x | x |
| Explosives | x | x | x | x | x |
| Other Chemicals | x | x | x | Other Hazardous Chemicals | x |
| | | | | Other NonHazardous Chemicals | x |

# Appendix B Sampling Methodology

## Overview

In 1998/99, both the waste and recycling set-outs of Seattle's residential sector were sampled. For the purposes of this study, "waste" and "recyclables" are distinguished by the manner in which residents set out the material and not by the composition of the material itself. If a resident placed a glass bottle in a garbage can, it would be included in the waste sort; the same bottle placed in a recycling bin would be part of the recycling sort[1].

The objective of the waste sampling was to provide statistically significant data on the composition of Seattle's single and multi-family waste streams. The residential waste stream was last sampled in 1994/95. The current project follows the same basic methodology, except that waste reduction indicators were not studied this year.

## Substream Definition

This study examined waste generated by two sources (single- and multi-family homes). All materials were collected by contracted hauling companies; self-hauled and commercial tonnage were excluded.

In Seattle, the single- and multi-family substreams are defined as follows:

- ***Single-family:*** Primarily detached single-family, duplex, triplex and four-plex homes. Waste is collected from trash cans; a three-bin (North) or toter (South) system is used for recyclables.
- ***Multi-family:*** Primarily apartments and condominiums with five or more units. Waste is collected from dumpsters; a variety of systems may be used for recyclables.

The split between single- and multi-family wastes may not be absolutely pure, due to the fact that some collection routes may include both single- and multi-family accounts.

## Hauler and Transfer Station Participation

Both of the firms contracted to haul residential waste in Seattle were included in the study.

The first step in selecting sample loads required collecting detailed data from Seattle Public Utilities and the participating companies regarding the "universe" of waste loads hauled to the various facilities - including route number, geographic area covered by the route, collection day, and residence type (single-family or multi-family).

The City owns two transfer stations (North and South Recycling and Disposal Stations—NRDS and SRDS). Residential wastes from the north neighborhoods that are collected by the City's

[1] This section only includes the methodology used to sample Seattle's waste stream. The methodology for the recycling sampling is provided under a separate cover.

contracted hauler are brought to NRDS and residential wastes from the south neighborhoods are hauled to SRDS. Waste sampling occurred at both NRDS and SRDS.

Prior to each sampling day, the affected companies were faxed a notice that listed each route to be included in the upcoming sort. (A copy of the notice is included in Appendix F .) The haulers were asked to write in the number of the truck that would be servicing that route and its estimated arrival time (to assist the field supervisor in identifying the sample truck). The hauler then faxed back the notice and alerted the appropriate drivers.

Transfer station managers were also given the sampling schedule and other pertinent information. The field supervisor coordinated the details of truck diversion, sample extraction, sorting location and disposal/recycling of sorted material with each transfer station manager.

## Sample Distribution

Based on analysis of data collected in previous studies, it was determined that 120 waste samples would provide an acceptable level of statistical precision for the composition estimates. Therefore, 120 samples were allocated to each waste substream of particular interest: single-family north, single-family south, and overall multi-family (divided evenly between North and South multi-family).

Table B-1 illustrates the total number of waste samples planned for the 1998/99 sampling period and the actual number of samples sorted.

**Table B-1 Planned and Actual Sampling Distribution**

| | Planned Number of Samples for Year | Actual Number of Samples Sorted |
|---|---|---|
| **Single-family waste** | | |
| North | 120 | 121 |
| South | 120 | 120 |
| **Multi-family waste** | | |
| North | 60 | 59 |
| South | 60 | 60 |
| **Total** | **360** | **360** |

## Sampling Calendar

In order to capture any seasonal variation, the samples were distributed across the 12-month study period. Since the field crew can sort approximately 15 waste samples per day, two days of waste sampling were required each month—one day each for the North and South.

Working around major holidays and weekends (since residential wastes and recyclables are not collected on those days) and the sorting crew's availability, sampling dates were selected so that the distribution across weeks of the month and days of the week was roughly even. Whenever possible, the sampling events for both the waste and recycling sorts were scheduled

in contiguous three- or four-day blocks. The year's calendar is shown in Table B-2, and the resulting allocation waste sampling days is shown in Table B-3[2].

**Table B-2 Waste Sampling Calendar**

| Date | Generator | Sorting Location |
|---|---|---|
| 5/12/98 | South | SRDS |
| 5/14/98 | North | NRDS |
| 6/24/98 | North | NRDS |
| 6/26/98 | South | SRDS |
| 7/8/98 | South | SRDS |
| 7/10/98 | North | NRDS |
| 8/18/98 | North | NRDS |
| 8/20/98 | South | SRDS |
| 9/10/98 | South | SRDS |
| 9/14/98 | North | NRDS |
| 10/27/98 | North | NRDS |
| 10/28/98 | South | SRDS |
| 11/2/98 | South | SRDS |
| 11/4/98 | North | NRDS |
| 12/17/98 | North | NRDS |
| 12/18/98 | South | SRDS |
| 1/11/99 | North | NRDS |
| 1/13/99 | South | SRDS |
| 1/14/99 | South | SRDS |
| 2/10/99 | South | SRDS |
| 2/11/99 | North | NRDS |
| 2/12/99 | North | NRDS |
| 3/9/99 | South | SRDS |
| 3/10/99 | North | NRDS |
| 4/26/99 | North | NRDS |
| 4/27/99 | North | NRDS |
| 4/28/99 | South | SRDS |

[2] Three additional days were included in the 1998/99 study in order to make up for samples missed on previous sorting days. The additional days were February 11, 1999 and April 26, 1999 at NRDS and January 13, 1999 at SRDS.

## Table B-3 Distribution of Waste Sampling Days for the Entire Year

| | *Number of Waste Sampling Days* | | | | | |
|---|---|---|---|---|---|---|
| | **Monday** | **Tuesday** | **Wednesday** | **Thursday** | **Friday** | **Overall** |
| **North** | **3** | **3** | **3** | **3** | **2** | **14** |
| ***Spring (May '98, March - April '99)*** | **1** | **1** | **1** | **1** | **0** | **4** |
| Week 1 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 2 | 0 | 0 | 1 | 1 | 0 | **2** |
| Week 3 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 4 | 1 | 1 | 0 | 0 | 0 | **2** |
| ***Summer (June - August '98)*** | **0** | **1** | **1** | **0** | **1** | **3** |
| Week 1 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 2 | 0 | 0 | 0 | 0 | 1 | **1** |
| Week 3 | 0 | 1 | 0 | 0 | 0 | **1** |
| Week 4 | 0 | 0 | 1 | 0 | 0 | **1** |
| ***Fall (September - November '98)*** | **1** | **1** | **1** | **0** | **0** | **3** |
| Week 1 | 0 | 0 | 1 | 0 | 0 | **1** |
| Week 2 | 1 | 0 | 0 | 0 | 0 | **1** |
| Week 3 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 4 | 0 | 1 | 0 | 0 | 0 | **1** |
| ***Winter (December '98, January -February '99)*** | **1** | **0** | **0** | **2** | **1** | **4** |
| Week 1 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 2 | 1 | 0 | 0 | 1 | 1 | **3** |
| Week 3 | 0 | 0 | 0 | 1 | 0 | **1** |
| Week 4 | 0 | 0 | 0 | 0 | 0 | **0** |

| | *Number of Waste Sampling Days* | | | | | |
|---|---|---|---|---|---|---|
| | **Monday** | **Tuesday** | **Wednesday** | **Thursday** | **Friday** | **Overall** |
| **South** | **2** | **2** | **4** | **2** | **3** | **13** |
| ***Spring (May '98, March - April '99)*** | **0** | **2** | **1** | **0** | **0** | **3** |
| Week 1 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 2 | 0 | 2 | 0 | 0 | 0 | **2** |
| Week 3 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 4 | 0 | 0 | 1 | 0 | 0 | **1** |
| ***Summer (June - August '98)*** | **0** | **0** | **1** | **1** | **1** | **3** |
| Week 1 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 2 | 0 | 0 | 1 | 0 | 0 | **1** |
| Week 3 | 0 | 0 | 0 | 1 | 0 | **1** |
| Week 4 | 0 | 0 | 0 | 0 | 1 | **1** |
| ***Fall (September - November '98)*** | **2** | **0** | **0** | **0** | **1** | **3** |
| Week 1 | 1 | 0 | 0 | 0 | 0 | **1** |
| Week 2 | 0 | 0 | 0 | 0 | 1 | **1** |
| Week 3 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 4 | 1 | 0 | 0 | 0 | 0 | **1** |
| ***Winter (December '98, January -February '99)*** | **0** | **0** | **2** | **1** | **1** | **4** |
| Week 1 | 0 | 0 | 0 | 0 | 0 | **0** |
| Week 2 | 0 | 0 | 2 | 1 | 0 | **3** |
| Week 3 | 0 | 0 | 0 | 0 | 1 | **1** |
| Week 4 | 0 | 0 | 0 | 0 | 0 | **0** |

## Sample Selection

Using a computer-generated random number, loads were selected for each sampling day. (For example, of all the possible routes for single-family waste in the South that run on the first Monday of the month, the one with the lowest random number was selected.) This step was repeated until a sufficient number of loads were selected for each sampling day.

