



## Waste Composition Study Summary of Results

Presented to:



### Hamilton County, Ohio

Hamilton County Recycling and Solid Waste District  
A Division of the Department of Environmental Services  
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## 1 INTRODUCTION

Hamilton County of Ohio (the County) contracted with SCS Engineers (SCS) to conduct a waste composition analysis of residential waste generated within the county. The primary objectives of the study are as follows:

- To estimate types and quantities of recyclable waste components in the residential waste stream; and
- To identify opportunities for greater waste stream diversion

The basis for this waste characterization consists of a sampling event, conducted at the Rumpke Landfill. The data generated by the field activities will be used by the County to develop long-term waste management strategies and to evaluate the effectiveness of current recycling programs. This report presents the data collected during the December 2011 field activities.

The remaining sections of this report are organized as follows:

- Section 2 describes field classification and sampling methods.
- Section 3 presents project data and results gathered from the study.

**Appendix A** presents the Health and Safety Plan that was in effect during field activities.

## 2 METHODS

This section summarizes methods used to characterize the residential waste stream generated in Hamilton County. Sorting activities for the study took place from December 12<sup>th</sup> through December 16<sup>th</sup> 2011. Waste characterization activities were performed by manually sorting samples from municipal solid waste (MSW) into distinct waste categories.

### WASTE SAMPLING

Waste sorting was performed at the Rumpke Landfill during the operating hours of the facility. Given the limited size of the data set, it was important that unrepresentative data were avoided. Each day vehicles carrying waste from targeted areas of the County were directed to dump their waste loads near the sorting area. A representative of SCS manually gathered samples from a random portion of each target load (approximately two hundred pounds) for classification (sorting). Two important procedural factors were considered:

- The target vehicle selected for sampling contained MSW that was representative of the type of waste typically generated in that sector; and
- The process of acquiring the waste sample did not, in itself, alter the apparent MSW composition.

After being filled with solid waste, the trash cans were weighed and set aside until at least two hundred pounds from the discharged load had been selected for characterization. This process was repeated until samples had been collected from all of the targeted loads.

## NUMBER OF SAMPLES

A total of 50 samples were collected during the week: 19 from City of Cincinnati Public Services waste collection vehicles and 31 from Rumpke waste collection vehicles dispatched on routes throughout Hamilton County but outside the City of Cincinnati.

## WASTE SORTING

The sorting and weighing program for samples entailed the use of one sorting crew and an SCS Crew Supervisor. During each day of fieldwork samples were collected from waste loads that were discharged at the Rumpke Landfill. The basic procedures and objectives for sorting (as described below) were identical for each sample, each day. Sorting was performed as follows:

1. The sort crew transferred the refuse sample onto the sorting table until it was full and began sort activities. Large or heavy waste items, such as bags of yard waste, were torn open, examined and then placed directly into the appropriate waste container for subsequent weighing.
2. Plastic bags of refuse were opened and sort crew members manually segregated each item of waste, according to categories defined in **Exhibit 1** and placed it in the appropriate waste container. These steps were repeated until the entire sample was sorted.
3. At the completion of sorting, the waste containers were moved to the scale where a representative of SCS weighed each category and recorded the net weight on the Sort Data Sheet. Measurements were made to the nearest 0.1 pounds.
4. After each waste category had been recorded, the waste was piled near the sorting area and transferred back to the working face by a bulldozer.
5. This four-step process was repeated until all of the day's samples taken at the site were characterized. Waste samples were maintained in as-disposed condition or as close to this as possible until the actual sorting began. Proper site layout and close supervision of sampling was maintained to avoid the need to repeatedly handle sampled wastes.

Members of the sorting crew were fully equipped with high visibility vests, puncture/cut resistant gloves, safety glasses, and tyvek suits. The Health and Safety Plan is presented in **Appendix A**.

Consistent with good practice in such sampling programs, efforts were made to minimize sampling bias or other impacts on the integrity of the database. To this end, field sampling had been coordinated to avoid holidays and other out of ordinary events.

**Exhibit 1. Description of Waste Categories**

<b>Major Waste Types</b>	<b>Waste Component Categories</b>	<b>Examples</b>
<b>Paper</b>	Recyclable Corrugated Cardboard	Packing/shipping boxes
	Paperboard	Cereal/Soda Boxes
	Newspaper/Print	Daily, weekly newspapers
	White Office Paper	High grade white copy paper or letterhead
	Glossy/Magazines	TV Guide, Periodicals, Journals
	Kraft Paper	Brown shopping bags
	Phone Books	Phone number listings
	Other Recyclable Paper	Junk mail, notebook paper, colored copy paper
	Composite - Coated	Milk/Juice Cartons/Boxes
	Soiled Compostable Paper	Napkins, Tissues, food stained paper
Non-Recyclable Paper	Paper coated with plastic or foil	
<b>Plastic</b>	HDPE (#2) Bottles	Milk, Detergent
	PET Bottles	Soda, Water Bottles
	PET Other	PET trays and tubs
	HDPE Other	HDPE trays and tubs
	Rigid Plastics	Plastic toys, items without a #
	Film	Garbage, shopping bags
	Other Plastics	Plastics not characterized above
<b>Metal</b>	Bi-Metal/Steel Cans	Ferrous cans generally used to contain food
	Other Ferrous	Ferrous metals, not otherwise classified
	Aluminum Cans	Soda, beer cans
	Other Aluminum	Aluminum tins and foils
<b>Organic</b>	Vegetative Food	Celery, orange/banana peels, plant based food
	Other Food	Non-plant based food
	Pet Waste	Kitty litter, dog cleanup bags
	Fines	Items less than 1/4" by 1/4"
	Wood	Lumber, treated and untreated
	Other Organics	Organic items not otherwise classified
<b>Other</b>	Carpet	Carpet rolls and padding
	Mattresses	Box springs and mattresses
	Diapers	Adult and child diapers
<b>Textiles</b>	Textiles	Clothing, rugs, blankets

## Waste Composition Study, December 2011 Results

<b>Major Waste Types</b>	<b>Waste Component Categories</b>	<b>Examples</b>
<b>Glass</b>	Glass Bottles	Containers used for food/beverages
	Glass Jars	Wide mouthed containers
	Other Glass	Plate or window glass, pint glasses
<b>Yard Waste</b>	Grass	Grass clippings
	Leaves	Leaves, pine needles
	Brush	Small sticks and hedge trimmings
	Other Yard Waste	Stumps, dirt other yard wastes
<b>Electronics</b>	Cathode Ray Tubes	Monitors, CPUs
	Appliances	Small electrical appliances
	Portable Electronics	Phones, tablets, mp3 players
	White Goods	Large appliances, washers, dryers, stoves
<b>C&amp;D Debris</b>	C&D Debris	Concrete, drywall, siding, roofing, etc.
<b>Household Hazardous Waste</b>	Paint	Oil based paints
	Automotive Fluids	Oil, antifreeze, brake fluid
	Batteries	Lead-acid, lithium, rechargeable batteries
	Other HHW	HHW not characterized above

## DATA REDUCTION

There were 50 samples manually sorted during the December 2011 field activities. Data presented include mean percentages by weight, standard deviations, and statistical confidence intervals (95 percent confidence interval) for each group of data. Derivation of this data is as follows:

$$\text{Mean}(\bar{X}) = \sum_{i=1}^n x_i * \frac{1}{n};$$

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

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

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

Waste samples are acquired to estimate the County's true residential waste composition (i.e., the proportion of each waste component present in residential waste collected in the County). The mean is the arithmetic average of all data and the standard deviation is a measure of the dispersion in the data. Together, the mean and standard deviation determine the confidence interval. A 95 percent confidence interval contains the true proportion of a waste component with 95 percent confidence (i.e., similar studies will produce the same results 95 percent of the time).

