SCS ENGINEERS

# Waste Composition Study as Part of The Municipal Solid Waste-to-Energy (MSWE) Project

## Summary of October 2009 Results

Presented to:

CITY OF CLEVELAND
Mayor Frank G. Jackson

Department of Public Utilities
1300 Lakeside Avenue
Cleveland, OH 44114
(216) 664-3922

Presented by:

**SCS ENGINEERS**
2060 Reading Road
Suite 200
Cincinnati, Ohio 45202
(513) 421-5353

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**Offices Nationwide**
www.scsengineers.com

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# 1 INTRODUCTION

SCS Engineers conducted a municipal solid waste composition study in October 2009 for the City of Cleveland Department of Public Works. The study, which was conducted during a five-day period during October 5-9, 2009 at the Ridge Road Transfer Station, aimed to provide reliable data on the composition of the residential waste stream produced in the City of Cleveland. The goal is to provide the City with data that can be used to help plan for the development of a municipal waste-to-energy facility. The October study was the first of a two-phase waste composition study for the City. The second phase of the waste sampling and analysis will be conducted in 2010. This report summarizes the data collected during the October phase of the study.

# 2 APPROACH

SCS utilized a field crew that consisted of a Crew Chief and an SCS Field Technician. The Crew Chief oversaw the project's onsite operations and managed the sorting crew. The Field Technician was responsible for selecting the appropriate trucks to sample with assistance from Ridge Road Transfer Station personnel. Once a truck was targeted for sampling, it was directed to a clear portion of the transfer station tipping floor where transfer station personnel selected the waste sample from a randomly selected portion of the discharged load. The sample was collected with using a small loader and then dumped into trash cans and weighed to establish an appropriate sample weight. Appendix A includes a summary of the vehicles that were targeted for sampling each day of the study.

The sorting crew consisted of seven laborers that hand-sorted each of the 50 samples that were collected during the five-day sampling period. Samples were sorted and weighed separately, with the weight of each component recorded (to the nearest 0.1 pound) on a unique field data sheet, one sheet for each sample. Each laborer was responsible for the sorting and cataloging of a particular waste category to maintain consistency and accuracy of the sorting protocol. The waste materials were sorted into 62 different categories in accordance with the City's specifications. A description of the various waste categories is included in Appendix B. The Crew Chief was responsible for quality control of the waste samples to ensure no cross-contamination.

Refuse samples were designated as originating from either manual rear-load compacting trucks, or from the Automated Residential Waste Collection Program (Pilot Program). The Pilot Program is in select areas throughout the City and uses trucks equipped with an automatic or semi-automatic arm to collect refuse from residents. Residents in the Pilot Program received sturdy garbage carts for trash and recycling which can be wheeled to the curb. Manual Rear-Load Trucks collect trash without an automated arm. Trash bags are collected from the curb by the driver or helper and then deposited in the back of the truck and compacted. Average waste composition results of the Manual Rear-Load Trucks and Pilot Program Trucks are presented separately to show differences in the composition of the waste stream. There were 35 samples collected from Manual Rear-Load trucks and 15 samples collected from Pilot Program trucks.

The City of Cleveland has three truck stations which each collect waste from a different sector of the City:

- Ridge Road Station – Trucks from this station collect waste from the western portion of the City which is subdivided into Districts 110, 120, and 130.

- Glenville Station – Trucks from this station collect waste from the near west and northeast portion of the City which is subdivided into Districts 210, 220 and 230.

- Carr Center Station – Trucks this station collect waste from the southeastern portion of the city which is subdivided into Districts 310, 320, and 330.

Each station also runs its own Pilot Program trucks in their service area. Exhibit 1 summarizes the number of samples collected from each District in the City of Cleveland.

**Exhibit 1. Sampling Distribution**

| Summary of Sampling per District | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ridge Road Station | | | | Glenville Station | | | | Carr Center Station | | | |
| District | 110 | 120 | 130 | Pilot | 210 | 220 | 230 | Pilot | 310 | 320 | 330 | Pilot |
| # of Samples | 4 | 4 | 4 | 5 | 4 | 4 | 3 | 5 | 4 | 4 | 4 | 5 |

# 3 RESULTS

Fifty samples were collected during the sampling event. The data from Pilot Program and Manual Rear-Load Trucks has been analyzed separately. Data presented include mean percentages by weight, standard deviations, and statistical confidence intervals (95 percent confidence interval). Derivation of this data is as follows:

$$Mean\ \left(\overline{X}\right) = \sum_{i=1}^{n} x_i * \frac{1}{n};$$

$$Standard\ Deviation\ (s) = \sqrt{\frac{\left(n\sum x^2\right) - \left(\sum x\right)^2}{n(n-1)}}\text{; and}$$

$$Upper/Lower\ Confidence\ Interval\ Limits = \overline{X} \pm \left[1.96 * \left(\frac{\sigma}{\sqrt{n}}\right)\right]$$

where: n = number of samples; and
x = sample percentage.