- ***North waste:*** There were enough waste loads hauled each day to allow for one sample to be taken from five different multi-family trucks and 10 different single-family trucks.
- ***South waste:*** Only two multi-family waste loads are collected each day; therefore, two or three samples were taken from each of these (for a total of five samples) and one sample from 10 different single-family trucks.

As the selected truck dumped at the transfer station, the loader would nose into the stream of material falling from the truck and capture a 5 cubic yard (250-300 pounds) slice of the garbage.

## Sorting Procedures

Each sample was sorted by hand into the component groups. (See Appendix A for the waste categories.) The weights of all materials were recorded on tally sheets, shown in Appendix F.

For the waste sampling, food containers were separated from the food and classified according to the containers' material. Each sample was sorted to the greatest reasonable detail. Rarely, a "supermix" of material (a residue composed of mixed material, each piece smaller than one half inch) remained after sorting a sample. In these cases, the field supervisor weighed the combined supermix (never totaling more than 10 pounds) and visually estimated the percentage of each component material in the supermix.

## Changes in Methodology from 1994/95 Study

The sorting methodology used in this project differed from 1994/95 in the following ways:

- Waste reduction indicators were not measured.
- The component categories were updated to provide more detail about specific materials in the waste stream. These category changes are tracked in Appendix A.

# Appendix C Comments on Monthly Sampling Events

Thirty samples were planned each month:

- 5 multi-family north
- 10 single-family north
- 5 multi-family south
- 10 single-family south

## May

South Seattle waste sampling began May 12th at the SRDS and fifteen samples were obtained according to the sampling plan. North Seattle sampling began on May 14th at the NRDS. One single-family truck was missed, but the other fourteen were sampled according to the planned schedule.

## June

On June 24th, thirteen north waste samples were sorted; one multi-family and one single-family truck did not show. On June 26th, the south waste sampling was completed as planned.

## July

On July 8th, south waste was sampled as planned. North waste was sampled on July 10th; one multi-family and two single-family loads were missed, resulting in 12 samples.

## August

North waste was sampled on August 18th; one extra multi-family sample was obtained and one single-family sample was missed, resulting in 15 total samples. On August 20th, south waste sampling went according to plan.

## September

South waste was sampled on September 10th and North waste was sampled on September 14th. The planned number of samples was gathered on both days.

## October

On October 27, the north waste sampling went according to plan. On October 28th, one multi-family truck scheduled for two samples was missed and two extra single-family samples were obtained, resulting in 15 total samples.

## November

The November 2nd waste sorts occurred at the NRDS. Two single-family loads were missed resulting in 13 total samples. South waste was sampled on November 4th. One multi-family load was missed and an extra single-family load was sorted resulting in 15 total samples.

## December

Twelve samples were obtained from the north service area on December 17th. One multi-family and two single-family loads were missed. On December 18th, three single-family loads were missed resulting in 12 total samples.

## January

On January 11th, fifteen samples were obtained from the north service area. One extra multi-family load was obtained and one single-family load was missed. On January 13th, extra samples from the south were sorted to make up for loads missed in previous months. The extra samples included 2 multi- and 8 single-family loads. On January 14th, four single-family loads were not sampled. In all, 7 multi-family and 14 single-family waste samples were sorted from the south in the month of January.

## February

The planned number of samples were obtained on February 10th at the SRDS. On February 11th, 8 extra single-family waste samples were sorted to make up for loads previously missed. On February 12th, 3 single-family loads were not sorted resulting in 12 total samples.

## March

The south waste sampling on March 9th went according to the original plan except that one single-family load was missed. On March 10th, three multi-family loads were not sorted resulting in 12 total samples.

## April

Two days of waste sampling occurred at the NRDS. On April 26th, 4 extra multi-family and 3 extra single-family loads were sorted to make up for loads missed in previous months. On April 27th, north waste was sampled and one single-family load was missed. On April 28th, 16 samples were sorted including one extra single-family load.

# Appendix D Calculations

## Composition Calculations

The composition estimates represent the **ratio of the components' weight to the total waste** for each noted substream. They are derived by summing each component's weight across all of the selected records and dividing by the sum of the total weight of waste, as shown in the following equation:

$$r_j = \frac{\sum_i c_{ij}}{\sum_i w_i}$$

where:

c = weight of particular component
w = sum of all component weights
for i 1 to n
where n = number of selected samples
for j 1 to m
where m = number of components

The confidence interval for this estimate is derived in two steps. First, the variance around the estimate is calculated, accounting for the fact that the ratio includes two random variables (the component and total sample weights). The **variance of the ratio estimator** equation follows:

$$\hat{V}_{r_j} = \left|\frac{1}{n}\right| \cdot \left(\frac{1}{\overline{w}^2}\right) \cdot \left( \frac{\sum_i \left(c_{ij} - r_j w_i\right)^2}{n-1} \right)$$

where:

$$\overline{w} = \frac{\sum_i w_i}{n}$$

Second, **precision levels** at the 90% confidence interval are calculated for a component's mean as follows:

$$r_j \pm \left(t \cdot \sqrt{\hat{V}_{r_j}}\right)$$

where:

t = the value of the t-statistic (1.645) corresponding to a 90% confidence level

For more detail, please refer to Chapter 6 "Ratio, Regression and Difference Estimation" of *Elementary Survey Sampling* by R.L. Scheaffer, W. Mendenhall and L. Ott (PWS Publishers, 1986).

## Weighted Averages

The overall, multi-family, north, south, and seasonal composition estimates were calculated by performing a weighted average across the relevant substreams.

The **weighted average for an overall composition estimate** is performed as follows:

$$O_j = \left(p_1 * r_{j1}\right) + (p_2 * r_{j2}) + (p_3 * r_{j3}) + \ldots$$

where:

p = the proportion of tonnage contributed by the noted substream

r = ratio of component weight to total waste weight in the noted substream

for j 1 to m

where m = number of components

The **variance of the weighted average** is calculated:

$$VarO_j = (p_1{}^2 * \hat{V}_{r_{j1}}) + (p_2{}^2 * \hat{V}_{r_{j2}}) + (p_3{}^2 * \hat{V}_{r_{j3}}) + \ldots$$

## Comparison Calculations

Identifying statistically significant differences requires a two-step calculation. First, assuming that the two groups to be compared have the same variance, a **pooled sample variance** is calculated:

$$S_{pool}{}^2 = \frac{\left[(n1-1)\cdot\left(n1\cdot\hat{V}_{r_j 1}\right)\right] + \left[(n2-1)\cdot\left(n2\cdot\hat{V}_{r_j 2}\right)\right]}{n1+n2-2}$$

Next, the **t-statistic** is constructed:

$$t = \frac{(r1-r2)}{\sqrt{\frac{S_{pool}{}^2}{n1} + \frac{S_{pool}{}^2}{n2}}}$$

The **p-value** of the t-statistic is calculated based on (n1+n2 -2) degrees of freedom.

# **Appendix E** Comparison Calculations

The comparison methodology is outlined in the first section of this appendix and the calculations are outlined in Appendix D. For more detail, the remaining sections describe technical issues regarding the statistics.

## Background

In an ongoing effort to monitor the types and amounts of materials disposed locally, Seattle has performed several waste characterization studies. Differences are often apparent between project years and among subpopulations. In this appendix, detailed results from the following comparisons are presented. The results of these comparisons can be used to indicate trends in the composition data.

- Year-to-year comparisons
  - 1988/89 vs. 1998/99
  - 1994/95 vs. 1998/99
- Comparisons among subpopulations
  - Single-family vs. multi-family
  - North vs. south
  - Single-family north vs. single-family south

In order to control for population changes and other factors that may influence the total amount of waste disposed from year to year, the tests described in this appendix measure waste proportions, not actual tonnage. For example, say that newspaper accounts for 5% of a particular substream's disposed waste each year, and that the substream disposed a total of 1,000 tons of waste in one year and 2,000 tons of waste in the next. While the amount of newspaper increased from 50 to 100 tons, the percentage remained the same. Therefore, the tests would indicate that there had been no change.

The purpose of conducting these comparisons is to identify trends within the residential substream, in the percentage of selected types of waste disposed over time and between substreams. One specific example is stated as follows:

*Hypothesis:* "There is no statistically significant difference, between the 1988/89 and 1998/99 study periods, in the percentage of paper disposed."

Statistics are then employed to look for evidence disproving the hypothesis. A "significant" result means that there is enough evidence to disprove the hypothesis and it can be concluded that there is a true difference across years. "Insignificant" results indicate that either a) there is no true difference, or b) even though there may be a difference, there is not enough evidence to prove it.[1]

[1] Please see the "Power Analysis" discussion on page E-3.

The purpose of these tests is to identify changes across years and among substreams. However, the study did not attempt to investigate *why* or *how* these changes occurred. The changes may be due to a variety of factors. For example, the decrease in paper could be due to any combination of the following:

- Consumer Preferences—plastic containers might have captured some of the market previously held by corrugated containers.
- Technology—manufacturers might use thinner paperboard than in the past, which would decrease the weight of cardboard, even if the same number of boxes were disposed.
- Recycling—more businesses may participate in paper recycling programs.

Future studies could be designed to test the influence of various potential sources of the increase/decrease of specific materials in the disposed waste stream.

## Statistical Considerations

The analyses are based on the component percentages, by weight. As described in Appendix D these percentages are calculated by dividing the sum of the selected component weights by the sum of the corresponding sample weights. T-tests (modified for ratio estimation) were used to examine the variations from year-to-year and within subpopulations.

