APPENDIX C

THE MISSOURI SOLID WASTE COMPOSITION STUDY – INTRODUCTION & SUMMARY

Excerpt from

THE MISSOURI SOLID WASTE COMPOSITION STUDY

Conducted by:
MIDWEST ASSISTANCE PROGRAM, Inc.
The Midwestern Rural Community Assistance Program

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THE MISSOURI DEPARTMENT OF NATURAL RESOURCES

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Jim Hull Director, Solid Waste Management Program
Kathy Weinsaft Former Chief of the Planning Unit, Solid Waste Management Program
Dennis Hanson Current Chief of the Planning Unit, Solid Waste Management Program
Katy D'Agostino Solid Waste Planner, Solid Waste Management Program
John Balkenbush Chief of Administration Unit, Solid Waste Management Program

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The waste sorters, who worked in all types of inclement weather and difficult conditions to get the results for this study.

Project Manager.....Dennis Siders

MSW Sort Supervisor.....Kristi Wilson

INTRODUCTION

The Missouri Waste Composition Study was a three-year effort to characterize and understand solid waste disposal in Missouri. The study was divided into two phases.

The first phase examined Municipal Solid Waste (MSW) at 19 landfills and transfer stations throughout Missouri. Municipal Solid Waste was separated, weighed, and recorded into 26 material categories. The methodology used, and the findings of phase I begin on page 93.

The second phase observed solid waste received at 14 Missouri landfills (actually 15 landfills were observed but the scale data from the Lee's Summit landfill was not useable and therefore that data is not included). Each solid waste load was classified into one of five components (Municipal Solid Waste, Construction, Demolition, Industrial, and Other waste) and the percentage of each material, within that component, was visually estimated and recorded. The methodology and findings of phase II begin on page 3.

Purpose of the Study

The Missouri Waste Composition Study was commissioned for the following reasons:

- Provide Information on changes in the Missouri solid waste components. In the 1987 Environmental Improvement and Energy Resources Authority (EIERA) commissioned a limited baseline waste composition study. This study examined MSW at four locations in 1987and estimated industrial waste based on SIC data. A comparison of the two waste components composition studies is listed on Pg. 113.
- Provide an estimate of the volume of recyclable materials still in the Missouri solid waste. The percentage of recyclable materials presently disposed into Missouri landfills offers opportunities for future recycling and waste reductions efforts.
- Provide data for the formulation of a statewide solid waste plan. The waste composition data provides detailed information, which is essential in planning solid waste policy for the next decade.
- Provide information on the current solid waste components which can be used by grant applicants to estimate available waste materials used by state agencies to evaluate grant applications, and by solid waste planners to target waste materials for future funding.
- Provide essential information for municipal and private recycling programs. Municipal and private recycling companies can use the data to predict material flows, route collection vehicles, plan processing and end market capacities, project revenues and operating expenses, and target educational materials.

Funding, Development, and Implementation

The Missouri Waste Composition Study was funded through grants from the Missouri Department of Natural Resources (DNR). The methodology for the study was developed jointly by the DNR Solid Waste Planners and the Midwest Assistance Program, Inc.(MAP). MAP conducted the study under the direction of Dennis Siders, Project Manager.

LANDFILLS OBSERVED

Landfill observation was actually the second phase of The Missouri Waste Composition Study. The hand sorting and categorizing of MSW was done prior to observing the landfills. However it is necessary to identify and understand the percentage each of the solid waste components (MSW, Construction, Demolition, Industrial, and Other) before examining the components separately. Therefore, phase II (landfill observations) will be discussed before phase I (MSW characterization).

The Problem

Many studies have been conducted throughout the United States to determine MSW composition. Some of these are discussed on page 111. However MSW is only one component of the overall solid waste problem. Until the entire solid waste component is examined and quantified, the volume of any one component cannot be accurately estimated. After completing phase I (MSW) it was known how much of each material was in Missouri's MSW component. For instance, about 18.7% of the MSW was food waste. But what did that percentage mean and what percentage of the total waste stream was MSW food waste?