## RESIDENTIAL WASTE COMPOSITION

### Manual Rear-Load Trucks

As shown in Exhibits 2 and 3, Organic, Paper, and Plastic waste together comprise about 80 percent of the waste stream sampled from Manual Rear-Load trucks. Additional observations regarding the composition are outlined below:

- **Organic Waste** - Nearly 38 percent of the waste sampled from the Manual Rear-Load Trucks was organic waste. Of that 38 percent, the textiles category comprised the most significant portion at about 10 percent of the total waste stream. Other waste types making up a significant portion of the organic waste were miscellaneous organic (7.2 percent), and food waste (6.6 percent).

- **Paper Waste** - About 25 percent of the waste stream sampled from the Manual Rear-Load Trucks was paper waste. Of that 25 percent, non-recyclable paper comprised the largest portion of the stream at a little over five percent of the total waste stream. Significant quantities of newspaper/newsprint (4.1 percent), mixed recyclable paper (4.2 percent), corrugated cardboard (4.5 percent) and paperboard (3.9 percent) were also observed. Recyclable Paper compromised about 19 percent of the total waste stream.

- **Plastic Waste** - About 19 percent of the waste stream from Manual Rear-Load trucks was comprised of plastic waste. Of that 10 percent, plastic film comprised the largest component of the materials by weight (8.4 percent). Other rigid plastics also comprised a significant portion of the plastic waste (5.1 percent). Recyclable Plastics (#1-7 bottles and recyclable containers/tubs) compromised about 4.1 percent of the total waste stream.

- **Commingled Recyclables -** Aluminum Cans/Tins/Foils, Steel/Bi-metal Cans, and Glass Bottles comprise about 6.3 percent of the total waste stream.

- **Miscellaneous Inorganic –** This category compromised about 2.4 percent of the total waste stream. A significant portion of this category can be attributed to kitty litter and vacuum bags.

- **Other Construction and Demolition Waste** - About one percent of the waste stream from Manual Rear-Load Trucks was other construction and demolition waste. In this case a large amount of carpet was in one of the samples and attributed to this category.

- **Hazardous Waste** – With the exception of tires, which were 0.2 percent of the waste stream, each of Hazardous Waste categories represented less than 0.1 percent of the total waste stream.