### Normality

The distribution of some of the waste categories (particularly the hazardous materials) are skewed and may not follow a normal distribution. Although t-tests assume a normal distribution, they are very robust to departures from this assumption, particularly with large sample sizes. In addition, most of the selected categories are sums of several individual waste components, which improves our ability to meet the assumptions of normality.

### Dependence

There may be dependence between waste types (if a person disposes of material A, they always dispose of material B at the same time).

There is certainly a degree of dependence between the calculated percentages. Because the percentages sum to 100 (in the case of year-to-year comparisons) or near 100 (in the case of subpopulation comparisons), if the percentage of material A increases, the percentage of some other material must decrease.

### Multiple T-Tests

In all statistical tests, there is a chance of incorrectly concluding that a result is significant. The year-to-year comparison required conducting several t-tests (one for each waste category) **each** of which carries that risk. However, we were willing to accept only a 10% chance, **overall**, of making an incorrect conclusion. Therefore, each test was adjusted by setting the significance threshold to $\frac{0.10}{w}$ ($w$ = the number of t-tests).

*The adjustment can be explained as follows:*

For each test, we set a $1-\frac{0.10}{w}$ chance of not making a mistake, which results in a $|1-\frac{0.10}{w}|^{w}$ chance of not making a mistake during all *w* tests.

Since one minus the chance of not making a mistake equals the chance of making a mistake, by making this adjustment, we have set the overall risk of making a wrong conclusion during any one of the tests at $\left(1-|1-\frac{0.10}{w}|^{w}\right)=0.10$.

The chance of a "false positive" for the year-to-year comparisons made in this study is restricted to 10% overall, or 1.25% for each test (10% divided by the eight tests within the residential substream equals 1.25%). Among, the subpopulation comparisons, the chance of a false positive results is also restricted to 10% overall and 0.91% for each test (10% divided by the eleven tests performed).

For more detail regarding this issue, please refer to Section 11.2 "The Multiplicity Problem and the Bonferroni Inequality" of *An Introduction to Contemporary Statistics* by L.H. Koopmans (Duxbury Press, 1981).

### Power Analysis

The greater the number of samples, the greater the ability to detect differences. In the future, an *a priori* power analysis might benefit this research by determining how many samples would be required to detect a particular minimum difference of interest.

## Interpreting the Calculation Results

The following tables include detailed calculation results. An asterisk notes the statistically significant differences.

*For the purposes of this study, only those calculation results with a p-value of less than 1.25% for the residential substream are considered to be statistically significant.* As described above, the threshold for determining statistically significant results (the "alpha-level") is conservative, accounting for the fact that so many individual tests were calculated.

The t-statistic is calculated from the data; according to statistical theory, the larger the absolute value of the t-statistic, the less likely that the two populations have the same mean. The p-value describes the probability of observing the calculated t-statistic if there were no true difference between the population means.

For example, in Table E-1, the proportion of paper in the disposed residential substream dropped from 31.24% to 28.08% across the study periods. The t-statistic is relatively large (3.7744) and the probability (p-value) of observing that t-statistic if there had been no true difference between years is just 0.02%. This value is less than the study's pre-determined threshold for statistically significant results (alpha-level of 1.25%); thus the decrease in paper is considered to be a true difference. On the other hand, the p-value corresponding to the

increase in metals is very large. The chance of observing the 5.27% to 4.46% decrease when the actual proportion had not changed is 2.02%—which is too high to be considered a true difference.

Table E-1 below shows that the proportions of plastics and other materials show increasing trends over the last ten years. On the other hand, the proportions of paper, glass, organics, and CDL wastes show decreasing trends. Variations among the proportions of metal and hazardous materials were not significant.

**Table E-1 Comparison of Residential Composition Results, 1988/89 vs. 1998/99**

**(Includes all 8 comparison groups)**

| | Mean Ratio (Material Wt/Total Wt) | | t-Statistic | p-Value (Cut-off for statistically valid difference = 0.0125) |
|---|---|---|---|---|
| | *1988/89* | *1998/99* | | |
| Paper | 31.24% | 28.08% | 3.7744 | 0.0002 * |
| Plastic | 8.06% | 10.29% | 7.6070 | 0.0000 * |
| Glass | 6.41% | 4.13% | 7.8050 | 0.0000 * |
| Metal | 5.27% | 4.46% | 2.3289 | 0.0202 |
| Organics | 33.42% | 30.39% | 2.7731 | 0.0057 * |
| Other Materials | 6.14% | 17.25% | 19.0123 | 0.0000 * |
| CDL Wastes | 8.80% | 4.96% | 5.3033 | 0.0000 * |
| Hazardous | 0.66% | 0.44% | 2.1545 | 0.0316 |
| *Number of Samples* | *212* | *360* | | |

Table E-2 shows that over the last four years, there has been an increasing trend in the amounts of plastics, organics, and other materials. The proportions of paper and CDL wastes show decreasing trends. Glass, metal and hazardous materials did not show any significant trends.

**Table E-2 Comparison of Residential Composition Results, 1994/95 vs. 1998/99**

**(Includes all 8 comparison groups)**

| | Mean Ratio (Material Wt/Total Wt) | | t-Statistic | p-Value (Cut-off for statistically valid difference = 0.0125) |
|---|---|---|---|---|
| | *1994/95* | *1998/99* | | |
| Paper | 34.58% | 28.08% | 9.6978 | 0.0000 * |
| Plastic | 9.58% | 10.29% | 3.0118 | 0.0027 * |
| Glass | 4.26% | 4.13% | 0.5852 | 0.5586 |
| Metal | 4.68% | 4.46% | 0.6896 | 0.4907 |
| Organics | 25.49% | 30.39% | 6.6875 | 0.0000 * |
| Other Materials | 13.20% | 17.25% | 7.0250 | 0.0000 * |
| CDL Wastes | 7.75% | 4.96% | 4.7050 | 0.0000 * |
| Hazardous | 0.46% | 0.44% | 0.1852 | 0.8531 |
| *Number of Samples* | *368* | *360* | | |

Table E-3 illustrates the differences in the tons disposed among the single- and multi-family subpopulations. Multi-family residents disposed a higher proportion of newspaper, OCC/kraft, curbside paper, curbside plastic, aluminum, curbside glass, and yard debris than single-family residents did. Single-family residents disposed a greater percentage of non-curbside plastic and food than multi-family residents did. The proportions of tin and household hazardous materials did not show significant variations.

**Table E-3 Comparison of Composition Results, by Generator Type**
**(May 1998 – May 1999)**

| | Mean Ratio (Material Wt/Total Wt) | | t-Statistic | p-Value (Cut-off for statistically valid difference = 0.0091) | |
|---|---|---|---|---|---|
| | *Single-family* | *Multi-family* | | | |
| Newspaper | 3.10% | 6.55% | 10.4997 | 0.0000 | * |
| OCC/Kraft | 3.18% | 5.76% | 8.8735 | 0.0000 | * |
| Curbside Paper | 9.98% | 13.75% | 8.0339 | 0.0000 | * |
| Curbside Plastic | 1.13% | 1.33% | 3.1282 | 0.0019 | * |
| Non-Curbside Plastic | 9.66% | 7.96% | 4.4872 | 0.0000 | * |
| Tin | 1.35% | 1.26% | 1.0268 | 0.3052 | |
| Aluminum | 0.68% | 0.91% | 4.5023 | 0.0000 | * |
| Curbside Glass | 3.38% | 4.33% | 3.0210 | 0.0027 | * |
| Yard Debris | 2.04% | 3.54% | 2.7258 | 0.0067 | * |
| Food | 31.09% | 21.40% | 10.8863 | 0.0000 | * |
| Household Hazardous | 0.24% | 0.34% | 0.7957 | 0.4267 | |
| *Number of Samples* | *241* | *119* | | | |

Residents in the north service area disposed more OCC/kraft and curbside paper than residents in the south service area did. Residents in the south disposed more tin, aluminum, curbside glass and food than residents in the north did. Variations among the proportions of newspaper, curbside plastic, non-curbside plastic, yard debris, and household hazardous materials were not significant between service areas.

**Table E-4 Comparison of Composition Results, by Service Area**
**(May 1998 – April 1999)**

| | Mean Ratio (Material Wt/Total Wt) | | t-Statistic | p-Value (Cut-off for statistically valid difference = 0.0125) | |
|---|---|---|---|---|---|
| | *North* | *South* | | | |
| Newspaper | 4.69% | 3.82% | 2.4519 | 0.0147 | |
| OCC/Kraft | 4.51% | 3.58% | 3.0920 | 0.0021 | * |
| Curbside Paper | 12.05% | 10.44% | 3.4358 | 0.0007 | * |
| Curbside Plastic | 1.14% | 1.25% | 1.7281 | 0.0848 | |
| Non-Curbside Plastic | 9.21% | 8.97% | 0.6284 | 0.5301 | |
| Tin | 1.18% | 1.46% | 3.3816 | 0.0008 | * |
| Aluminum | 0.63% | 0.88% | 5.3652 | 0.0000 | * |
| Curbside Glass | 3.04% | 4.35% | 4.4989 | 0.0000 | * |
| Yard Debris | 2.23% | 2.86% | 1.2107 | 0.2268 | |
| Food | 26.06% | 29.61% | 3.7458 | 0.0002 | * |
| Household Hazardous | 0.30% | 0.26% | 0.3236 | 0.7464 | |
| *Number of Samples* | *180* | *180* | | | |

The single-family north and the single-family south subpopulations showed differences in the proportions of six waste categories disposed, as shown in Table E-5. In the north service area, single-family residences disposed more curbside paper while residents in the south disposed more OCC/kraft paper, tin, aluminum, curbside glass, and food. Variations in the amounts of newspaper, curbside plastic, non-curbside plastics, yard debris and household hazardous were not significant.