Each landfill and transfer station reports their total waste received to DNR each quarter. After estimating import and export waste, DNR publishes a report on the total waste disposed in Missouri. However, it cannot be assumed that 18.7% of this total is food waste because the total is not exclusively MSW. There are other components of the waste stream included in the total. But how do we know what portion each of these components comprise, and what materials make up these other components?

Methodology

Several studies have been conducted to determine the composition of solid waste. Many states have conducted MSW waste sorts with methodologies similar to those used in phase I (page 93). This is a great way to characterize the MSW component but does not quantify the MSW component (40% - 90% of the local waste stream), or characterize the remaining solid waste components.

Franklin and Associates have developed a methodology to estimate waste flows based on production data. This method assumes that every manufactured item has a limited life cycle and then becomes waste. This methodology works great for national or international waste projections, but become less useful on a smaller scale.

The Missouri Waste Composition Study determined that the best way to estimate waste components (not waste generation or recovery) delivered to Missouri landfills, and the materials within these components, was to observe and record waste unloaded at Missouri landfills.

Landfill Selection

As of June 1st 1999, Missouri had 30 active landfills. Fifteen landfills were selected as being representative of all Missouri landfills (The City of Lee's Summit Landfill was observed but the data was not useable due to errors in the scale software program). The 14 observed landfills are listed below with the tonnage they received in 1998. A map of the 14 landfills, that were observed, is on page 5.

Landfills Observed	1998 Tonnage	% of Total State Tonnage
Black Oak	283,475	6.3%
Bridgeton	913,621	20.4%
Butler County	122,185	2.7%
City of Columbia	125,867	2.8%
City of St. Joseph	120,158	2.7%
Courtney Ridge	418,625	9.3%
Fred Weber	321,269	7.2%
Lamar	168,591	3.8%
Lemons	196,092	4.4%
Maple Hill	114,982	2.6%
Oak Ridge	262,365	5.8%
Peerless C&D	146,249	3.3%
Rockhill C&D	123,849	2.8%
Southeast	348,260	7.8%
Total observed landfills	**3,665,588**	**81.7%**
City of Lee's Summit*	80,682	1.8%
City of Springfield**	101,284	2.3%
14 rural landfills (not observed)***	628,512	13.9%
2 C&D landfills (not observed)****	12,557	00.3%
Total unobserved landfills	**823,035**	**18.3%**
Total for all Missouri Landfills (1998)	**4,488,623**	**100%**

*The City of Lee's Summit landfill was observed but the scale data was not useable. A weighted average from Southeast and Courtney Ridge was used to estimate waste composition.
**The City of Springfield's landfill was not observed. Demographics and waste contracts are similar to the City of St. Joseph and therefore the waste composition was estimated to be similar to the City of St. Joseph Landfill.
***A weighted average from the 5 rural landfills, which were observed, was used to estimate waste composition.
**** A weighted average from the 2 C&D landfills which were observed was used to estimate waste composition.

Landfills Observed

Each of the 14 landfills listed on page four was observed for a one-week period. The only exception was the Peerless C&D, which was observed for two weeks in order to get seasonal data on C&D material flows. The premise, agreed upon by DNR and MAP, assumed that the waste received at each of the fourteen observed landfills during a randomly selected week would be similar to the waste received at that landfill during the entire year. Smaller landfills would be assumed to have the same composition as the weighted average of others landfills within their same geographic category or as in the case of Springfield, the same as a similar City.

Observations from phase I (MSW waste sorts) and discussions with landfill managers implied that there was much more variation geographically than seasonally. Therefore, three major demographic categories of landfills were established. These were landfills in:

- Large metropolitan areas (St. Louis and Kansas City)
- Small metropolitan areas (Columbia, St. Joseph and Springfield)
- Rural areas

It was assumed that the percentage of each solid waste component, and the materials within those components, could be applied to any landfill where the demographics were similar, and the results would be acceptable.