## Exhibit 2. Waste Composition for October 2009
## Manual Rear-Load Trucks

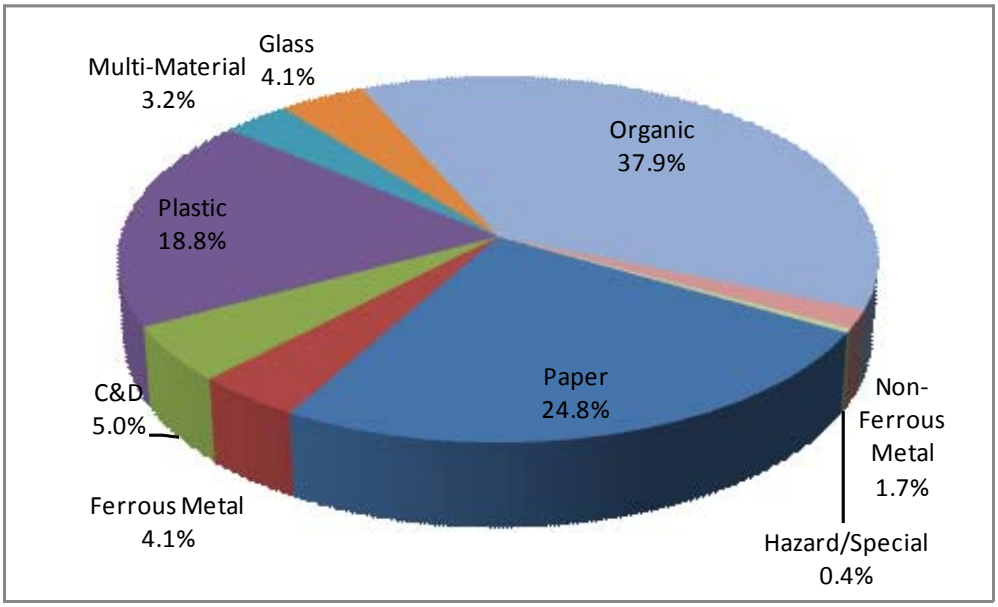
| Material Components | Mean Composition | Standard Deviation | 95% Confidence Limits Lower | 95% Confidence Limits Upper |
|---|---|---|---|---|
| **PAPER** | | | | |
| 1 Newspaper/Flyers | 4.1% | 2.8% | 3.1% | 5.0% |
| 2 Magazines/Catalogs | 1.9% | 3.6% | 0.7% | 3.1% |
| 3 Corrugated Cardboard | 4.5% | 2.4% | 3.7% | 5.3% |
| 4 Paperboard | 3.9% | 1.8% | 3.3% | 4.5% |
| 5 Telephone Books/Directories | 0.7% | 1.1% | 0.3% | 1.1% |
| 6 Mixed Paper | 4.2% | 2.7% | 3.3% | 5.1% |
| 7 Wallpaper | <0.1% | <0.1% | <0.1% | <0.1% |
| 8 Polycoated Paper | 0.4% | 0.5% | 0.2% | 0.5% |
| 9 Non-Recyclable Paper | 5.1% | 2.3% | 4.3% | 5.8% |
| **Total Paper** | **24.8%** | | | |
| **PLASTIC** | | | | |
| 10 PET #1 Bottles (<2 Liters) | 1.3% | 0.7% | 1.1% | 1.6% |
| 11 Pet #1 Bottles (>2 Liters) | 0.7% | 0.4% | 0.6% | 0.8% |
| 12 HDPE #2 Bottles | 1.2% | 0.6% | 1.1% | 1.4% |
| 13 #3-#7 Plastic Bottles | 0.1% | 0.3% | <0.1% | 0.2% |
| 14 Polystyrene | 1.3% | 0.7% | 1.0% | 1.5% |
| 15 Other Recyclable Containers/Tubs | 0.7% | 0.5% | 0.5% | 0.8% |
| 16 Film Plastic - Other | 8.4% | 3.0% | 7.4% | 9.4% |
| 17 Other Rigid Plastic | 5.1% | 2.8% | 4.2% | 6.1% |
| **Total Plastic** | **18.8%** | | | |
| **ORGANIC** | | | | |
| 18 Food Waste | 6.6% | 3.6% | 5.4% | 7.8% |
| 19 Clothing/Linens/Textiles/Leather | 9.7% | 7.1% | 7.4% | 12.0% |
| 20 Wood (Land Clearing) | 0.3% | 1.3% | <0.1% | 0.7% |
| 21 Leaves and Grass | 4.5% | 6.6% | 2.3% | 6.7% |
| 22 Wood (Yard Waste) | 1.8% | 3.0% | 0.8% | 2.8% |
| 23 Untreated Lumber/Wood | 2.1% | 3.1% | 1.0% | 3.1% |
| 24 Fish Waste | <0.1% | <0.1% | <0.1% | <0.1% |
| 25 Diapers & Sanitary Products | 3.1% | 2.1% | 2.4% | 3.8% |
| 26 Fines | 2.7% | 1.3% | 2.3% | 3.1% |
| 27 Miscellaneous Organics | 7.2% | 1.1% | 6.8% | 7.5% |
| **Total Organic** | **37.9%** | | | |
| **FERROUS METAL** | | | | |
| 28 Ferrous/Bi-metal Cans | 1.6% | 0.9% | 1.3% | 1.9% |
| 29 Aerosol | <0.1% | 0.2% | <0.1% | 0.1% |
| 30 Empty Paint Cans/Lids | 0.1% | 0.4% | <0.1% | 0.3% |
| 31 Other Ferrous | 2.3% | 4.6% | 0.8% | 3.8% |
| **Total Ferrous Metal** | **4.1%** | | | |