## 3 SUMMARY OF RESULTS

### MSW COMPOSITION

#### City of Cincinnati

**Exhibit 2** presents a compilation of the nineteen residential waste samples collected from routes throughout Cincinnati and sorted in December 2011. The composition includes confidence intervals based on the number of samples and variability between the samples. Based on the samples collected, the three largest subcomponents, by weight, of the residential waste stream are Textiles (11.3 percent), Plastic Films (10.7 percent), and Soiled Paper (10.6 percent). The three largest recyclable subcomponents are Paperboard (4.7 percent), Other Recyclable Paper (4.1 percent), and Corrugated Cardboard (3.1 percent).

**Exhibit 2. City of Cincinnati Waste Composition**

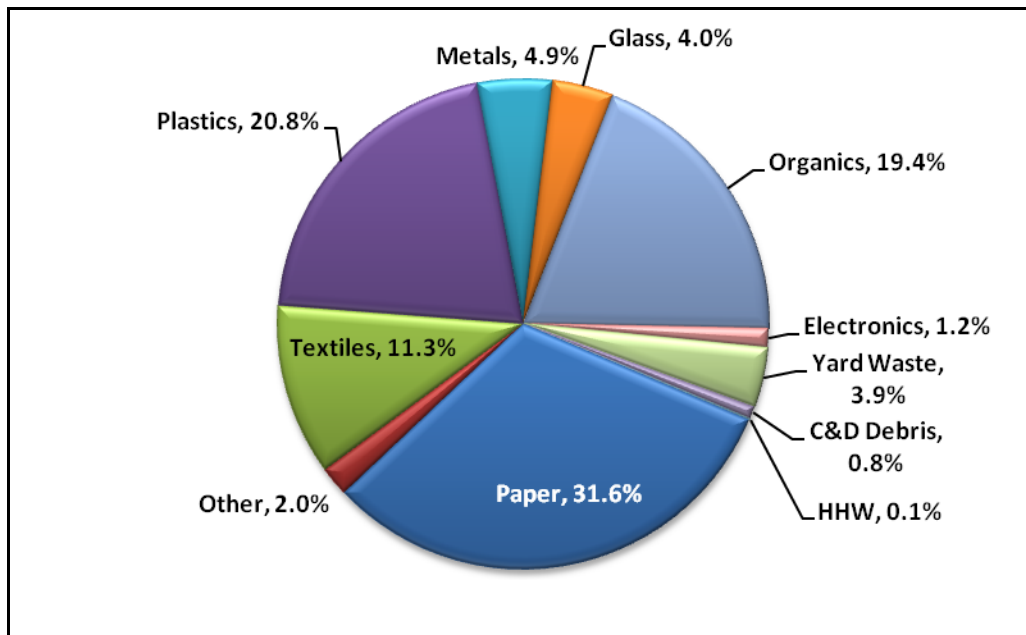
Material Components	Mean Composition	Standard Deviation	95% Confidence Limits	
			Lower	Upper
<b>PAPER</b>				
1 Corrugated Cardboard	3.1%	4.0%	1.3%	4.9%
2 Paperboard	4.7%	2.3%	3.7%	5.7%
3 Newspaper	2.4%	2.4%	1.3%	3.5%
4 Office Paper	1.1%	1.2%	0.5%	1.6%
5 Magazines	2.5%	3.0%	1.2%	3.9%
6 Kraft Paper	1.2%	1.4%	0.6%	1.8%
7 Phone Books	<0.1%	0.4%	<0.1%	0.3%
8 Other Recyclable Paper	4.1%	3.4%	2.5%	5.6%
9 Composite	0.8%	0.9%	0.4%	1.2%
10 Soiled Paper	10.6%	4.9%	8.4%	12.8%
11 Other Paper (Non Recyclable)	1.1%	1.4%	0.5%	1.7%
<b>Total Paper</b>	<b>31.5%</b>			
<b>PLASTIC</b>				
12 HDPE Bottles and Jugs	1.3%	0.8%	0.9%	1.6%
13 PET Bottles	2.2%	1.2%	1.7%	2.8%
14 PET Other	0.3%	0.3%	0.1%	0.4%
15 HDPE Other	<0.1%	0.1%	<0.1%	0.1%
16 Rigid Plastics	2.6%	1.8%	1.8%	3.4%
17 Plastic Film	10.7%	2.5%	9.6%	11.8%
18 Other Plastics	3.7%	1.6%	3.0%	4.4%
<b>Total Plastic</b>	<b>20.7%</b>			
<b>METAL</b>				
19 Steel/Bi Metal Food Cans	2.0%	1.9%	1.2%	2.8%
20 Other Ferrous	0.8%	1.1%	0.3%	1.3%
21 Aluminum Cans	1.1%	0.7%	0.8%	1.4%
22 Other Aluminum	1.1%	1.3%	0.5%	1.7%
<b>Total Metals</b>	<b>4.9%</b>			
<b>GLASS</b>				
23 Glass Bottles	3.1%	1.8%	2.3%	3.9%
24 Glass Jars	0.8%	1.1%	0.4%	1.3%
25 Other Glass	0.1%	0.4%	<0.1%	0.3%
<b>Total Glass</b>	<b>4.0%</b>			
<b>ORGANIC</b>				
26 Vegetative Food	4.3%	2.8%	3.0%	5.6%
27 Other Food	3.9%	3.5%	2.3%	5.4%
28 Pet Waste	0.6%	1.2%	<0.1%	1.1%
29 Fines	1.6%	0.7%	1.3%	1.9%
30 Wood	1.4%	3.7%	<0.1%	3.1%
31 Other Organics	7.7%	1.3%	7.1%	8.3%
<b>Total Organics</b>	<b>19.4%</b>			
<b>TEXTILES</b>				
39 Textiles	11.3%	11.3%	6.2%	16.4%
<b>Textiles</b>	<b>11.28%</b>			