**Table E-5 Comparison of Single-family Composition Results**
**(May 1998 – April 1999)**

| | **Mean Ratio** *(Material Wt/Total Wt)* | | **t-Statistic** | **p-Value** *(Cut-off for statistically valid difference = 0.0091)* |
|---|---|---|---|---|
| | *SF North* | *SF South* | | |
| Newspaper | 3.48% | 2.72% | 2.3902 | 0.0176 |
| OCC/Kraft | 3.65% | 2.70% | 4.5124 | 0.0000 * |
| Curbside Paper | 10.97% | 8.99% | 3.9877 | 0.0001 * |
| Curbside Plastic | 1.05% | 1.21% | 2.1487 | 0.0327 |
| Non-Curbside Plastic | 9.93% | 9.39% | 1.1500 | 0.2513 |
| Tin | 1.13% | 1.58% | 4.3409 | 0.0000 * |
| Aluminum | 0.54% | 0.83% | 5.5809 | 0.0000 * |
| Curbside Glass | 2.49% | 4.27% | 5.9488 | 0.0000 * |
| Yard Debris | 1.69% | 2.40% | 1.3607 | 0.1749 |
| Food | 28.74% | 33.43% | 4.4796 | 0.0000 * |
| Household Hazardous | 0.19% | 0.30% | 1.1788 | 0.2396 |
| *Number of Samples* | *121* | *120* | | |

# Appendix F Field Forms

The field forms are included in the following order:

- North waste route sheet
- South waste route sheet
- Waste tally sheet

***Sorting Date:*** **Tuesday, October 27, 1998**

***Sorting Location:*** **NRDS**

***Sample Type:*** **Waste**

***Company:*** **General Disposal**

## Multi-Family

| Route | Load | Household Count | Truck Number | Estimated Arrival Time | Samples | *For Sorting Crew Use: Net Weight* | *Sample ID* |
|---|---|---|---|---|---|---|---|
| 8 | | | | | 1 | | |
| 14 | | | | | 1 | | |
| 82 | AM | | | | 1 | | |
| 82 | PM | | | | 1 | | |
| 82 | PM | | | | 1 | | |

## Single Family

| Route | Load | Household Count | Truck Number | Estimated Arrival Time | Samples | *For Sorting Crew Use: Net Weight* | *Sample ID* |
|---|---|---|---|---|---|---|---|
| 1 | | | | | 1 | | |
| 3 | | | | | 1 | | |
| 4 | | | | | 1 | | |
| 7 | | | | | 1 | | |
| 8 | | | | | 1 | | |
| 11 | | | | | 1 | | |
| 19 | | | | | 1 | | |
| 20 | | | | | 1 | | |
| 22 | | | | | 1 | | |
| 23 | | | | | 1 | | |

***Sorting Date:*** **Friday, June 26, 1998**

***Sorting Location:*** **SRDS**

***Sample Type:*** **Waste**

***Company:*** **US Disposal**

## Multi-Family

| Route | Household Count | Truck Number | Estimated Arrival Time | Samples | *For Sorting Crew Use:* Net Weight | Sample ID |
|---|---|---|---|---|---|---|
| 55 | | | | 3 | | |
| | | | | | | |
| | | | | | | |
| 56 | | | | 2 | | |
| | | | | | | |

## Single Family

| Route | Household Count | Truck Number | Estimated Arrival Time | Samples | *For Sorting Crew Use:* Net Weight | Sample ID |
|---|---|---|---|---|---|---|
| 1 | | | | 1 | | |
| 2 | | | | 1 | | |
| 3 | | | | 1 | | |
| 4 | | | | 1 | | |
| 8 | | | | 1 | | |
| 10 | | | | 1 | | |
| 13 | | | | 1 | | |
| 14 | | | | 1 | | |
| 17 | | | | 1 | | |
| 18 | | | | 1 | | |

| Paper | | | | |
|---|---|---|---|---|
| Newspaper | | | | |
| OCC/Kraft, unwaxed | | | | |
| OCC/Kraft, waxed | | | | |
| Office Paper | | | | |
| Computer Paper | | | | |
| Mixed Low Grade | | | | |
| Phone Books | | | | |
| Milk/Juice Polycoats | | | | |
| Frozen Food Polycoats | | | | |
| Compostable/Soiled | | | | |
| Paper/Other Materials | | | | |
| Other Paper | | | | |
| **Glass** | | | | |
| Clear Beverage | | | | |
| Green Beverage | | | | |
| Brown Beverage | | | | |
| Container Glass | | | | |
| Fluorescent Tubes | | | | |
| Other Glass | | | | |
| **Plastic** | | | | |
| PET Pop & Liquor | | | | |
| Other PET Bottles | | | | |
| HDPE Milk & Juice | | | | |
| Other HDPE Bottles | | | | |
| Other Plastic Bottles | | | | |
| Jars & Tubs | | | | |
| Expanded Polystyrene | | | | |
| Other Rigid Packaging | | | | |
| Grocery/Bread Bags | | | | |
| Garbage Bags | | | | |
| Other Film | | | | |
| Plastic Products | | | | |
| Plastic/Other Materials | | | | |

| Organics | | | | |
|---|---|---|---|---|
| Pallets | | | | |
| Crates/Boxes | | | | |
| Leaves and Grass | | | | |
| Prunings | | | | |
| Food | | | | |
| **CDL Wastes** | | | | |
| Dimension Lumber | | | | |
| Other Untreated Wood | | | | |
| Treated Wood | | | | |
| Contaminated Wood | | | | |
| New Gypsum Scrap | | | | |
| Demo Gypsum Scrap | | | | |
| Fiberglass Insulation | | | | |
| Rock/Concrete/Brick | | | | |
| Asphaltic Roofing | | | | |
| Other Construction Debris | | | | |
| Sand/Soil/Dirt | | | | |
| **Metal** | | | | |
| Aluminum Cans | | | | |
| Alum. Foil/Containers | | | | |
| Other Aluminum | | | | |
| Other Nonferrous | | | | |
| Tin Food Cans | | | | |
| Empty Aerosol Cans | | | | |
| Other Ferrous | | | | |
| Mixed Metals/Materials | | | | |
| **Metal Count** | | | | |
| Motor Oil Filters | | | | |

Date Sample ID

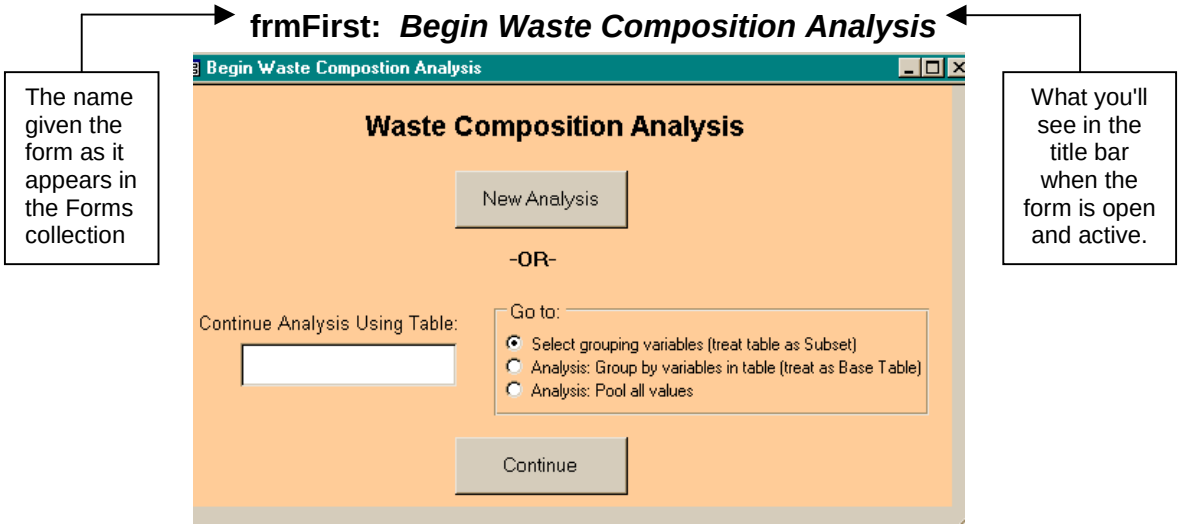
| Other Materials | | | | |
|---|---|---|---|---|
| Textiles/Clothing | | | | |
| Carpet/Upholstery | | | | |
| Leather | | | | |
| Disposable Diapers | | | | |
| Animal By-Products | | | | |
| Rubber Products | | | | |
| Tires | | | | |
| Ash | | | | |
| Furniture | | | | |
| Mattresses | | | | |
| Small Appliances | | | | |
| A/V Equipment | | | | |
| Ceramics/Porcelain | | | | |
| Non-distinct Fines | | | | |
| Misc. Organics | | | | |
| Misc. Inorganics | | | | |
| **Hazardous** | | | | |
| Latex Paints | | | | |
| Hazardous Adhesives/Glues | | | | |
| NonHazardous Adhesives/Glues | | | | |
| Oil-based Paints/Solvents | | | | |
| Cleaners | | | | |
| Pesticides/Herbicides | | | | |
| Dry-Cell Batteries | | | | |
| Wet-Cell Batteries | | | | |
| Gasoline/Kerosene | | | | |
| Motor Oil/Diesel Oil | | | | |
| Asbestos | | | | |
| Explosives | | | | |
| Other Hazardous Chemicals | | | | |
| Other NonHazardous Chemicals | | | | |