## Exhibit 2 – continued.

| Material Components | Mean Composition | Standard Deviation | 95% Confidence Limits Lower | 95% Confidence Limits Upper |
|---|---|---|---|---|
| **NON-FERROUS METAL** | | | | |
| 32 Aluminum Cans/Tins/Foil | 1.3% | 0.9% | 1.0% | 1.6% |
| 33 Aerosol Cans | 0.1% | 0.2% | <0.1% | 0.2% |
| 34 Other Aluminum | <0.1% | <0.1% | <0.1% | <0.1% |
| 35 Other Non-Ferrous | 0.2% | 0.4% | <0.1% | 0.3% |
| **Total Non-Ferrous Metal** | **1.7%** | | | |
| **GLASS** | | | | |
| 36 Clear Bottles | 1.9% | 1.5% | 1.4% | 2.4% |
| 37 Colored Bottles | 1.5% | 1.3% | 1.1% | 2.0% |
| 38 Non-Container Glass | 0.7% | 1.7% | 0.2% | 1.3% |
| **Total Glass** | **4.1%** | | | |
| **Construction and Demolition Waste** | | | | |
| 39 Asphalt, Brick, Concrete | 0.8% | 2.7% | <0.1% | 1.7% |
| 40 Roofing Shingles | <0.1% | 0.1% | <0.1% | <0.1% |
| 41 Drywall/Gypsum Board | 0.4% | 2.3% | <0.1% | 1.2% |
| 42 Treated Wood | 2.7% | 4.9% | 1.1% | 4.3% |
| 43 Other C&D Waste | 1.0% | 6.2% | <0.1% | 3.1% |
| **Total C&D Waste** | **5.0%** | | | |
| **Multi Material Waste** | | | | |
| 44 Predominantly Paper | <0.1% | <0.1% | <0.1% | <0.1% |
| 45 Predominantly Glass | <0.1% | <0.1% | <0.1% | <0.1% |
| 46 Predominantly Ferrous | 0.5% | 2.4% | <0.1% | 1.3% |
| 47 Predominantly Non-Ferrous | <0.1% | <0.1% | <0.1% | <0.1% |
| 48 Predominantly Plastic | 0.2% | 0.9% | <0.1% | 0.5% |
| 49 Other Composites | 0.2% | 0.7% | <0.1% | 0.4% |
| 50 Misc. Inorganic | 2.4% | 2.9% | 1.5% | 3.4% |
| **Total Multi-Material** | **3.2%** | | | |
| **Hazardous/Special Care** | | | | |
| 51 Lead-Acid Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| 52 Other Rechargeable Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| 53 Other Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| 54 Oil-based Paints/Thinners | <0.1% | <0.1% | <0.1% | <0.1% |
| 55 Latex Paints | <0.1% | 0.2% | <0.1% | 0.1% |
| 56 Poisons | <0.1% | <0.1% | <0.1% | <0.1% |
| 57 Corrosives/Solvents | <0.1% | <0.1% | <0.1% | <0.1% |
| 58 Tires | 0.2% | 0.9% | <0.1% | 0.5% |
| 59 Medical | <0.1% | <0.1% | <0.1% | <0.1% |
| 60 Fuel/Lubricants/Auto | <0.1% | 0.2% | <0.1% | 0.1% |
| 61 HW Containers | <0.1% | 0.3% | <0.1% | 0.2% |
| 62 Other Hazardous | <0.1% | <0.1% | <0.1% | <0.1% |
| **Total Hazardous/Special Care** | **0.4%** | | | |
| **TOTALS** | **100.0%** | | | |

Note: Composition based on 35 samples.

**Exhibit 3. Major Waste Components**
**Manual Rear-Load Trucks**




## Pilot Program Trucks

As shown in Exhibits 4 and 5, Organic, Paper, and Plastic waste together comprise about 80 percent of the waste stream sampled from Pilot Program trucks. Additional observations regarding the composition are outlined below.

- **Organic Waste** - Nearly 40 percent of the waste stream from Pilot Program trucks was comprised of organic wastes. Of that 40 percent, the textiles category comprised the most significant portion at about nine percent of the total waste stream. Other significant components of the organic portion of the waste stream include miscellaneous organics (6.9 percent), and food waste (6.7 percent).

- **Paper Waste -** Nearly 24 percent of the waste stream consisted of paper materials. Non-recyclable paper made up the largest portion of paper at 5.5 percent of the entire waste stream. Significant quantities of newspaper/newsprint (3.9 percent), mixed recyclable paper (4.5 percent), corrugated cardboard (3.0 percent) and paperboard (4.4 percent) were also observed. Recyclable Paper compromised about 18 percent of the total waste stream.

- **Plastic Waste** - About 19 percent of the waste stream from Pilot Program trucks was comprised of plastics. Plastic film comprised the largest component of plastic waste by weight (8.5 percent). Other rigid plastics also composed a significant portion of the plastic waste (5.6 percent). Recyclable Plastics (#1-7 bottles and recyclable containers/tubs) compromised about 3.8 percent of the total waste stream.

- **Commingled Recyclables -** Aluminum, Steel/Bi-metal Cans, and Glass Bottles characterize about 7.6 percent of the total waste stream.

- **Miscellaneous. Inorganic** – This category compromised about 2.5 percent of the total waste stream. A significant portion of this category can be attributed to Kitty Litter and vacuum bags.

- **Other Construction and Demolition -** About 2.6 percent of the waste stream from Pilot Program trucks was construction and demolition waste. In this case a large amount of linoleum flooring was in one of the samples and attributed to this category.

- **Hazardous -** Each of Hazardous Waste categories represented less than 0.1 percent of the total waste stream, except medical waste (0.4 percent).