**Exhibit 2. City of Cincinnati Waste Composition (continued)**

Material Components	Mean Composition	Standard Deviation	95% Confidence Limits	
			Lower	Upper
<b>YARD WASTE</b>				
32 Grass	0.6%	2.8%	<0.1%	1.9%
33 Leaves	3.1%	5.8%	0.5%	5.7%
34 Brush	<0.1%	0.2%	<0.1%	0.1%
35 Other Yardwaste	0.1%	0.5%	<0.1%	0.3%
<b>Total Yard Waste</b>	<b>3.9%</b>			
<b>OTHER</b>				
36 Carpet	0.2%	0.7%	<0.1%	0.5%
37 Mattresses	<0.1%	<0.1%	<0.1%	<0.1%
38 Diapers	1.7%	2.9%	0.4%	3.0%
<b>Total Other Waste</b>	<b>2.0%</b>			
<b>C&amp;D Debris</b>				
40 C&D Debris	0.8%	2.5%	<0.1%	1.9%
<b>Total C&amp;D Debris</b>	<b>0.83%</b>			
<b>ELECTRONICS</b>				
40 Cathode Ray Tubes	<0.1%	<0.1%	<0.1%	<0.1%
41 Appliances	1.2%	1.7%	0.5%	2.0%
42 Portable Electronics	<0.1%	<0.1%	<0.1%	<0.1%
43 White Goods	<0.1%	<0.1%	<0.1%	<0.1%
<b>Total Electronics</b>	<b>1.2%</b>			
<b>HHW</b>				
44 Paint	<0.1%	<0.1%	<0.1%	<0.1%
45 Automotive fluids	<0.1%	0.3%	<0.1%	0.2%
46 Batteries	<0.1%	<0.1%	<0.1%	<0.1%
47 Other HHW	<0.1%	0.1%	<0.1%	<0.1%
<b>Total Household Hazardous Wastes</b>	<b>0.1%</b>			
<b>TOTALS</b>	<b>100.0%</b>			

Note: Composition based on 19 samples

**Exhibit 2. City of Cincinnati Waste Composition (continued)****Hamilton County – Areas Outside of Cincinnati**

**Exhibit 3** presents a compilation of the 31 waste samples collected from areas in Hamilton County but outside the city of Cincinnati. The composition includes confidence intervals based on the number of samples and variability between the samples. Based on the samples collected, the three largest subcomponents, by weight, of the residential waste stream are Soiled Paper (11.4 percent), Plastic Film (10.1 percent) and Other Organic (6.9 percent). The three largest recyclable subcomponents are Paperboard (5.5 percent), Newspaper (5.3 percent), and Other Recyclable Paper (4.2 percent).

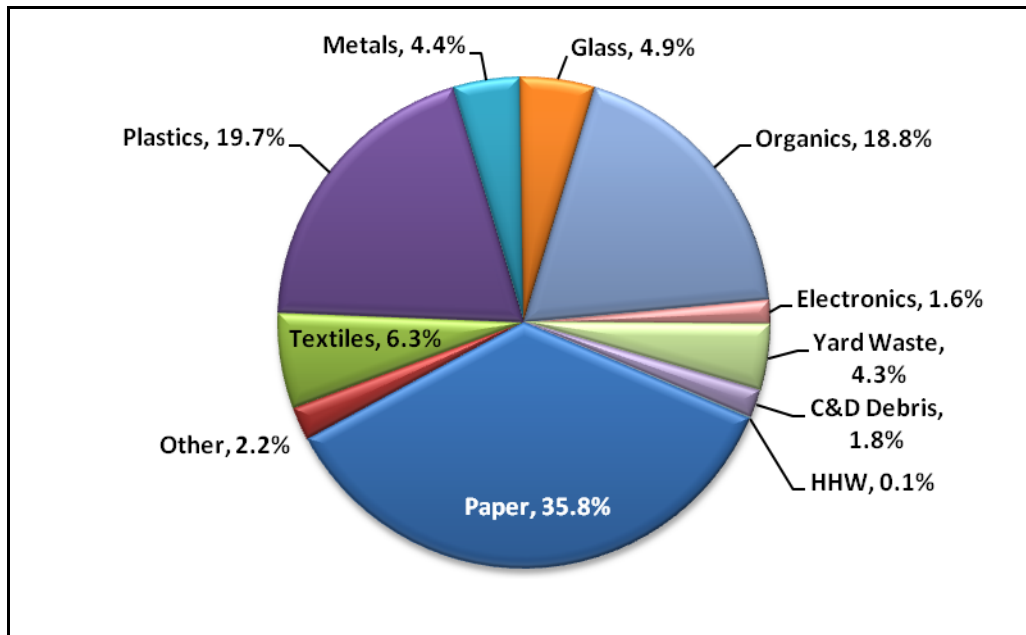
**Exhibit 3. Hamilton County, Excluding Cincinnati**

Material Components	Mean Composition	Standard Deviation	95% Confidence Limits	
			Lower	Upper
<b>PAPER</b>				
1 Corrugated Cardboard	2.4%	2.9%	1.4%	3.4%
2 Paperboard	5.5%	2.3%	4.7%	6.4%
3 Newspaper	5.3%	5.7%	3.3%	7.3%
4 Office Paper	1.6%	3.2%	0.5%	2.8%
5 Magazines	2.5%	2.7%	1.6%	3.5%
6 Kraft Paper	0.8%	0.7%	0.6%	1.0%
7 Phone Books	0.3%	0.9%	<0.1%	0.6%
8 Other Recyclable Paper	4.2%	3.1%	3.1%	5.3%
9 Composite	0.6%	0.9%	0.3%	0.9%
10 Soiled Paper	11.4%	3.6%	10.2%	12.7%
11 Other Paper (Non Recyclable)	1.1%	1.1%	0.7%	1.4%
<b>Total Paper</b>	<b>35.8%</b>			
<b>PLASTIC</b>				
12 HDPE Bottles and Jugs	1.0%	0.6%	0.8%	1.3%
13 PET Bottles	2.4%	1.5%	1.9%	2.9%
14 PET Other	0.2%	0.4%	<0.1%	0.3%
15 HDPE Other	0.2%	0.5%	<0.1%	0.4%
16 Rigid Plastics	2.2%	2.6%	1.3%	3.1%
17 Plastic Film	10.1%	3.2%	8.9%	11.2%
18 Other Plastics	3.7%	1.3%	3.2%	4.1%
<b>Total Plastic</b>	<b>19.7%</b>			
<b>METAL</b>				
19 Steel/Bi Metal Food Cans	2.2%	1.0%	1.8%	2.5%
20 Other Ferrous	0.5%	0.8%	0.2%	0.7%
21 Aluminum Cans	1.0%	0.5%	0.8%	1.2%
22 Other Aluminum	0.7%	1.0%	0.4%	1.1%
<b>Total Metals</b>	<b>4.4%</b>			
<b>GLASS</b>				
23 Glass Bottles	4.0%	3.1%	3.0%	5.1%
24 Glass Jars	0.7%	0.9%	0.4%	1.0%
25 Other Glass	0.2%	0.6%	<0.1%	0.4%
<b>Total Glass</b>	<b>4.9%</b>			
<b>ORGANIC</b>				
26 Vegetative Food	4.3%	2.2%	3.5%	5.1%
27 Other Food	4.2%	2.5%	3.3%	5.1%
28 Pet Waste	0.9%	1.7%	0.3%	1.5%
29 Fines	1.5%	0.8%	1.2%	1.8%
30 Wood	1.1%	2.5%	0.2%	2.0%
31 Other Organics	6.9%	1.7%	6.2%	7.5%
<b>Total Organics</b>	<b>18.8%</b>			
<b>TEXTILES</b>				
39 Textiles	6.3%	5.4%	4.4%	8.2%
<b>Textiles</b>	<b>6.28%</b>			