Observation and Recording

The method of observation was the same for each landfill. Each truck was recorded by name and number and visually observed while they unloaded. Each load was categorized into one of five waste components (MSW, Construction, Demolition, Industrial, or Other). These categories are defined on page 7. With the exception of MSW (MSW was characterized during phase I) each load was also visually inspected and the percentage of major materials was estimated. For instance a construction load might be estimated to contain 50% wood scraps and 50% dry wall scraps. Obviously this was a subjective estimate.

Where traffic permitted, the project manager walked around each load of waste several times to visually characterize the load and assign percentages to the materials therein. None of the loads were physically sorted and weighed. Time, money, and landfill space were all limiting factors, which made this activity prohibitive.

At the close of each day a copy of the scale log was obtained from the landfill staff. The scale weights were then matched with the appropriate truck and recorded. The truck number, weight, waste component assignment, and percentage of materials within each component were then entered onto a Microsoft Excel spreadsheet. All weights were entered twice, once for waste component assignment and again for material percentage estimates in order to assure a double check for accuracy.

The following table summarizes the observation data. In order to maintain consistency, the project manager personally observed all loads, made all estimates on waste composition, and assigned all material percentages.

Observation Data

Landfill	Observation hours	Trucks Observed	Total tonnage observed
Black Oak	38	249	3,735
Bridgeton	47	1,063	9,196
Butler County	50	182	2,077
City of Columbia	55	470	1,808
City of St. Joseph	47	667	2,109
Courtney Ridge	45	733	4,350
Fred Weber	36	797	3,040
Lamar	47	197	2,769
Lemons	49	257	3,000
Maple Hill	38	221	1,757
Oak Ridge	44	720	6,172
Peerless C&D	96	777	5,355
Rockhill C&D	38	420	1,697
Southeast	44	660	4,485
Total	**674**	**7,413**	**51,550**

Definition of Waste Components

The solid waste stream is made up of a number of waste components. Identifying and defining these components is always difficult. There are no national guidelines or norms on how to categorize waste components. In order to accomplish the purposes outlined on page 1, the following guidelines were used to categorize solid waste into waste components:

Municipal Solid Waste (MSW)

For the purpose of this study MSW is defined as residential, institutional, or commercial waste that is disposed in small containers or plastic bags. This is a somewhat simplistic definition but is inclusive enough to cover most of the materials found in the MSW component. MSW is normally collected in packer trucks, which collect from residential, institutional, and commercial generators. In many cases the same truck will collect MSW from all three generators in the same load. MSW is generally delivered to the landfill in packer trucks or transfer trailers. Some rural landfills still receive MSW in open top trucks or trailers. Definitions of the sort categories contained within the MSW component are on page 97.

Construction Waste

The construction waste component was identified by interviewing the driver, when possible, concerning the origin of the load, and examining the contents of each load. Construction waste loads were primarily transported to the landfill in open top roll-off containers, dump trucks, or open trailers. Construction waste consists of mostly new construction material, which was a waste product of the construction process. The construction loads tended to be lighter, less weathered, and more homogeneous (all wood or dry wall, etc.) than demolition loads. As a

general rule construction waste materials are easier to recover and recycle than demolition waste materials. Definitions of the major materials contained within the construction waste component are on page 123.

Demolition Waste

Demolition waste materials are similar to construction waste materials and are traditionally included together as "construction and demolition (C&D)". Demolition materials are older, usually mixed with other materials, and more difficult to recover or recycle. Demolition waste loads were usually transported to the landfill in open top roll-off containers, dump trucks, or open trailers. Roofing waste was typically delivered to the landfill by independent contractors and was not mixed with other materials. Demolition wood was more weathered, there was very little if any cardboard, and there was more masonry materials (brick, concrete blocks, rock and dirt) in the demolition waste component than the construction waste component. Definitions of the major materials contained within the demolition waste component are on page 127.