## Exhibit 4. Waste Composition for October 2009 Pilot Program Trucks

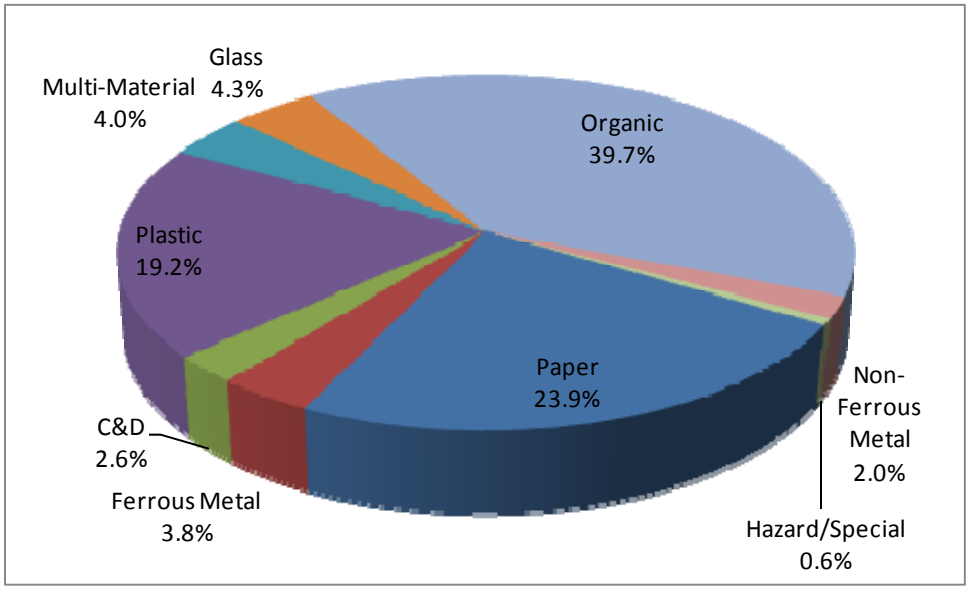
| Material Components | Mean Composition | Standard Deviation | 95% Confidence Limits Lower | 95% Confidence Limits Upper |
|---|---|---|---|---|
| **PAPER** | | | | |
| 1 Newspaper/Flyers | 3.9% | 2.5% | 2.7% | 5.2% |
| 2 Magazines/Catalogs | 1.7% | 1.2% | 1.1% | 2.3% |
| 3 Corrugated Cardboard | 3.0% | 1.7% | 2.1% | 3.8% |
| 4 Paperboard | 4.4% | 2.1% | 3.4% | 5.5% |
| 5 Telephone Books/Directories | 0.9% | 1.7% | <0.1% | 1.7% |
| 6 Mixed Paper | 4.5% | 2.2% | 3.3% | 5.6% |
| 7 Wallpaper | <0.1% | <0.1% | <0.1% | <0.1% |
| 8 Polycoated Paper | <0.1% | 0.7% | <0.1% | 0.4% |
| 9 Non-Recyclable Paper | 5.5% | 3.4% | 3.8% | 7.2% |
| **Total Paper** | **23.9%** | | | |
| **PLASTIC** | | | | |
| 10 PET #1 Bottles (<2 Liters) | 1.4% | 0.7% | 1.1% | 1.7% |
| 11 Pet #1 Bottles (>2 Liters) | 0.5% | 0.5% | 0.3% | 0.8% |
| 12 HDPE #2 Bottles | 0.9% | 0.4% | 0.8% | 1.1% |
| 13 #3-#7 Plastic Bottles | 0.2% | 0.3% | <0.1% | 0.4% |
| 14 Polystyrene | 1.3% | 0.8% | 0.9% | 1.8% |
| 15 Other Recyclable Containers/Tubs | 0.7% | 0.6% | 0.4% | 1.0% |
| 16 Film Plastic - Other | 8.5% | 2.0% | 7.5% | 9.5% |
| 17 Other Rigid Plastic | 5.6% | 3.0% | 4.0% | 7.1% |
| **Total Plastic** | **19.2%** | | | |
| **ORGANIC** | | | | |
| 18 Food Waste | 6.7% | 3.3% | 5.0% | 8.4% |
| 19 Clothing/Linens/Textiles/Leather | 8.8% | 5.3% | 6.2% | 11.5% |
| 20 Wood (Land Clearing) | <0.1% | <0.1% | <0.1% | <0.1% |
| 21 Leaves and Grass | 7.5% | 6.7% | 4.1% | 10.9% |
| 22 Wood (Yard Waste) | 1.8% | 3.5% | <0.1% | 3.5% |
| 23 Untreated Lumber/Wood | 1.4% | 2.1% | 0.4% | 2.5% |
| 24 Fish Waste | <0.1% | <0.1% | <0.1% | <0.1% |
| 25 Diapers & Sanitary Products | 3.5% | 3.0% | 2.0% | 5.1% |
| 26 Fines | 3.0% | 2.5% | 1.7% | 4.3% |
| 27 Miscellaneous Organics | 6.9% | 1.3% | 6.2% | 7.6% |
| **Total Organic** | **39.7%** | | | |
| **FERROUS METAL** | | | | |
| 28 Ferrous/Bi-metal Cans | 2.5% | 2.7% | 1.2% | 3.8% |
| 29 Aerosol | 0.2% | 0.3% | <0.1% | 0.4% |
| 30 Empty Paint Cans/Lids | <0.1% | 0.2% | <0.1% | 0.2% |
| 31 Other Ferrous | 1.0% | 0.9% | 0.5% | 1.5% |
| **Total Ferrous Metal** | **3.8%** | | | |