**Exhibit 3. Hamilton County, Excluding Cincinnati (continued)**

Material Components	Mean Composition	Standard Deviation	95% Confidence Limits	
			Lower	Upper
<b>YARD WASTE</b>				
32 Grass	0.6%	3.5%	<0.1%	1.8%
33 Leaves	2.3%	4.2%	0.8%	3.8%
34 Brush	0.6%	2.9%	<0.1%	1.6%
35 Other Yardwaste	0.7%	1.9%	<0.1%	1.4%
<b>Total Yard Waste</b>	<b>4.3%</b>			
<b>OTHER</b>				
36 Carpet	1.0%	4.5%	<0.1%	2.6%
37 Mattresses	<0.1%	<0.1%	<0.1%	<0.1%
38 Diapers	1.2%	1.9%	0.5%	1.8%
<b>Total Other Waste</b>	<b>2.2%</b>			
<b>C&amp;D Debris</b>				
40 C&D Debris	1.8%	4.0%	0.4%	3.3%
<b>Total C&amp;D Debris</b>	<b>1.85%</b>			
<b>ELECTRONICS</b>				
40 Cathode Ray Tubes	<0.1%	<0.1%	<0.1%	<0.1%
41 Appliances	1.6%	3.2%	0.4%	2.7%
42 Portable Electronics	<0.1%	0.2%	<0.1%	0.1%
43 White Goods	<0.1%	<0.1%	<0.1%	<0.1%
<b>Total Electronics</b>	<b>1.6%</b>			
<b>HHW</b>				
44 Paint	<0.1%	<0.1%	<0.1%	<0.1%
45 Automotive fluids	<0.1%	<0.1%	<0.1%	<0.1%
46 Batteries	<0.1%	<0.1%	<0.1%	<0.1%
47 Other HHW	<0.1%	0.3%	<0.1%	0.2%
<b>Total Household Hazardous Wastes</b>	<b>&lt;0.1%</b>			
<b>TOTALS</b>	<b>100.0%</b>			

Note: Composition based on 31 samples

**Exhibit 3. Hamilton County, Excluding Cincinnati (continued)****Hamilton County – Cincinnati and other Cities/Townships**

**Exhibit 4** presents a compilation of the 50 residential waste samples collected from throughout Hamilton County (including Cincinnati and outlying cities/townships) and sorted in December 2011. The composition includes confidence intervals based on the number of samples and variability between the samples. Based on the samples collected, the three largest subcomponents, by weight, of the residential waste stream are Soiled Paper (11.1 percent), Plastic Films (10.3 percent) and Textiles (8.2 percent). The three largest recyclable subcomponents are Paperboard (5.2 percent), Newspaper (4.2 percent), and Other Recyclable Paper (4.1 percent).

**Exhibit 4. Hamilton County Waste Composition**

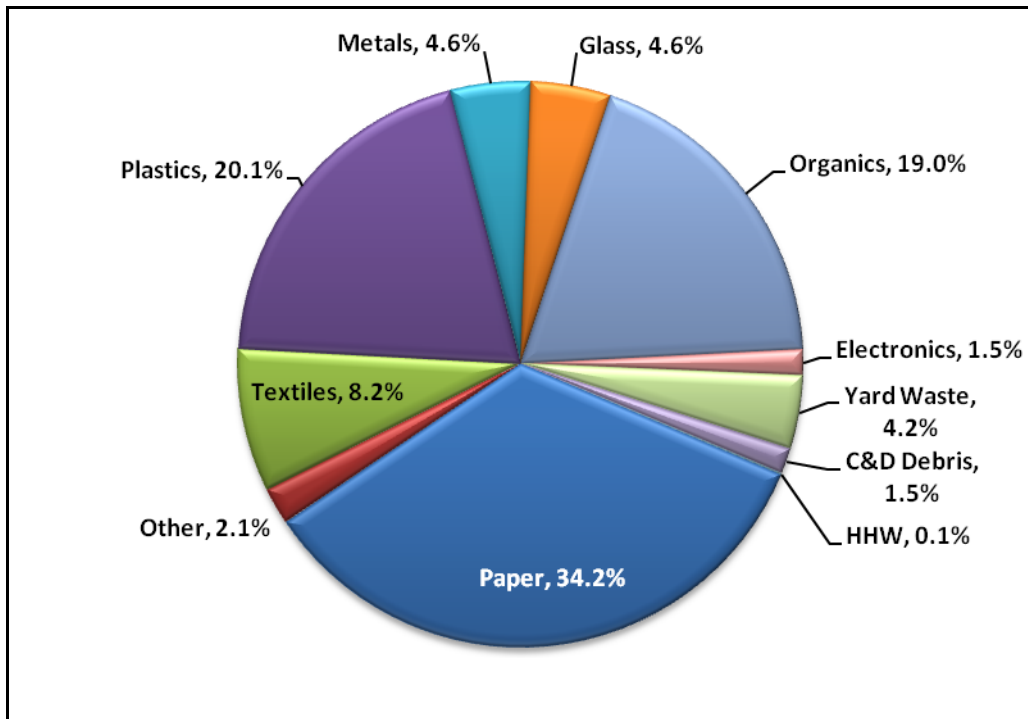
Material Components	Mean Composition	Standard Deviation	95% Confidence Limits	
			Lower	Upper
<b>PAPER</b>				
1 Corrugated Cardboard	2.7%	3.3%	1.7%	3.6%
2 Paperboard	5.2%	2.3%	4.6%	5.9%
3 Newspaper	4.2%	4.9%	2.8%	5.5%
4 Office Paper	1.4%	2.6%	0.7%	2.2%
5 Magazines	2.5%	2.8%	1.8%	3.3%
6 Kraft Paper	1.0%	1.0%	0.7%	1.2%
7 Phone Books	0.2%	0.7%	<0.1%	0.4%
8 Other Recyclable Paper	4.1%	3.2%	3.3%	5.0%
9 Composite	0.7%	0.9%	0.4%	0.9%
10 Soiled Paper	11.1%	4.1%	10.0%	12.2%
11 Other Paper (Non Recyclable)	1.1%	1.2%	0.7%	1.4%
<b>Total Paper</b>	<b>34.2%</b>			
<b>PLASTIC</b>				
12 HDPE Bottles and Jugs	1.1%	0.7%	0.9%	1.3%
13 PET Bottles	2.3%	1.4%	1.9%	2.7%
14 PET Other	0.2%	0.4%	0.1%	0.3%
15 HDPE Other	0.1%	0.4%	<0.1%	0.2%
16 Rigid Plastics	2.3%	2.3%	1.7%	3.0%
17 Plastic Film	10.3%	3.0%	9.5%	11.1%
18 Other Plastics	3.7%	1.4%	3.3%	4.1%
<b>Total Plastic</b>	<b>20.1%</b>			
<b>METAL</b>				
19 Steel/Bi Metal Food Cans	2.1%	1.4%	1.7%	2.5%
20 Other Ferrous	0.6%	0.9%	0.3%	0.8%
21 Aluminum Cans	1.0%	0.6%	0.9%	1.2%
22 Other Aluminum	0.9%	1.1%	0.5%	1.2%
<b>Total Metals</b>	<b>4.6%</b>			
<b>GLASS</b>				
23 Glass Bottles	3.7%	2.7%	2.9%	4.4%
24 Glass Jars	0.8%	1.0%	0.5%	1.0%
25 Other Glass	0.1%	0.5%	<0.1%	0.3%
<b>Total Glass</b>	<b>4.6%</b>			
<b>ORGANIC</b>				
26 Vegetative Food	4.3%	2.4%	3.6%	5.0%
27 Other Food	4.1%	2.9%	3.3%	4.9%
28 Pet Waste	0.8%	1.6%	0.3%	1.2%
29 Fines	1.5%	0.8%	1.3%	1.8%
30 Wood	1.2%	3.0%	0.4%	2.0%
31 Other Organics	7.2%	1.6%	6.7%	7.6%
<b>Total Organics</b>	<b>19.0%</b>			
<b>TEXTILES</b>				
39 Textiles	8.2%	8.4%	5.8%	10.5%
<b>Textiles</b>	<b>8.18%</b>			