| Supermix |
|---|
| |
| |

# Appendix G  Database Description

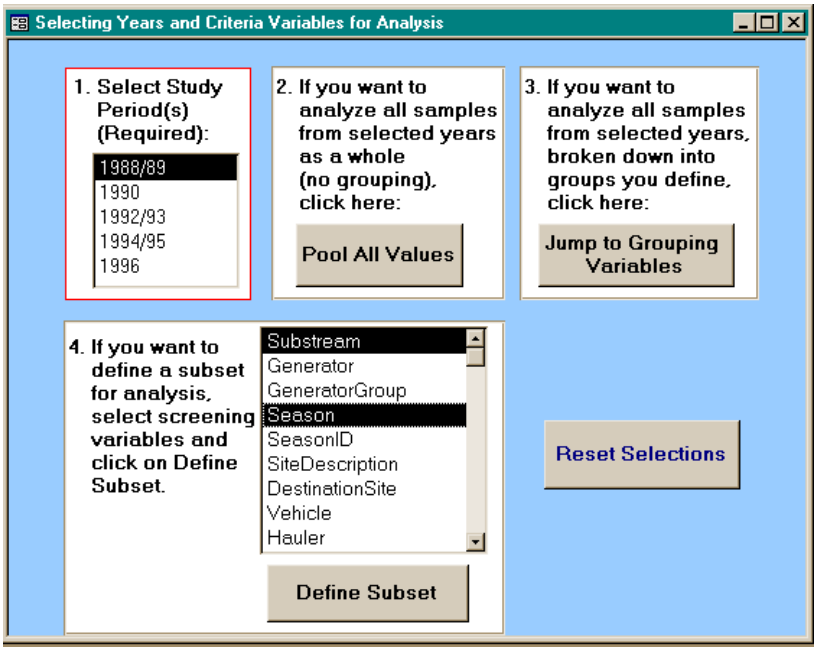
The database used for the previous waste composition studies was developed with software (Thor) that is no longer in common use.  Thus, as part of the 1998/99 study a new version of the database was created in Microsoft Access format.  This database contains all the waste composition data collected throughout this project (from 1988/89 to 1998/99) and includes a variety of analytical tools.  The following is a User's Guide and includes a detailed description of the database functions.

## STEP 1. Upon opening the database, the following form will appear:




| Button/Feature | Action | Comments |
|---|---|---|
| New Analysis | Go to frmStrataSelect (Step 2) | Select if you want to create a new subset of data to analyze. |
| Continue Analysis Using Table: (text box) | | Enter name of table saved during previous session.  Table can be treated as a Subset (simply a set of the Sample ID numbers under consideration), or as a "BaseTable" — a Subset along with grouping variable information.  While any saved table can serve as a Subset, only on frmGroups (Step 4) can you save a BaseTable. |
| Continue/Go to: Select grouping variables (treat table as Subset) | Go to frmGroups (Step 4) | Since you've already created your Subset, you skip Step 3. |
| Continue/Go to: Analysis: Group by variables in table (treat as BaseTable) | Go to frmAnalysis (Step 5) | Since you've already created your Subset, and the grouping variables are defined in the BaseTable, you skip Steps 3 and 4. |
| Continue/Go to: Analysis:  Pool all values | Go to frmAnalysis (Step 5) | Since you've already created your Subset, and you don't want to group by any variables, you skip Steps 3 and 4. |

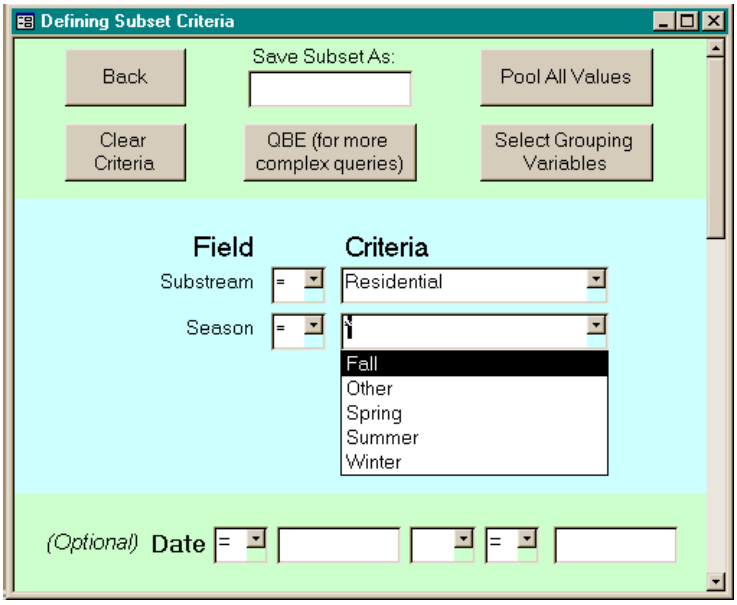
## STEP 2. frmStrataSelect: *Selecting Years and Criteria Variables for Analysis*




*Note:* A few variables at the end of the list of Criteria Variables aren't meant to be selected (but must be included in the query that populates this listbox). They are: SvyKey, Date (because it's handled in Step 3), PoolAll, and StudyPeriod (which is dealt with on this form).

| Button/Feature | Action | Comments |
|---|---|---|
| 1. Select Study Period(s) | | List boxes are "multi-select," i.e. you can select either one value with your mouse, one or more contiguous using the <SHIFT> key, or one or more noncontigous using the <CONTROL> key.<br><br>If more than one study period is selected, you can only analyze by Uniform Subclass categories. If only one year is selected, then analysis on both Uniform and Original Subclasses (specific to selected year) opens up. |
| Pool All Values | Go to frmAnalysis (Step 5) | Select if (1) you have no screening criteria other than year; and (2) you want the waste subclass proportions calculated on all the samples (of year(s) specified) as a whole. |
| Jump to Grouping Variables | Go to frmGroups (Step 4) | Select if (1) you have no screening criteria other than year; and (2) you want to analyze that subset broken down by certain grouping variables. |
| Define Subset | Go to frmValueSelect (Step 3) | Select if you want to restrict analysis to a certain set of samples defined by values of the Criteria Variable(s) you select here. |
| Reset Selections | Clears all selections | |

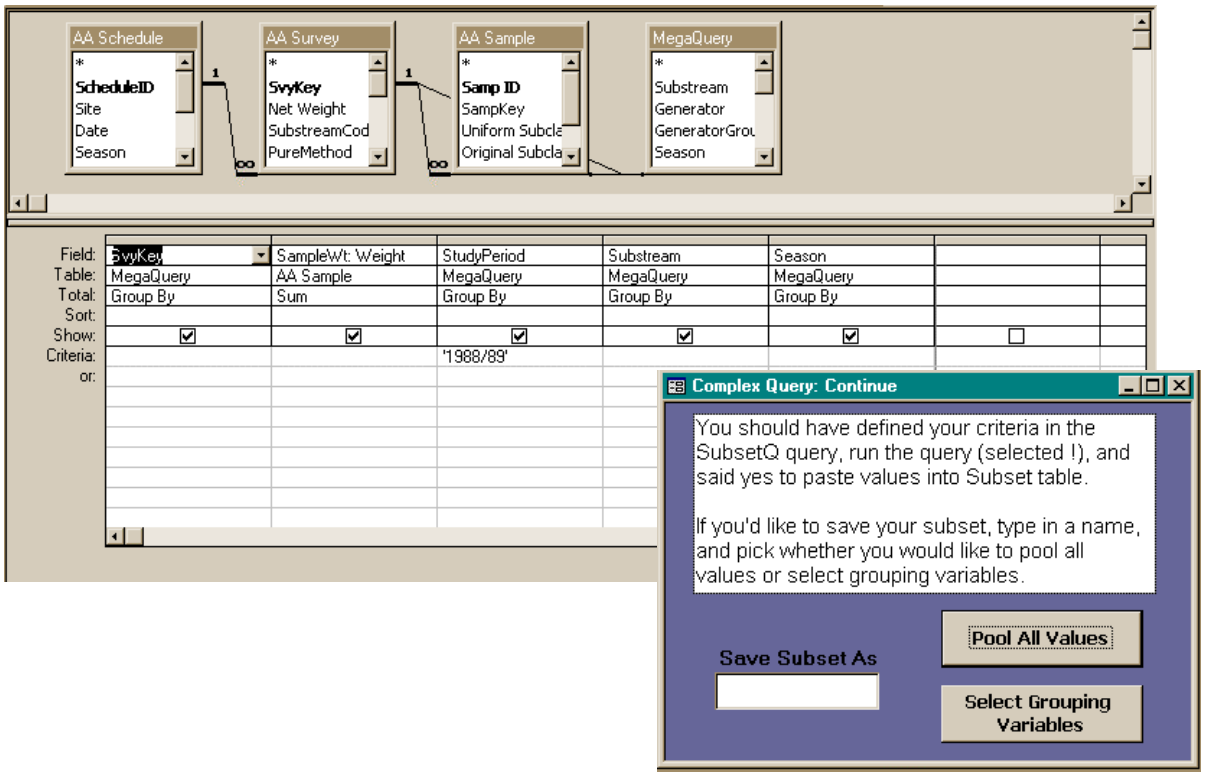
## STEP 3a. frmValueSelect*: Defining Subset Criteria* (other than year)