## Exhibit 4 - continued

| Material Components | Mean Composition | Standard Deviation | 95% Confidence Limits Lower | 95% Confidence Limits Upper |
|---|---|---|---|---|
| **NON-FERROUS METAL** | | | | |
| 32 Aluminum Cans/Tins/Foil | 1.7% | 1.9% | 0.7% | 2.6% |
| 33 Aerosol Cans | 0.3% | 0.3% | 0.1% | 0.4% |
| 34 Other Aluminum | <0.1% | <0.1% | <0.1% | <0.1% |
| 35 Other Non-Ferrous | <0.1% | 0.8% | <0.1% | 0.4% |
| **Total Non-Ferrous Metal** | **2.0%** | | | |
| **GLASS** | | | | |
| 36 Clear Bottles | 2.7% | 2.2% | 1.5% | 3.8% |
| 37 Colored Bottles | 0.8% | 1.0% | 0.2% | 1.3% |
| 38 Non-Container Glass | 0.9% | 1.4% | 0.2% | 1.6% |
| **Total Glass** | **4.3%** | | | |
| **Construction and Demolition Waste** | | | | |
| 39 Asphalt, Brick, Concrete | <0.1% | <0.1% | <0.1% | <0.1% |
| 40 Roofing Shingles | <0.1% | <0.1% | <0.1% | <0.1% |
| 41 Drywall/Gypsum Board | 0.1% | 0.4% | <0.1% | 0.3% |
| 42 Treated Wood | 1.3% | 2.9% | <0.1% | 2.8% |
| 43 Other C&D Waste | 1.2% | 3.4% | <0.1% | 2.9% |
| **Total C&D Waste** | **2.6%** | | | |
| **Multi Material Waste** | | | | |
| 44 Predominantly Paper | <0.1% | <0.1% | <0.1% | <0.1% |
| 45 Predominantly Glass | <0.1% | <0.1% | <0.1% | <0.1% |
| 46 Predominantly Ferrous | 0.9% | 2.5% | <0.1% | 2.2% |
| 47 Predominantly Non-Ferrous | <0.1% | <0.1% | <0.1% | <0.1% |
| 48 Predominantly Plastic | 0.1% | 0.5% | <0.1% | 0.3% |
| 49 Other Composites | 0.4% | 1.5% | <0.1% | 1.2% |
| 50 Misc. Inorganic | 2.5% | 3.1% | 1.0% | 4.1% |
| **Total Multi-Material** | **4.0%** | | | |
| **Hazardous/Special Care** | | | | |
| 51 Lead-Acid Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| 52 Other Rechargeable Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| 53 Other Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| 54 Oil-based Paints/Thinners | <0.1% | <0.1% | <0.1% | <0.1% |
| 55 Latex Paints | <0.1% | 0.2% | <0.1% | 0.2% |
| 56 Poisons | <0.1% | <0.1% | <0.1% | <0.1% |
| 57 Corrosives/Solvents | <0.1% | <0.1% | <0.1% | <0.1% |
| 58 Tires | <0.1% | <0.1% | <0.1% | <0.1% |
| 59 Medical | 0.4% | 1.6% | <0.1% | 1.2% |
| 60 Fuel/Lubricants/Auto | <0.1% | <0.1% | <0.1% | <0.1% |
| 61 HW Containers | <0.1% | 0.1% | <0.1% | 0.1% |
| 62 Other Hazardous | <0.1% | <0.1% | <0.1% | <0.1% |
| **Total Hazardous/Special Care** | **0.6%** | | | |
| **TOTALS** | **100.0%** | | | |

Note: Composition based on 15 samples.

**Exhibit 5. Major Waste Components**
**Pilot Program Trucks**




## WASTE STREAM COMPARISON

For the most part, the samples from the Pilot Program and Manual Rear-Load trucks were similar. The waste categories for which the 95 percent confidence intervals differ indicate a statistically significant difference between waste loads from Manual Rear-Load trucks and Pilot Program trucks. Three waste categories had significantly different proportions of the waste stream and these are described below.

**Corrugated Cardboard** – There is significantly more corrugated cardboard in waste loads from Manual Rear-Load trucks than in waste loads from Pilot Program trucks. As can be seen in Exhibit 2, the 95 percent confidence interval for the Manual Rear-Load trucks is from 3.7 percent to 5.3 percent. This is significantly higher than the confidence interval for Pilot Program trucks which is from 2.1 percent to 3.8 percent shown in Exhibit 4. This difference can likely be attributed to residents having a readily accessible recycling container adjacent to their waste containers.

**Plastic HDPE #2 Bottles** – There is significantly more plastic HDPE #2 bottles in waste loads from Manual Rear-Load trucks than in waste loads from Pilot Program trucks. The confidence interval for the Manual Rear-Load trucks is from 1.1 percent to 1.4 percent. The confidence interval for the Pilot Program trucks is from 0.8 percent to 1.1 percent.

**Glass Colored Bottles** – There is significantly more glass colored bottles in waste loads from Manual Rear-Load trucks than in waste loads from Pilot Program trucks. The confidence interval for the Manual Rear-Load trucks is from 1.1 percent to 2.0 percent. The confidence interval for the Pilot Program trucks is from 0.2 percent to 1.3 percent.