**Exhibit 4. Hamilton County Waste Composition (continued)**

Material Components	Mean Composition	Standard Deviation	95% Confidence Limits	
			Lower	Upper
<b>YARD WASTE</b>				
32 Grass	0.6%	3.2%	<0.1%	1.5%
33 Leaves	2.6%	4.8%	1.3%	4.0%
34 Brush	0.4%	2.3%	<0.1%	1.0%
35 Other Yardwaste	0.5%	1.6%	<0.1%	0.9%
<b>Total Yard Waste</b>	<b>4.2%</b>			
<b>OTHER</b>				
36 Carpet	0.7%	3.6%	<0.1%	1.7%
37 Mattresses	<0.1%	<0.1%	<0.1%	<0.1%
38 Diapers	1.4%	2.3%	0.8%	2.0%
<b>Total Other Waste</b>	<b>2.1%</b>			
<b>C&amp;D Debris</b>				
40 C&D Debris	1.5%	3.5%	0.5%	2.4%
<b>Total C&amp;D Debris</b>	<b>1.46%</b>			
<b>ELECTRONICS</b>				
40 Cathode Ray Tubes	<0.1%	<0.1%	<0.1%	<0.1%
41 Appliances	1.4%	2.7%	0.7%	2.2%
42 Portable Electronics	<0.1%	0.1%	<0.1%	<0.1%
43 White Goods	<0.1%	<0.1%	<0.1%	<0.1%
<b>Total Electronics</b>	<b>1.4%</b>			
<b>HHW</b>				
44 Paint	<0.1%	<0.1%	<0.1%	<0.1%
45 Automotive fluids	<0.1%	0.2%	<0.1%	<0.1%
46 Batteries	<0.1%	<0.1%	<0.1%	<0.1%
47 Other HHW	<0.1%	0.3%	<0.1%	0.1%
<b>Total Household Hazardous Wastes</b>	<b>&lt;0.1%</b>			
<b>TOTALS</b>	<b>100.0%</b>			

Note: Composition based on 50 samples

**Exhibit 5. Hamilton County Waste Composition (continued)**





## DIVERSION OPPORTUNITIES

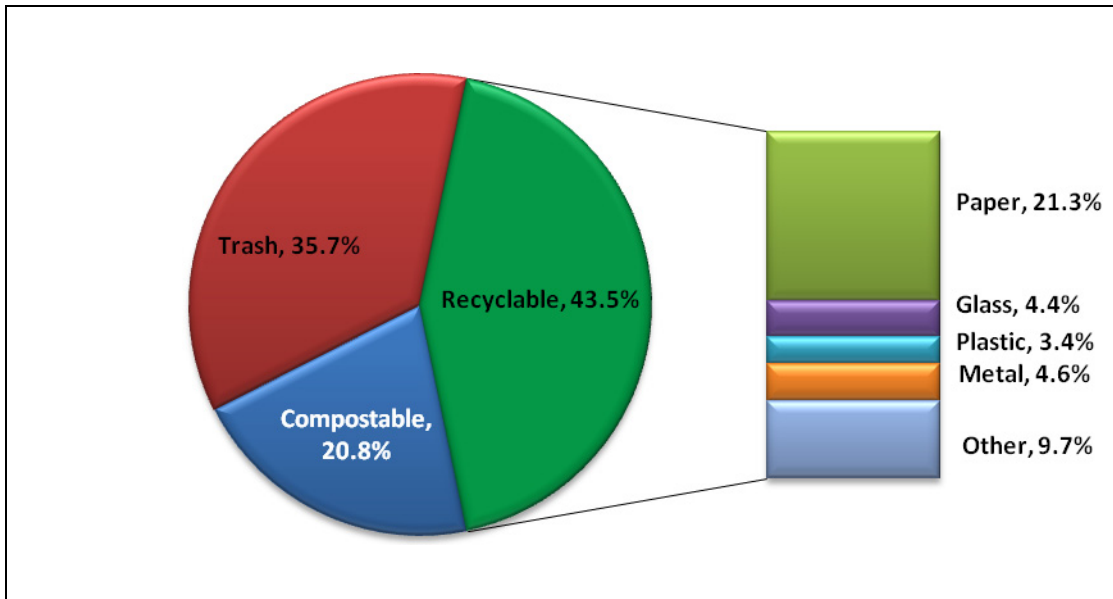
A significant portion of the residential waste stream is compostable or recyclable. Some materials, such as Composite Paper, Other Glass, and Plastic Film (largely plastic bags and packaging), are considered trash since these materials do not currently have markets for recycling or composting. **Exhibit 6** details the materials included in the compostable, recyclable, and trash classifications used for this section.

**Exhibit 6. Compostable, Recyclable, and Trash Classifications for Waste Materials**

Compostable via Backyard Composting	Recyclable with Existing Infrastructure and Markets		Trash
Soiled Paper Vegetative Food Wood Grass Leaves Brush Other Yard Waste	Corrugated Cardboard Paperboard Newspaper Office Paper Magazines Kraft Paper Phone Books Other Recyclable Paper HDPE Bottles and Jugs PET Bottles Steel/Bi Metal Food Cans Other Ferrous	Other Aluminum Glass Bottles Glass Jars Textiles Cathode Ray Tubes Appliances Portable Electronics White Goods Paint Automotive fluids Batteries Aluminum Cans	Other Paper (Non Rec) Composite Plastic Film Other Plastics PET Other HDPE Other Rigid Plastics Fines Diapers Other Organics Other HHW Other Glass C&D Debris Carpet Mattresses