| Button/Feature | Action | Comments |
|---|---|---|
| Back | Close form | Should bounce you back to previous form. |
| Clear Criteria | Clears all selections | |
| Save Subset As: (text box) | | When you select either "Pool All Values" or "Select Grouping Variables," the *Subset* (as opposed to BaseTable) defined by your selections on this form will be saved under the name you type in. |
| QBE (for more complex queries) | Go to frmComplexSS via QBE grid (Step 3b) | In this example, the subset created would be 1988/89 samples that are residential AND taken in the fall. If you want to screen according to OR relationships between variables, or some other more complex definition, select this button. Probably will rarely use. |
| Pool All Values | Go to frmAnalysis (Step 5) | Now that you've defined the subset of interest, you just want waste subclass proportions calculated on that subset of samples *as a whole*. |
| Select Grouping Variables | Go to frmGroups (Step 4) | You've defined what samples should be included in analysis, next you want to specify by which grouping variables the analysis should be broken down. |

Additional Comments: If you decide not to screen by one of your selected variables, simply do nothing. The * showing in the combo-box means "select all values."

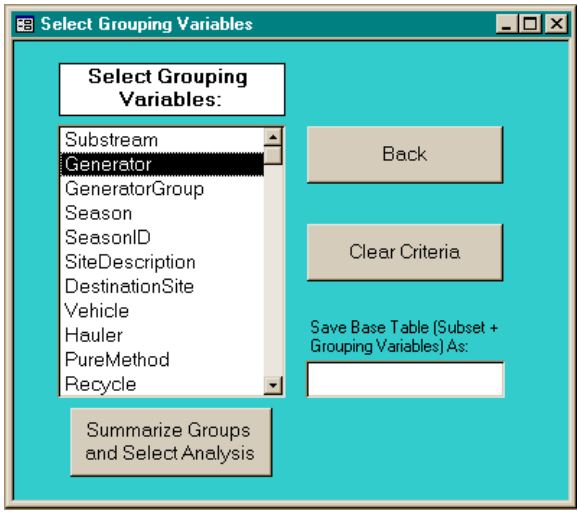
## STEP 3b. QBE grid tailored to selected year(s) and criteria variables:




**FrmComplexSS:** ***Complex Query: Continue***

| Button/Feature | Action | Comments |
|---|---|---|
| Save Subset As: (text box) | | When you select either "Pool All Values" or "Select Grouping Variables," the *Subset* (as opposed to BaseTable) defined by your selections on this form will be saved under the name you type in. |
| Pool All Values | Go to frmAnalysis (Step 5) | Now that you've defined the subset of interest, you just want waste subclass proportions calculated on that subset of samples *as a whole*. |
| Select Grouping Variables | Go to frmGroups (Step 4) | You've defined what samples should be included in analysis, next you want to specify by which grouping variables the analysis should be broken down. |

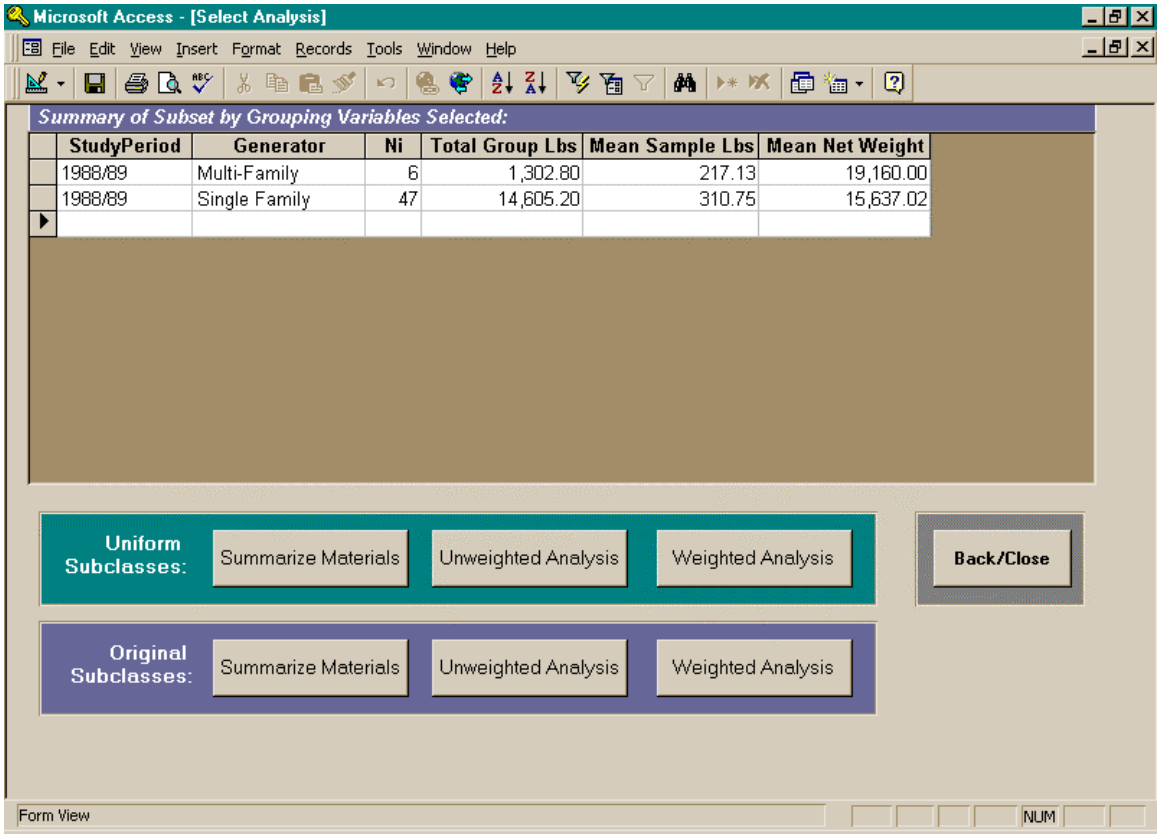
## STEP 4. frmGroups: *Select Grouping Variables*




*Note:* A few variables at the end of the list of Grouping Variables aren't meant to be selected to group by (but must be included in the query that populates this listbox). They are: SvyKey, Date, PoolAll, and StudyPeriod (which is assumed).

| Button/Feature | Action | Comments |
|---|---|---|
| Back | Close form | Should bounce you back to previous form. |
| Clear Criteria | Resets list box | |
| Save BaseTable (Subset + Grouping Variables) As: (text box) | | When you select "Summarize Groups and Select Analysis," the *BaseTable* (as opposed to Subset) defined by your selections on this form will be saved under the name you type in. This enables you later to skip right to Step 5: Select Analysis by selecting "Treat as BaseTable" in Step 1. |
| Summarize Groups and Select Analysis | Go to frmAnalysis (Step 5) | If there is more than one value in selected dataset for the grouping variables you select in the multiple select list box (or if you selected more than one StudyPeriod), analysis will be broken down by the unique strata combinations created.<br><br>*E.g.,* Here our grouping variables are StudyPeriod (selected in Step 1) and Generator (selected here). In the subset of data we defined (Residential samples collected in the Fall during the 1988/89 StudyPeriod), there is 1 value for StudyPeriod (1988/89) and 2 values for Generator (Single Family and Multi-Family). Therefore, we expect to see 1*2 = 2 strata groups represented in the "Summary of Subset by Grouping Variable(s) Selected" table in Step 5. |

## STEP 5. frmAnalysis: *Select Analysis*




One thing this form shows is how many distinct strata groups were defined by selections on previous forms. Since there was only one value selected for StudyPeriod and two values occurring in the subset (screened for Fall Residential samples) for Generator, there are 1*2 unique strata groups. Had "Pool All Values" be selected at any point (in Steps 1–3), there would be just one line of summary information.

***Subset Summary:***
**Ni** ($N_i$) denotes sample size of the given strata group—of the 53 Fall/Residential samples collected in 1988/89, 6 were multi-family and 47 were single family.
**Total Group Lbs** gives the sum of all the sample weights within that strata group.
**Mean Sample Lbs** gives the average weight per sample within that strata group.
**Mean Net Weight** gives the average weight of the trucks (in tons) within that strata group.

Note that the “Original Subclasses” buttons are available, because we selected only one StudyPeriod. They would otherwise not appear.