# 4 LABORATORY ANALYSIS

As part of this study, SCS contracted with Test America Laboratories to perform the moisture analysis of targeted waste samples. The results of the laboratory analysis, including the waste samples tested and the content tested for, are outlined in Exhibit 6.

**Exhibit 6. Moisture Analyses**

| Moisture Analysis (Pilot Trucks) | |
|---|---|
| Sample Material | Result (% Moisture) |
| Plastic | 26 |
| Misc. Organic | 80 |
| Paper | 32 |
| Food | 89 |
| Textiles | 46 |
| Moisture Analysis (Manual Rear-Load Trucks) | |
| Sample Material | Result (% Moisture) |
| Plastic | 21 |
| Misc. Organic | 42 |
| Paper | 37 |
| Food | 77 |
| Textiles | 13 |
| Average Moisture (Pilot and Manual Rear-Load) | |
| Sample Material | Result (% Moisture) |
| Plastic | 23.5 |
| Misc. Organic | 61 |
| Paper | 34.5 |
| Food | 83 |
| Textiles | 29.5 |

Each test was carried out according to the appropriate U.S. EPA test method. All samples were received into the laboratory at a temperature of 10° C and the reported results were obtained in compliance with 2003 National Environmental Laboratory Accreditation Conference standards.

# Appendix A

## Summary of Vehicles Targeted for Sampling

## NUMBER OF SAMPLES BY COLLECTION DISTRICT

| | | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|---|
| Ridge Road Station | District 110 | 1 | | 1 | 1 | 1 |
| | District 120 | 1 | 1 | 1 | 1 | |
| | District 130 | 1 | 1 | | 1 | 1 |
| | Pilot | 1 | 1 | 1 | 1 | 1 |
| Glenville Station | District 210 | 1 | 1 | 1 | | 1 |
| | District 220 | | 1 | 1 | 1 | 1 |
| | District 230 | 1 | 1 | | 1 | 1 |
| | Pilot | 1 | 1 | 1 | 1 | 1 |
| Carr Center Station | District 310 | | 1 | 1 | 1 | 1 |
| | District 320 | 1 | | 1 | 1 | |
| | District 330 | 1 | 1 | 1 | | 1 |
| | Pilot | 1 | 1 | 1 | 1 | 1 |
| Total Samples | | 10 | 10 | 10 | 10 | 10 |

# Appendix B

## Description of Waste Categories

Cleveland Public Power 2009 Waste Stream Analysis

Categories and Definitions

**PAPER**

1. Newspaper/Newsprint: Consists of all paper products printed on daily or weekly newspapers, advertising, newsprint catalogs, and other similar items. Includes any glossy, shiny, or other coated newspaper inserts. Publications can be one color (e.g., black and white) or multi-color.

2. Magazines: Publications which are printed on glossy paper. This does not include magazines, glossy catalogs, etc., which do not consist of glossy paper throughout (e.g., comic books).

3. Corrugated: Paperboard containers consisting of kraft (brown) linerboard with corrugated (fluted medium) fillings. Excludes waxed corrugated boxes; those are non-recyclable and should be included as 'Other Paper'.

4. Paperboard: Non-corrugated boxes and containers typically used for holding food products, detergents, shoes, and other similar packaged goods. Outside of box or container can be printed. Inside surface is typically a dull gray, brown, or white color.

5. Telephone Books/ Directories

6. Mixed Recyclable Paper: High-grade paper products originating from an office environment such as white or colored printing, writing, or copier paper; computer paper (with or without green bars); computer tab cards; file folders. Envelopes, junk mail, construction paper, wrapping paper, brochures, kraft paper, and other recyclable papers.

7. Wallpaper

8. Aseptic/Poly-Coated Food Containers: Consist of plastic or waxed paper containers such as gable-topped milk and juice cartons, Chinese food take-out boxes, and juice drink boxes such as those made by Ocean Spray etc.

9. Non-Recyclable Paper: All paper products not covered by the above categories, including all tissues, paper towels, and napkins, carbon paper, and other non-recyclable papers.

**PLASTICS**

10. PET (#l) (Polyethylene Terephthalate) Narrow Neck Bottles (<2 liters): Rigid clear or colored cylindrical bottles or containers with or without base cups for holding carbonated soft drinks, cooking oil, mouthwash, liquor, juice, water, and

other food ingredients, etc. The bottom of the bottle or container is coded "1" and usually has a small dot or nipple, not a seam.

11. 2 Liter PET bottles: Same as above but specific for this size category

12. HDPE (#2) (High Density Polyethylene) Narrow Neck Bottles – Natural or Pigmented: Moderately flexible to stiff cylindrical containers, commonly used for shampoos, detergents, motor oils, antifreeze, transmission fluids, windshield washer fluids, cleaning solutions and syrup, milk, juice or spring water products. The bottom of the container is coded "2" and usually has a seam.