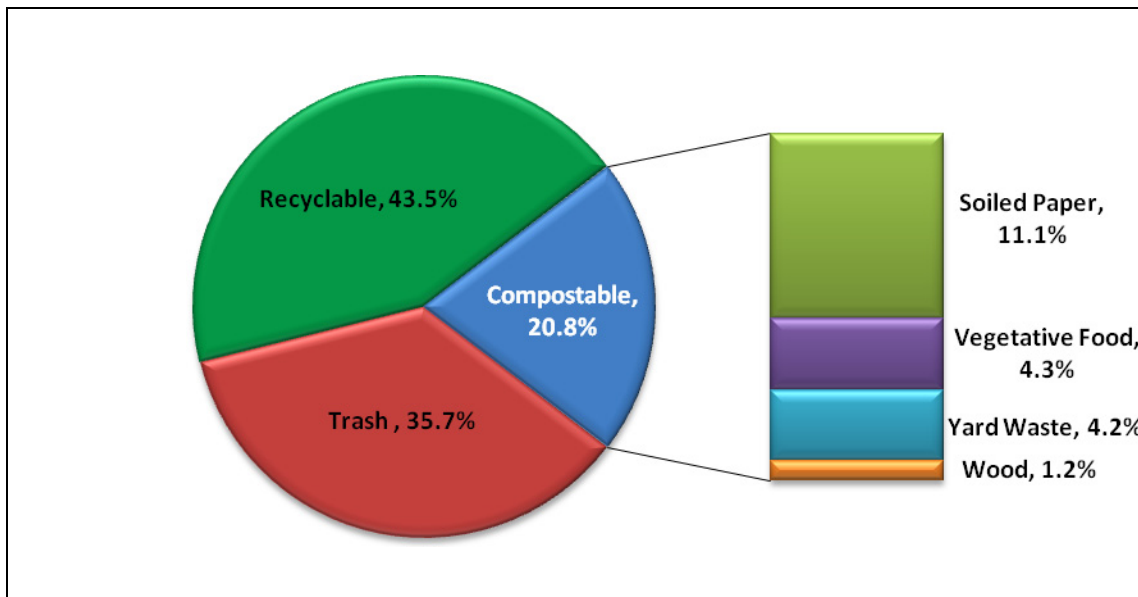
The largest diversion opportunities for Hamilton County are capturing more recyclable paper, and composting Soiled Paper and Vegetative Food Waste. According to the data collected in December 2011, Soiled Paper made up 11.1 percent of the waste stream and Vegetative Food Waste made up 4.3 percent. Materials such as napkins and tissues were noted to be prevalent in the waste stream. Recyclable paper composed 21.3 percent of the waste stream. The largest subcomponents in this category were Paperboard (5.2 percent) and Newspaper (4.2 percent). **Exhibits 7, 8, and 9** portray the waste composition by recyclable (with existing recycling markets and infrastructure), compostable (backyard composting), and trash materials. According to the waste characterization, approximately 64 percent of the waste stream is considered recyclable or compostable. The following exhibits are based on the entire County's residential waste stream.

**Exhibit 7. Recyclable Diversion Opportunities with Existing Recycling Infrastructure for the Hamilton County Waste Stream**

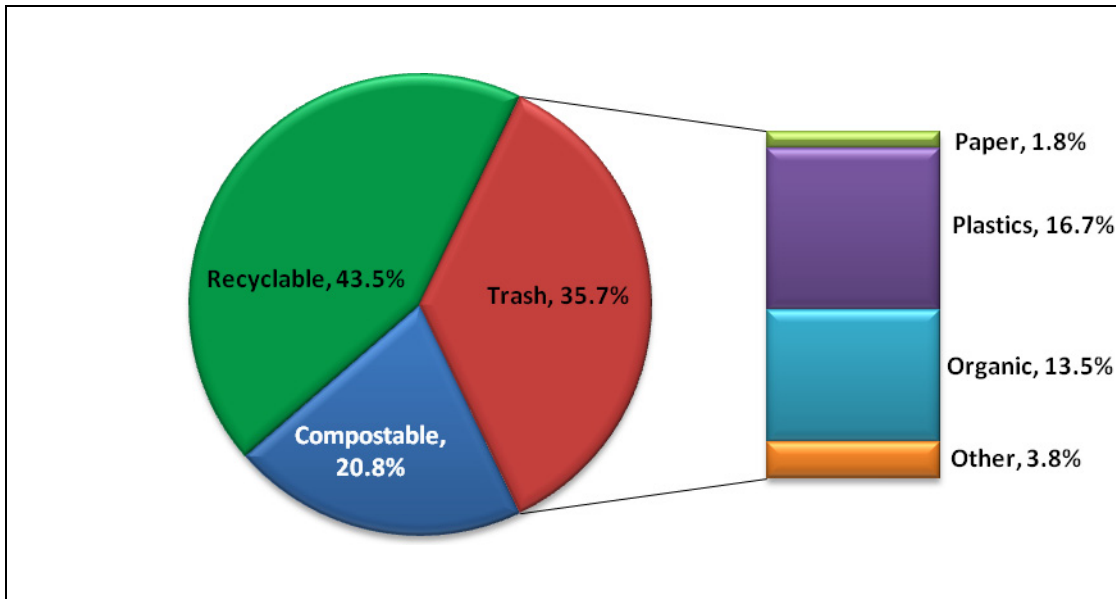


Note: Other Recyclables include Textiles, Electronics, and HHW (Paint, Automotive Fluids, and Batteries).

**Exhibit 8. Backyard Composting Diversion Opportunities for the Hamilton County Waste Stream**



**Exhibit 9. Trash Components with Existing Infrastructure of the Hamilton County Waste Stream**



Note: Other Trash Category includes Other Glass, Carpet, Mattresses, Diapers, C&D Debris, and Other HHW.

## Appendix A

### SCS Health and Safety Plan

**HEALTH AND SAFETY PLAN**  
**FOR THE**  
**HAMILTON COUNTY**  
**2011 WASTE CHARACTERIZATION STUDY**

EMERGENCY PHONE NUMBERS

Fire, First Aid, Ambulance, Police  
**911**

Good Samaritan Medical Center Western Ridge **(513) 246-9800**

Hamilton County Sheriff's Office **(513) 946-5320**

Field Responsibility:

Stacey Demers, Project Director  
Josh DeGayner, Site Manager & Crew Chief

SCS ENGINEERS  
11260 Roger Bacon Drive  
Suite 300  
Reston, VA 20190  
(703) 471-6150

**A Copy Of This Safety Plan And Its Attachments  
Must Be Kept At The Site During All Field Activities.**

December 2011

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## **SECTION 1**

### **INTRODUCTION**

The health and safety of site workers is a primary concern and goal. Thus, a comprehensive, carefully managed, and thoroughly documented Health and Safety Plan is crucial for successful project completion.

#### **1.1 PURPOSE**

The purpose of this document is to inform persons of potential safety and health hazards and mitigating measures recommended for action when performing the project field work at transfer stations, on landfill sites, and associated areas where municipal solid waste is being handled. These recommendations are intended for work on sites containing biodegradable and solid waste materials, not for sites containing hazardous or toxic wastes regulated under federal or Ohio state laws. This document has been prepared for use on the 2011 Hamilton County Waste Composition Study to be performed by SCS Engineers.

#### **1.2 DISCUSSION**

Waste characterization involves collecting field samples and sorting the solid waste into designated categories. The data that is generated from the field activities will be compiled and presented to Hamilton County.

There have been no reported serious or fatal incidents attributed specifically to the performance of waste characterization studies. However, accidents may occur due to the potential hazards associated with the presence of heavy equipment at the site, the components of the waste itself (potentially sharp objects, broken glass), climatic conditions, and carelessness. At transfer stations, combustion of the waste materials on the tipping floor or in "Hot Loads" from refuse vehicles can present potential hazards.