Industrial Waste

The industrial waste component is a waste product of industrial processing or industrial activity. Materials were identified and estimated when there was large volumes of the same material in a packer, compactor unit, or roll-off container. Industrial waste loads were normally homogeneous, containing a single waste product from a manufacturing process. Definitions of the major materials contained within the industrial waste component are on page 131.

Other Waste

Other waste is defined as waste which does not fit into one of the above categories or was handled differently at the landfill (i.e. soil-like materials used for daily cover, asbestos, etc.). Bulky items such as furniture, mattresses, appliances, bicycles, shelving etc. are included in the other waste category. Commercial yard waste such as brush, stumps, sewage sludge, and hay are also included in this category. Definitions of the major materials contained within the other waste component are on page 135

The results of each landfill observation are included on pages 9- 92. Each landfill profile contains a description of the facility, information about the observation period, tonnage and percentages of waste received during the observation period.

The summary table in each profile lists the tonnage of each material received during the observation period and the percentage of that material. The Percentages are applied to the total waste received by that facility in 1998 to provide an estimate of the total tonnage for each material received during 1998.

The charts in each profile illustrate the percentage of each waste component for that facility, the materials received within each waste component and percentage comparisons to other landfills and the state average.

Summary

The Missouri Solid Waste Composition Study was a three-year project to understand the characteristics and composition of solid waste entering transfer stations and landfills in Missouri.

Phase I examined Municipal Solid Waste (MSW) in 19 of the state's 20 solid waste management districts. During this two year activity, 140,581 pounds of residential and commercial MSW was hand sorted into 6 major material categories, 26 minor material categories, and 16 potentially hazardous categories. The results were recorded by weight and volume. Those results are explained on pages 93-122.

Phase II examined the non-MSW waste components at 14 landfills throughout Missouri. Waste loads deposited at these 14 landfills were observed for a one-week period at each facility. The waste was subjectively analyzed and recorded into one of five solid waste components (MSW, construction, demolition, industrial, and "other"). A further visual examination of each load was made and the percentage of each major material was estimated. Those estimated percentages were then applied to the weight of each load to determine the weight of each material. The results of each of the solid waste components (other than MSW) are explained on pages 123-138.

There were some minor differences found between disposal facilities examined in Phase I (see the chart on page 109). However during Phase II there was considerable difference in the waste composition of the landfills observed. Some of these differences could be explained through demographic similarities of the areas surrounding the landfills. The landfills were grouped by population demographics into three categories (large metropolitan landfills, small metropolitan landfills, and rural landfills). Results based on these groupings are explained on pages 139-166.

The table on page 168 lists the solid waste components and materials by landfill type and total for Missouri.

The charts on page 169 depicts the total solid waste components, the MSW component, and the construction component, in both tons per year and percent of the total.

The charts on page 171 depict the demolition waste components, the industrial waste components, and the "other" waste components, in both tons per year and percent of the total.

The charts on page 173 depict the tonnage for each solid waste material within each waste component, and the combined materials from all waste components.