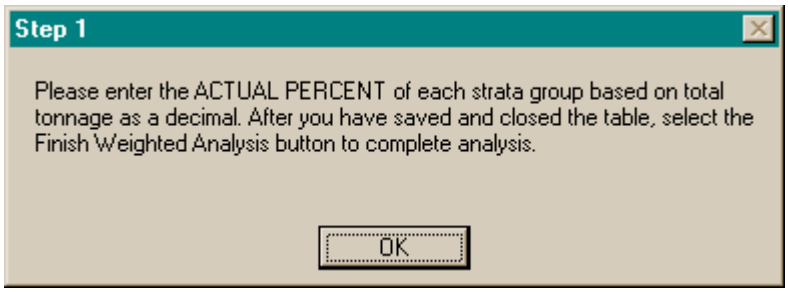
## STEP 5 (Cont'd). frmAnalysis: *Select Analysis*

| Button/Feature | Action | Comments |
|---|---|---|
| Summarize Materials (Uniform Subclasses) | Create table and report "MaterialsSummary_Uniform" Go to form "MatSum_U_Report," view report (Step 7) | Calculated for each subclass in each strata group: % Occurrence (% of samples in which the material was present), Min % (the minimum **nonzero** % composition across samples—you know if % Occurrence isn't 100% then the true minimum % is 0), Max %, and Mean % (per sample within strata groups = Σ [% composition of particular subclass within each sample, across all samples] ÷ number of samples). |
| Summarize Materials *(Original Subclasses) | Create table and report "MaterialsSummary_ Original" Go to form "MatSum_O_Report," view (Step 7) | |
| Unweighted Analysis (Uniform Subclasses) | Create table and report "UnweightedComposition_Uniform" Go to form "Unweighted_U_Report," view report (Step 7) | Calculated for each subclass in each strata group: Ratio (sum of component weights across all samples ÷ sum of total sample weights across all samples—called Mean in report), Variance, +/- (1.645 * the square root of Variance), Low, and High (the Ratio minus and plus the +/- term, respectively). The Low and High terms form the boundaries of the 90% ($\alpha$ = 0.10) confidence interval about the estimated Ratio. |
| Unweighted Analysis *(Original Subclasses) | Create table and report "UnweightedComposition_ Original" Go to form "Unweighted_O_Report," view report (Step 7) | |
| Weighted Analysis (Uniform Subclasses) | MsgBox telling user to enter weights as decimals. Open table "Weights" Open frmU_Weighted (Step 6) | Also called "Overall Composition" estimates. Same as above, but only one set of values are generated for each subclass by taking weighted averages of above estimates across the strata groups. I.e., unweighted values are "folded" back into one overall value using tonnage percentages per strata as weights. The weighted values can only be interpreted within the context of the subset of data analyzed. |
| Weighted Analysis *(Original Subclasses) | MsgBox telling user to enter weights as decimals. Open table "Weights" Open frmO_Weighted (Step 6) | |
| Back/Close | Closes the form. | Should bounce you back to previous form. |

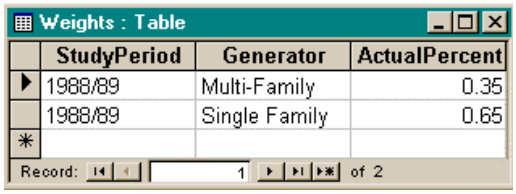
*Original Subclasses options won't appear if > 1 study period was selected.

## STEP 6. (Weighted Analysis)

When you select Weighted Analysis, a message box pops up prompting you to enter in weight percentages that should add up to 1.0. After you select OK, the table "Weights" appears with the ActualPercent field blank.

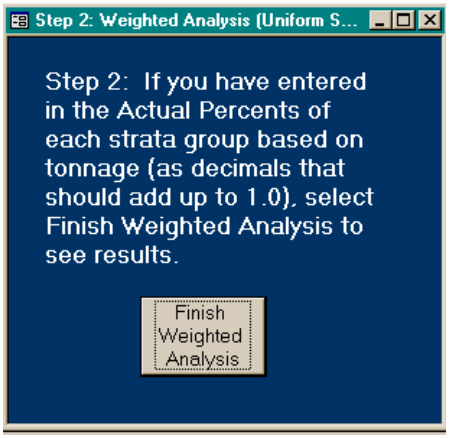


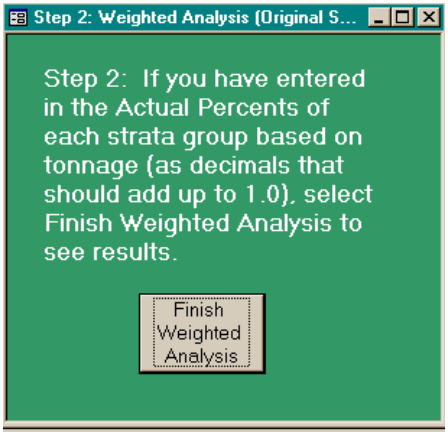

As an example, 0.35 and 0.65 are entered here, which would indicate that during the 1988/89 study period, 35% of waste collected, by weight, came from multi-family homes, while 65% came from single family homes.




Behind the table, ready to appear once you've clicked on the X in the upper corner of the table to close it, you will find either…

**frmU_Weighted:** ***Step 2: Weighted Analysis (Uniform Subclasses)***
**frmO_Weighted:** ***Step 2: Weighted Analysis (Original Subclasses)***



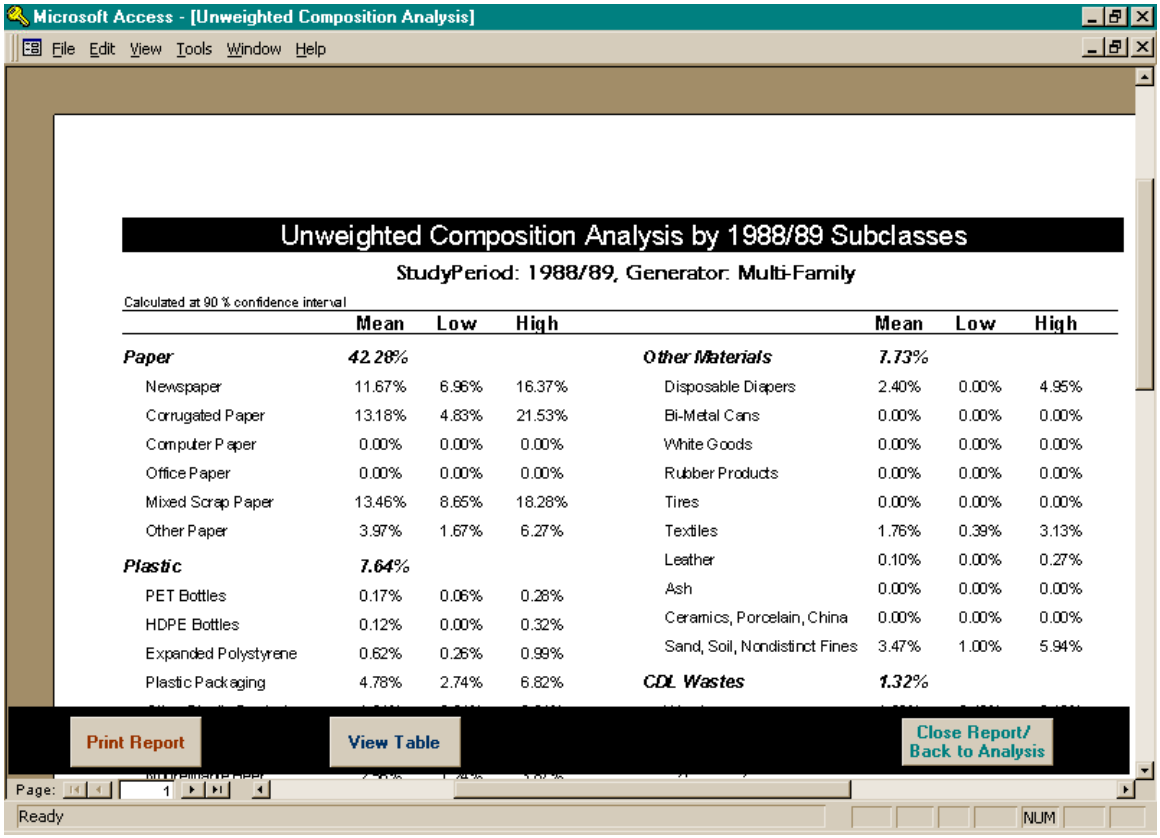

| Button/Feature | Action | Comments |
|---|---|---|
| Finish Weighted Analysis | Create table and report<br>"WeightedComposition_Uniform" or<br>"WeightedComposition_Original"<br>Go to form (Step 7)<br>"Weighted_U_Report" or<br>"Weighted _O_Report" | See explanation of weighted analysis in Step 5. |

## STEP 7. View report/Report forms

The reports are meant to be interfaced using the appropriate form. The basic purpose of these forms is to avoid the user closing a report on their own, and selecting "Yes" to the save prompt (which creates problems). Reports should never be saved (see explanation).

"U" indicated Uniform subclasses, "O" signifies Original subclasses.