The presence of heavy equipment in operation at the site (end loaders, graders, transfer station compactors, garbage trucks, etc.) presents potential hazards which can be avoided with the use of general common sense. The equipment operators generally are involved in performing their tasks and may be unaware of the presence of other individuals within the immediate area. Personnel will be trained to be aware of the movement and location of equipment at all times. Also, highly visible clothing, including safety vests and hard hats, is required.

The components of solid waste present potential physical hazards. These include, but are not limited to, cuts from broken glass and sharp metal objects; splinters from pieces of wood; punctures from nails and other potential objects and scrapes and abrasions from the general handling of the solid waste. There also exists the potential for exposure to household products, such as bleach, cleansers, and other toxic chemicals.

To alleviate the possibility of injury, caution should be employed at all times when physically handling the solid waste. Protective clothing, including gloves and safety glasses, should be worn at all times. If there is any question about the handling of a component of solid waste, the Site Manager or Crew Chief should be notified.

The waste characterization will be performed outdoors. Weather exposure is a risk. Sufficient water for personal use will be brought on-site daily. Caution should be taken to avoid the possibility of heat stress due to protective clothing or weather, or frostbite in areas of extreme cold. Depending on temperature, fans may be used to circulate air and cool sorting personnel.

Landfill gas (LFG) is produced by the anaerobic decomposition of organic waste materials placed in a landfill. LFG is typically composed of 50 to 60 percent methane, 40 to 50 percent carbon dioxide, and trace amounts of various other gases, including odorous and possible toxic compounds. At the Rumpke Landfill, the generation of LFG is not expected to be a concern.

Refuse discharged at the Rumpke Landfill can pose a potential fire hazard. Fires can be started through carelessness, sparks, or from "Hot Loads" discharged from refuse facilities. If fire or smoke is observed, landfill personnel should be notified immediately, all SCS personnel and subcontractors should leave the immediate area at once, and the local, emergency fire department should be notified.

### **1.3 RESPONSIBLE INDIVIDUALS**

Safety during the field work will be the responsibility of the Site Manager. The Site Manager may temporarily suspend work if there appears to be a threat to health or safety. The Site Manager and other SCS personnel will be on site during all field activities. Other safety-related responsibilities are described below.

The SCS Site Manager, or appointed representative, will have responsibility for overall safety policy, planning, and execution. He will be responsible for making project level decisions regarding safety rules and operations.

The Site Manager will have primary responsibility for:

- Assuring that appropriate personnel protective equipment is available and properly utilized by all SCS and sampling personnel;
- Assuring that sampling personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and in planned procedures for dealing with emergencies;
- Assuring that sampling personnel are aware of the potential hazards associated with site operations;
- Supervising the monitoring of safety performance by all personnel to ensure that required



work practices are employed; and

- Correcting work practices or conditions that may result in injury to personnel or exposure to hazardous substances.

#### **1.4 SCOPE AND APPLICABILITY**

A copy of this safety plan and its attachments must be kept at the site during all field activities.

The provisions of this plan are mandatory for all SCS project personnel and personnel under contract to SCS while field work is being conducted at the site.

Prior to conducting any field work, those individuals who will be performing field work must read this Safety Plan and all attachments. If any of the information presented in these materials is unclear, the reader will contact the Site Manager for clarification. Once the information has been read and understood, the individual will sign a copy of the acknowledgment shown in *Exhibit 1* on the following page.

After field personnel have read the Safety Plan and attachments, but before beginning field activities, a training session will be conducted to familiarize personnel with health and safety requirements relevant to the project.

**EXHIBIT 1**

**ACKNOWLEDGMENT OF RECEIPT, HEALTH AND SAFETY PLAN**

CONFIRMATION OF NOTIFICATION

HEALTH AND SAFETY PLAN FOR WAKE COUNTY 2011 WASTE COMPOSITION  
STUDY

I have been provided, read, and understand the Health and Safety Plan for the Hamilton County 2011 Waste Composition Study. I confirm that I will provide and use appropriate footwear and clothing.

I also understand that SCS Engineers will provide:

- Hard Hats
- Safety Glasses
- Gloves
- Safety Vest
- Tyvek Suit

These must be used during sorting activities. I understand that all safety regulations must be observed. **Violations of safety rules or use of safety equipment is grounds for dismissal.**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## SECTION 2

### EMERGENCY INFORMATION AND PROCEDURES

#### 2.1 EMERGENCY INFORMATION

Emergency telephone numbers for reporting an emergency are listed on the cover of this Plan.

#### 2.2 ACCIDENTS/INJURIES

Depending on the severity of the injury, treatment may be given at the site by trained personnel, additional assistance may be required at the site (emergency medical technicians), or the victim may have to be transported to a hospital. The address of the nearest hospital is as follows:

6949 Good Samaritan Drive  
Cincinnati, OH 45247  
(513) 246-9800

#### 2.3 FIRE

The potential for fire exists on this project. No smoking will be allowed by project participants while on site.

#### 2.4 EVACUATION

##### Stages of Evacuation

The Site Manager is responsible for judging if circumstances exist which require evacuation. Specific evacuation procedures will be covered in the health and safety training session prior to beginning field work.

Three stages of evacuation will be used:

- Withdraw from immediate work area.
- Withdraw from building.
- Withdraw from facility property.

These three stages are discussed below:

### **Withdrawal from Work Area**

Withdrawal to a safe location will be required if any of the following occur:

- Occurrence of a minor accident, field operations will resume after first aid and/or decontamination procedures have been administered.
- Equipment, protective clothing, or respirator malfunctions.

### **Withdrawal from Building**

SCS project personnel will be evacuated from the building in the following cases:

- Explosive or toxic levels of gases or volatile organics are suspected.
- A major accident or injury occurs.
- Fire and/or explosion occurs.

### **Withdrawal from the Facility Property**

The Site Manager is responsible for judging if circumstances exist for evacuation of the facility property. Prior to evacuating the property, all field staff will meet at the rendezvous site, which will be designated by Waste Industries. Fire and police departments must be contacted.

## **2.5 INCIDENT REPORTING**

Incident reporting procedures are listed below and should be performed in the order indicated.

1. Call the appropriate emergency number (911) (e.g., ambulance, fire, etc.). Give information in format provided under subsequent section titled "Oral Accident/Incident Report Format".
2. Call project points of contact. Give information in format provided under "Oral Accident/Incident Report Format".
3. Call SCS points of contact to report an accident or incident.

### **Oral Accident/Incident Report Format**

Accident/Incident reports should contain the following information:

- Name, location, and title of the person(s) reporting.
- Location of accident/incident, (i.e., building number, facility name.)
- Casualties (fatalities, disabling injuries).

- Suspected/known chemical substances involved, if any.
- Details of any existing chemical hazard or contamination.
- Summary of accident/incident, giving pertinent details including type of operation at time of accident, etc.
- Suspected/known cause of accident incident.

Information will not be released under any circumstances to parties other than those listed in *Section 2-5*.