MISSOURI SOLID WASTE COMPONENTS

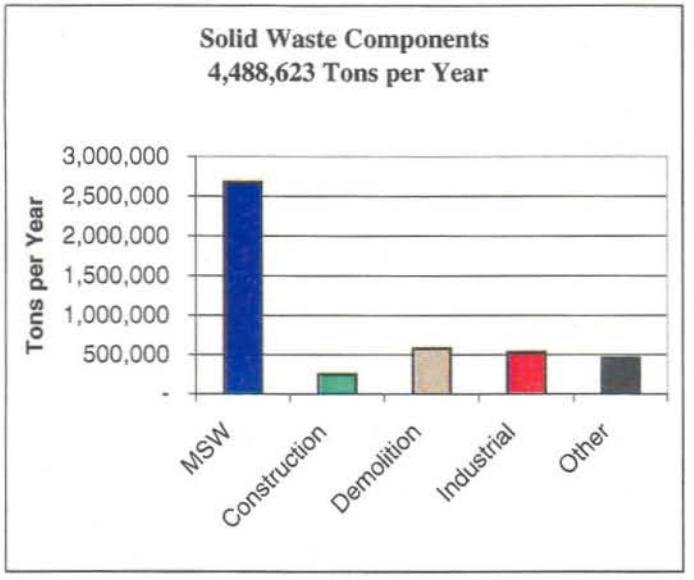
MATERIAL	Large Metro		Small Metro		Rural		All MO. Landfills	
	Pct.	Estimated Tonnage*	Pct.	Estimated Tonnage**	Pct.	Estimated Tonnage***	Pct.	Estimated Tonnage
Municipal Solid Waste								
Paper	18.5%	482,802	15.1%	52,408	30.0%	457,956	22.1%	993,166
Glass	2.9%	75,390	1.8%	6,255	4.5%	68,848	3.4%	150,493
Metals	3.4%	89,892	2.3%	7,866	5.8%	88,243	4.1%	186,001
Plastics	7.2%	187,745	4.7%	16,158	12.0%	182,669	8.6%	386,572
Organics	15.3%	400,524	10.6%	36,951	25.7%	391,527	18.5%	829,002
Inorganics	2.4%	62,767	2.5%	8,582	3.6%	55,543	2.8%	126,892
TOTAL MSW	49.8%	1,301,140	36.9%	128,322	81.6%	1,244,785	59.6%	2,674,247
Construction Waste								
Wood	3.8%	100,208	2.4%	8,253	0.3%	4,447	2.5%	112,908
Dry Wall	1.7%	45,467	3.1%	10,753	0.2%	2,630	1.3%	58,850
Masonry	1.2%	31,772	0.8%	2,837	0.1%	1,681	0.8%	36,290
Metal	0.1%	2,485	0.1%	476	0.0%	305	0.1%	3,266
Plastic	0.3%	9,002	0.1%	411	0.0%	195	0.2%	9,608
Cardboard	0.7%	18,925	0.3%	1,113	0.0%	740	0.5%	20,778
Other	0.4%	11,662	0.3%	950	0.1%	1,109	0.3%	13,721
TOTAL CONSTRUCTION	8.4%	219,520	5.0%	17,500	0.7%	11,172	5.5%	248,192
Demolition Waste								
Wood	5.2%	136,045	8.6%	29,980	1.8%	26,827	4.3%	192,852
Dry Wall	1.0%	27,392	1.0%	3,471	0.6%	8,413	0.9%	39,276
Roofing	3.6%	93,866	3.8%	13,155	2.0%	30,096	3.1%	137,117
Masonry	4.7%	123,924	3.5%	12,100	0.4%	5,770	3.2%	141,794
Metal	0.6%	16,651	0.3%	1,073	0.1%	2,265	0.4%	19,989
Carpet	0.6%	15,779	0.6%	2,188	0.4%	5,843	0.5%	23,810
Other	0.8%	21,961	0.5%	1,653	0.2%	3,027	0.6%	26,641
TOTAL DEMOLITION	16.7%	436,426	18.3%	63,620	5.4%	82,241	13.0%	582,287
Industrial Waste								
Cardboard	3.3%	87,000	4.1%	14,397	1.1%	16,662	2.6%	118,059
Paper	0.9%	23,025	1.8%	6,149	1.0%	15,761	1.0%	44,935
Food	1.4%	37,333	5.7%	19,698	0.6%	8,691	1.5%	65,722
Metal	0.1%	1,414	0.6%	2,110	0.2%	3,216	0.2%	6,740
Wood	2.8%	72,612	3.4%	11,741	1.0%	14,960	2.2%	99,313
Plastic	0.9%	23,926	2.5%	8,703	1.1%	17,363	1.1%	49,992
Textiles	0.1%	2,496	0.1%	253	0.6%	8,516	0.3%	11,265
Rubber	0.5%	12,507	0.2%	752	0.7%	10,261	0.5%	23,520
Other	0.9%	24,438	2.8%	9,844	4.9%	74,629	2.4%	108,911
TOTAL INDUSTRIAL	10.9%	284,752	21.2%	73,546	11.1%	170,060	11.8%	528,358
Special Wastes								
Bulky Items	1.6%	41,096	1.5%	5,071	1.0%	14,616	1.4%	60,783
Soil and Inert Materials	9.8%	257,316	16.2%	56,290	0.0%	-	7.0%	313,606
Asbestos	1.3%	33,826	0.4%	1,369	0.1%	1,250	0.8%	36,445
Other	1.5%	40,038	0.4%	1,490	0.1%	2,270	1.0%	43,798
TOTAL SPECIAL	14.2%	372,275	18.5%	64,321	1.2%	18,137	10.1%	454,733
TOTAL WASTE STREAM	**100%**	**2,614,920**	**100%**	**347,309**	**100%**	**1,526,394**	100%	4,488,623