**MatSum_U_Report:** ***Form for Materials Summary Report (Uniform Subclasses)***
**MatSum_O_Report:** ***Form for Materials Summary Report (Original Subclasses)***
**Unweighted_U_Report:** ***Form for Unweighted Composition Report (Uniform Subclasses)***
**Unweighted_O_Report:** ***Form for Unweighted Composition Report (Original Subclasses)***
**Weighted_U_Report:** ***Form for Weighted Composition Report (Uniform Subclasses)***
**Weighted_O_Report:** ***Form for Weighted Composition Report (Original Subclasses)***



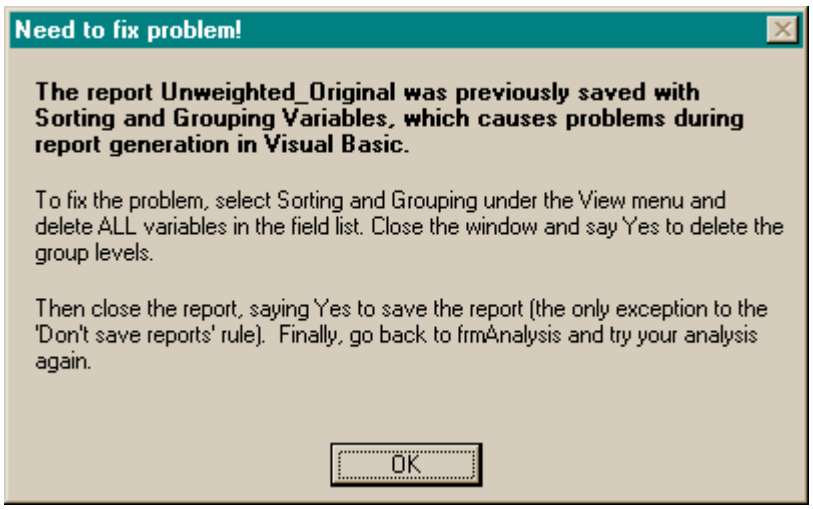

| Mean | Low | High | | Mean | Low | High |
|---|---|---|---|---|---|---|
| ***Paper*** | ***42.28%*** | | | ***Other Materials*** | ***7.73%*** | |
| Newspaper | 11.67% | 6.96% | 16.37% | Disposable Diapers | 2.40% | 0.00% | 4.95% |
| Corrugated Paper | 13.18% | 4.83% | 21.53% | Bi-Metal Cans | 0.00% | 0.00% | 0.00% |
| Computer Paper | 0.00% | 0.00% | 0.00% | White Goods | 0.00% | 0.00% | 0.00% |
| Office Paper | 0.00% | 0.00% | 0.00% | Rubber Products | 0.00% | 0.00% | 0.00% |
| Mixed Scrap Paper | 13.46% | 8.65% | 18.28% | Tires | 0.00% | 0.00% | 0.00% |
| Other Paper | 3.97% | 1.67% | 6.27% | Textiles | 1.76% | 0.39% | 3.13% |
| ***Plastic*** | ***7.64%*** | | | Leather | 0.10% | 0.00% | 0.27% |
| PET Bottles | 0.17% | 0.06% | 0.28% | Ash | 0.00% | 0.00% | 0.00% |
| HDPE Bottles | 0.12% | 0.00% | 0.32% | Ceramics, Porcelain, China | 0.00% | 0.00% | 0.00% |
| Expanded Polystyrene | 0.62% | 0.26% | 0.99% | Sand, Soil, Nondistinct Fines | 3.47% | 1.00% | 5.94% |
| Plastic Packaging | 4.78% | 2.74% | 6.82% | ***CDL Wastes*** | ***1.32%*** | | |

| Button/Feature | Action | Comments |
|---|---|---|
| Print Report | Prints report on default printer. | |
| View Table | View the appropriate output table. | Seeing the data in the output table can be useful for seeing more decimal places, or the variance of the estimates. |
| Close Table | Closes output table. | |
| Close All/Back to Analysis* | Close form and table/report and return to frmAnalysis (Step 5). | Always use this button to close the report. |

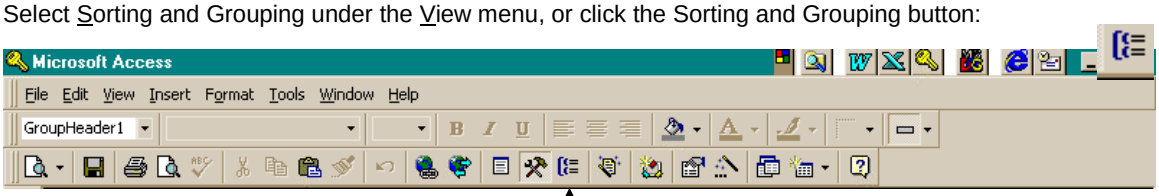
***Why reports should never be saved and how to fix things if one is saved.***

The important thing to remember when dealing w/ the reports is NEVER TO SAVE THEM. Always close without saving them, otherwise the group level variables get saved with the report, and the next time through, those group levels already being in the report cause the new ones created in code during report generation to be added on top of the prexisting ones. Group levels saved with a report cannot be deleted using Visual Basic; they can only be deleted manually.

These problems can be avoided by always using the form button "Close All/Back to Analysis" when you're done with a report. In the event a report was saved with group levels, the following message box should pop up:

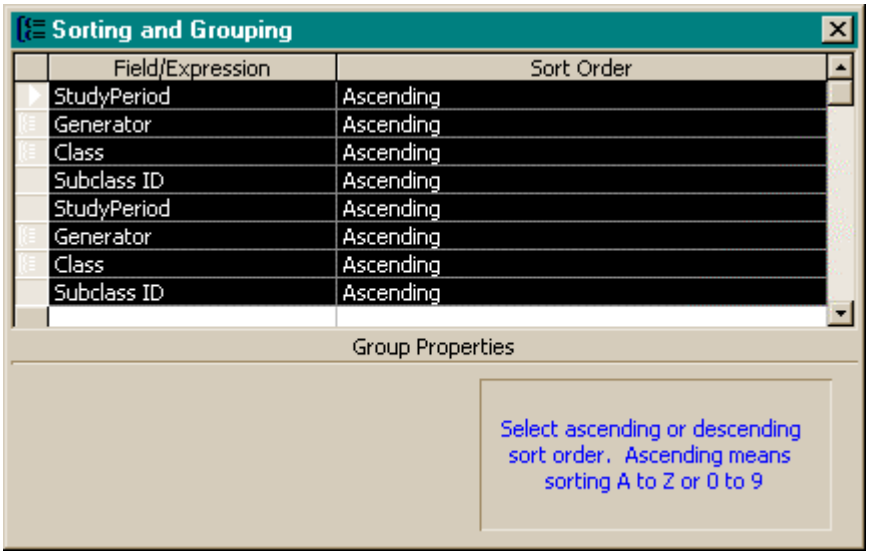



1. Select OK. Screen will then show the design view of the form.
2. Select Sorting and Grouping under the View menu, or click the Sorting and Grouping button:




on the toolbar, right here: ——————

3. With your mouse, select all Fields and press <Delete>. Select Yes to the message box asking if you want to delete the selected group level(s) and all associated sections and controls.




4. Close the Sorting and Grouping box.
5. Close the form, this time saying Yes to the prompt to save.

6. Go back to Step 5.

## A walk-through example of how to use the Seattle Waste Composition Calculations Database

***Goal:*** To get composition estimates for the first 6 months of the 1994/95 study period, weighted by Generator (Single Family/Multi-Family) and Destination (called "Origin" in the 1998/99 study) (North RDS/South RDS).

**Step 1:** frmFirst (Begin Waste Composition Analysis)
- Select "New Analysis"

**Step 2:** frmStrataSelect (Selecting Years and Criteria Variables for Analysis)
- Select 1994/95 in the Study Period list box
- Select "Define Subset" (Date is a special-case variable which is dealt with on the next form).

**Step 3:** frmValueSelect (Defining Subset Criteria)
- Create the following statement using the drop-down boxes at the bottom of the form: Date < 11/1/94
- Select "Select Grouping Variables"
- You should get a message box telling you that 187 out of 2587 total samples were selected for analysis. (187 of the 368 samples collected in the 1994/95 StudyPeriod were selected). Select OK

**Step 4:** frmGroups (Select Grouping Variables)
- Holding down the <Control> key, select Generator and Destination as your grouping variables
- Type "Example" (or any other table name besides "Subset," "BaseTable," or those reserved as data tables) in the "Save BaseTable As:" textbox if you'd like to save the subset you created along with the grouping variable information.

**Step 5:** frmAnalysis
- Select Weighted Analysis for Original Subclasses (the subclasses used in the 1994/95 study). If you wanted to compare these values with other years, you'd want to select Uniform Subclasses.
- You should get a message box telling you to enter the weights based on tonnage. Select OK.

**Step 6:** Table Weights/frmO_Weighted (Step 2: Weighted Analysis (Original Subclasses))
- Enter in the weights as shown below:

| StudyPeriod | Generator | Destination | ActualPercent |
|---|---|---|---|
| 1994/95 | Multi-Family | North | 0.3244 |
| 1994/95 | Multi-Family | South | 0.0911 |
| 1994/95 | Single Family | North | 0.3275 |
| 1994/95 | Single Family | South | 0.2570 |

- Close the table (make sure to move your cursor off the final cell to ensure it gets saved) by clicking the X in the upper right hand corner.
- Select Finish Weighted Analysis

**Step 7:** Report Weighted_Original/Form Weighted_O_Report
- Select "View Table" if you'd like to see the raw data underlying the report.
- Select "Print Report" if you'd like to have a hard copy of the report.
- To close the report and/or perform other analyses, use the "Close All/Back to Analysis" button

**Flowchart of the Seattle Waste Composition Calculations Database**