**Distribution of Written Accident/Incident Report**

The accident/incident report form will be distributed by the Site Manager to the following individuals as appropriate and in the following order of priority:

Name	Address
Stacey Demers	SCS Engineers 11260 Roger Bacon Drive Reston, Virginia 22090 703/471-6150
Jeff Rumpke	Rumpke 3800 Struble Road Cincinnati, Ohio 513/741-5230
Holly Christmann	Hamilton County 250 William Howard Taft Road Cincinnati, Ohio 513/946-7705

## SECTION 3

### GENERAL FIELD SAFETY PROCEDURES

Safety is the responsibility of every individual involved in field efforts. Properly followed procedures are essential to assure personal safety and minimize lost time due to injuries or accidents. Anticipated hazards while working at the sites include, but are not limited to:

- Exposure to toxic or hazardous chemicals;
- Physical hazards from use of heavy equipment end-loaders, graders, transfer station compactors, etc;
- Fire or explosion caused by ignition of methane gas or other chemicals;
- Site physical hazards including debris, uneven terrain, poor footing, and water hazards; and
- Heat stress from personal protective equipment and weather.

This section presents procedures and requirements designed to reduce these hazards and minimize their impact on personnel safety and completion of the task.

#### 3.1 SAFETY EQUIPMENT

The level of protection required will depend on the specific activity and the location. The Site Manager will define appropriate protection. The minimum personal protective equipment that will be worn at all times by field personnel is EPA Protocol Level D (hard hat, safety glasses, stout work boots, and heavy work clothes).

SCS field personnel (including subcontractors) will be informed in the use of safety equipment and will be required to wear protective clothing appropriate for the tasks in which they will be involved.

Extra equipment will be located on-site. This equipment will include the following items:

- Dust Masks
- Gloves (surgical and heavy rubber)
- Safety Vests
- Eye Protection
- Ear Protection
- Hard Hats
- First Aid Kit

Sufficient water for personal use will be brought on-site daily.

### **3.2 SITE STANDARD OPERATING PROCEDURES**

SCS team members will conduct themselves in a professional manner at all times. The following restrictions will also be observed by all SCS personnel and subcontractors to SCS.

- Working while under the influence of intoxicants, narcotics, or controlled substances is prohibited;
- Smoking anywhere on site is prohibited;
- Loose clothing will not be worn on-site. Long hair will be worn up inside hard hat;
- Eating, drinking, chewing gum, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited on-site;
- No personnel will be admitted to the site without the proper safety equipment, clearance or other approval;
- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy, as established by the Site Manager, will be immediately dismissed from the site;
- No unapproved work clothes or equipment will be allowed on-site;
- Prescription drugs should not be taken by personnel where the potential for contact with toxic substances exist. Use must be specifically approved by a qualified physician;
- Work areas for various operational activities will be established;
- Work areas will be established based on prevailing site conditions and are subject to change. Personnel should check with the Site Manager for current and appropriate procedures regularly;
- Contact with contaminated or potentially contaminated material should be avoided. Whenever possible, do not walk through puddles, mud, or any discolored ground surface. Do not kneel on the ground. Do not lean, sit or place equipment on drums, containers, or vehicles;
- No exchange of personal protective equipment will be allowed except in emergency situations involving a threat to health or safety;
- Lunch eaten at the site will be eaten only at the designated areas located away from the

immediate area of the site;

- Due caution will be observed when proceeding on-foot through open areas, Aerotek personnel will not cross the line of cones that will separate the sorting area from the area where heavy equipment will be operating; and
- Any medical emergency supersedes routine safety requirements.

A safety meeting will be conducted by the Site Manger prior to beginning field work. The meeting will cover, but is not limited to, a review of site information and a question-and-answer period. The site information review will include:

Expected hazards:

- Special conditions.
- Sampling procedures.
- Location of telephones.
- Emergency medical information.
- Level of personal protection required.

Before entering the site, the following checklist should be reviewed:

- Check location of lavatory, water supply and telephones.
- Layout and check alternative safety gear.
  - First aid kit
  - Fire extinguishers
  - Extra clothing
- Put on required safety gear.
- Check gear for rips and malfunctions.
- Identify and be familiar with the responsibilities for each of the crewmembers prior to proceeding.
- Use caution.

The following regulations will be observed during sampling:

- No eating/drinking/smoking while sampling;
- Use standard sampling techniques;
- Use maximum care in handling samples. If the sampling site is not accessible using your gear (i.e., water too high, slippery ground, steeply sloped terrain, holes, etc.), do not sample. Confer with the Crew Chief about alternate sampling site;



- Wipe off spills, dirt, and residue immediately;
- If any gear or equipment damage develops, immediately repair or replace;
- If any personal protective equipment fails, proceed immediately to a designated area; and
- If you experience any physical discomfort, abnormalities, fatigue, or lightheadedness, immediately stop work, tell the Crew Chief, and leave the area with escort.

### **3.3 INSPECTIONS**

The Site Manager will inspect all safety equipment daily for the following:

- Proper working order.
- Nicks, cuts, tears, etc., in boots and gloves.
- Persistent stains.

Any piece of safety equipment that is not in order will be repaired or disposed of properly.

### **3.4 WEATHER**

Decreased body ventilation caused by protective clothing and equipment can result in increased potential for heat stress. Workers should carefully observe each other for signs of heat stress, particularly on hot days. If appropriate, extra equipment will be assembled during periods of inclement weather, such as rain, wind, heat, and cold. Examples might include tents, coveralls, heaters, etc.

### **3.5 HOUSEKEEPING**

Work areas will be kept clean and orderly at all times.

### **3.6 DECONTAMINATION**

The risks of illness due to ingestion of diseased or decomposing materials from the work site are significant. To minimize these risks, all personnel should remove and store the outer layer of their protective clothing (i.e., coveralls, gloves, hat, etc.) on-site. Hands, face and nails should be thoroughly washed, or scrubbed, with soap and water prior to engaging in any activity likely to transmit materials encountered on-site into the mouth.

## SECTION 4

### PERSONNEL PROTECTION LEVEL DETERMINATION

The Site Manager is responsible for insuring the health, safety, and efficiency of the team at the work site. The level of personal protection necessary for the health and safety of the team will be determined by the Site Manager. These factors include surface air and wind characteristics, the location of the site relative to human traffic, and overt signs of hazards to life and health. Under no circumstances will the team members downgrade the level of personal protection selected. The constituents of the typical level of required personal protection are listed below:

#### LEVEL D PERSONAL PROTECTION

Level D is the basic work uniform of the team.

##### Equipment

1. Boots/shoes: Leather or chemical-resistant, steel toes.
2. Safety glasses.
3. Hard hat.
4. Dust mask. (Optional)
5. Work gloves (surgical and heavy rubber).
6. Safety vests.
7. Tyvek Suits (Sorting Crewmembers Only)

##### When to Use:

1. Site set-up and operations in working zones, including Waste Sorting Area.

##### Used By:

1. Team members working in the area, including:
  - Site Manager
  - Crew Chief
  - Sorting Crewmembers
  - Others, such as visitors, in the work zones.

Additional gear may be required, at the discretion of the Site Manager, as site conditions demand.