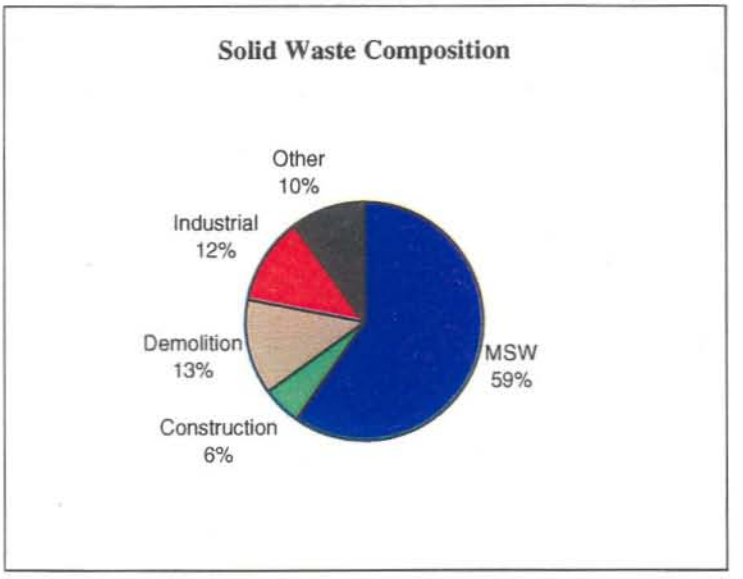
* Based on observation data from 5 sanitary and 2 C&D landfills, plus weighted average for Lee's Summit

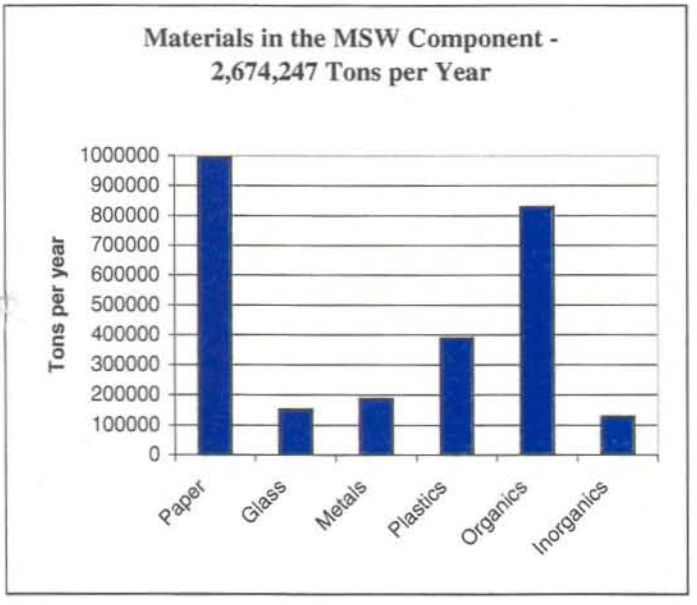
** Based on observation data from 2 landfills, plus the weighted average for Springfield.