13. #3-#7 Bottles: Rigid, narrow-necked bottles with code “3”, “4”, “5”, or “7” on the bottom.

14. Polystyrene: Rigid containers with code "6" on the bottom. Includes foamed polystyrene cups and food service containers (i.e., "clamshells") as well as clear rigid food service containers and packing "peanuts."

15. Other Plastic Containers/Tubs: Any type of recyclable plastic container (any number except 6) and tubs not covered by the above categories (i.e., yoghurt containers, margarine tubs, etc.).

16. Film Plastic: Translucent and opaque films/bags, such as trash, grocery and garbage bags, dry cleaning film.

17. Other Rigid Plastic (Non-Recyclable): Rigid plastic items such as pens, toys, CD cases.

**ORGANICS**

18. Food Waste: Putrescible organic materials which are the by-products of activities connected with the growing, preparation, cooking, processing, or consumption of food by human beings or domesticated animals.

19. Clothing/Linens/Textiles/Leather: Apparel and linens made from natural and synthetic fibers, such as clothing, blankets, sheets, towels, curtains, pillows, rags, shoes, belts, handbags, stuffed toys, upholstery, and other fabric products.

20. Land Clearing Wood: Large Stumps, logs or branches.

21. Leaves and Grass Trimmings

22. Woody Yard Waste: Smaller diameter branches or trimmings from shrubs and trees.

23. Untreated Lumber/Wood: Any size of untreated lumber or wood used for building, such as 2x4's or pallets.

24. Fish Waste: Fish carcasses and leftover food

25. Diapers and Sanitary Products: Disposable diapers, tampons, and sanitary napkins.

26. Fines: Any materials separated by falling through the sorting table mesh that cannot be categorized and are less than 0.5 inches in diameter.

27. Miscellaneous Organics: All other organic materials not covered by the above categories, including feces and dead animals, and organic items too small to sort.

**FERROUS**

28. Ferrous/Bi-Metal Cans: Steel and bi-metal food and beverage cans.

29. Aerosol Cans: Any empty ferrous Aerosol cans.

30. Paint Cans and Lids: Empty paint cans and lids, any size.

31. Other Ferrous: Ferrous scrap materials such as wire coat hangers, household appliances, nails and screws, auto parts, and other items adhering to a magnet.

**NON- FERROUS**

32. Aluminum Cans/Tins/Foil: Aluminum beverage containers, tins, and and foil.

33. Aerosol Cans: Any empty non ferrous Aerosol cans.

34. Other Aluminum: Other aluminum items such as siding, lawn chairs, window frames, rain gutters, etc.

35. Other Non-ferrous: Non-magnetizable, non-aluminum metals such as silver, lead, copper, brass, bronze, zinc, stainless steel.

**GLASS**

36. Clear Glass: Glass bottles used for food and beverages.

37. Colored Glass: Brown, Green or other colored glass bottles used for food and beverages

38. Other Glass: Glass not used for containers. Includes window glass, drinking glasses, light bulbs, and dinnerware

## CONSTRUCTION AND DEMOLITION

39. Asphalt, Brick, Rock, or Concrete

40. Roofing Shingles

41. Sheetrock/Drywall/Gypsum Board

42. Treated Wood

43. Other C&D

## MULTI-MATERIAL OBJECTS

44. Predominantly Paper

45. Predominantly Glass

46. Predominantly Ferrous

47. Predominantly Non-Ferrous

48. Predominantly Plastic

49. Other Composites

50. Misc. Inorganic: Unclassifiable inorganic objects, often kitty litter or the contents of vacuum bags.

## SPECIAL CARE WASTE

**Note:** The hazardous waste packed with Containers, the weights for both the hazardous waste and containers must be estimated and reported.

51. Lead Acid Batteries: Lead-acid batteries from automobiles, trucks, buses, boats, motorcycles, etc.

52. Alkaline Batteries

53. Other Rechargeable Batteries: All rechargeable batteries other than Category #50, e.g., Ni-Cd, SSLA, Ni-MH, Li-ion, etc.

54. Paints/Thinners: Oil-based paint or thinners and any other flammable liquid including stains, furniture polish, wood preservatives, and rust proofing agents.

55. Latex Paint

56. Tires

57. Poisons: Any toxic waste items thus marked such as pesticides and insecticides.

58. Corrosives/Solvents: Any toxic waste items thus marked including swimming pool chemicals, oven cleaner, drain cleaner, and photographic chemicals.

59. Medical: Any item contaminated with blood and other body fluid. Include syringes, needles, dressings, etc.

60. Fuel/Lubricants/Auto: Any waste item thus marked including motor oil, transmission fluid, brake fluid and antifreeze.

61. HW Containers: The empty containers for hazardous materials and chemicals.

62. Other Hazardous: Any other hazardous material not otherwise described.