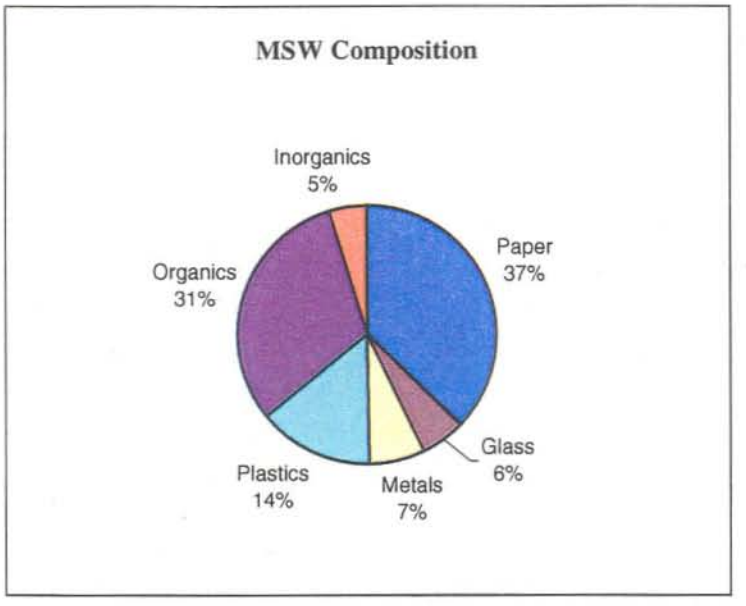
*** Based on observation data from 5 landfills, plus the weighted average from 14 sanitary and 2 C&D rural landfills

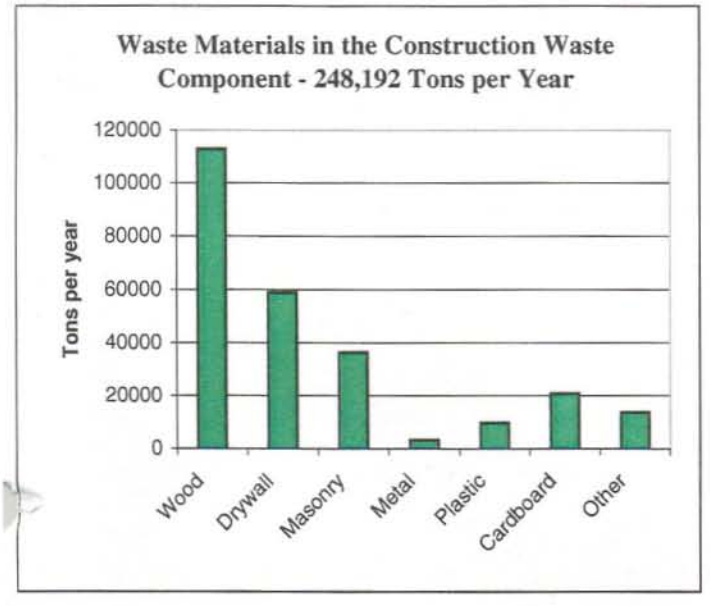
MISSOURI SOLID WASTE COMPONENTS

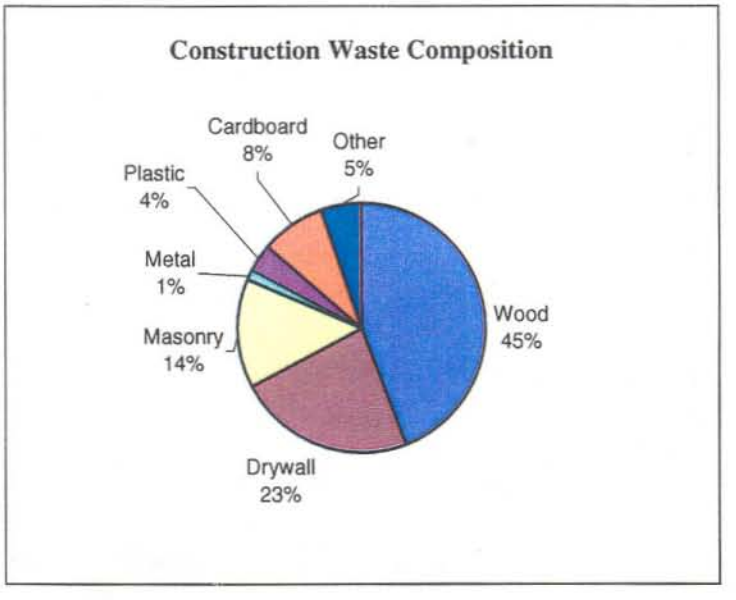












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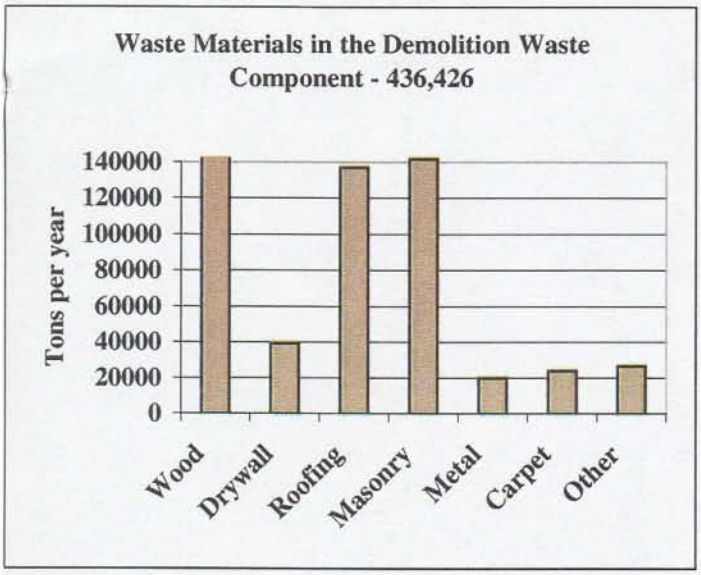

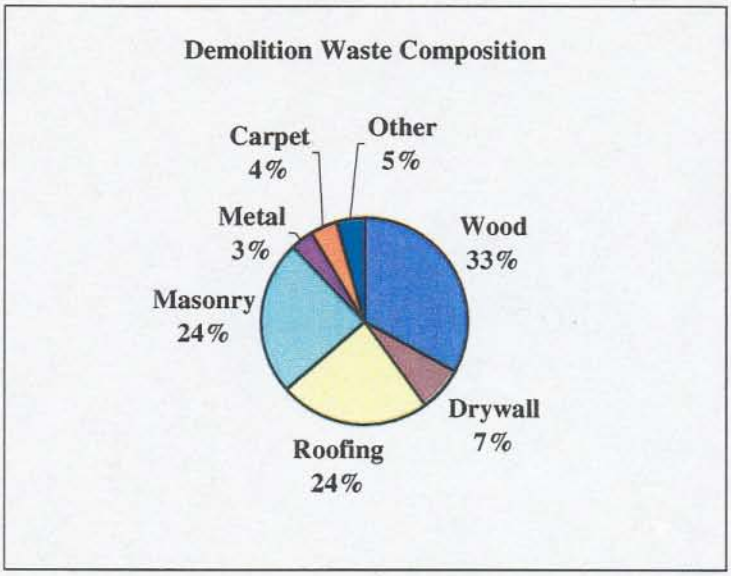

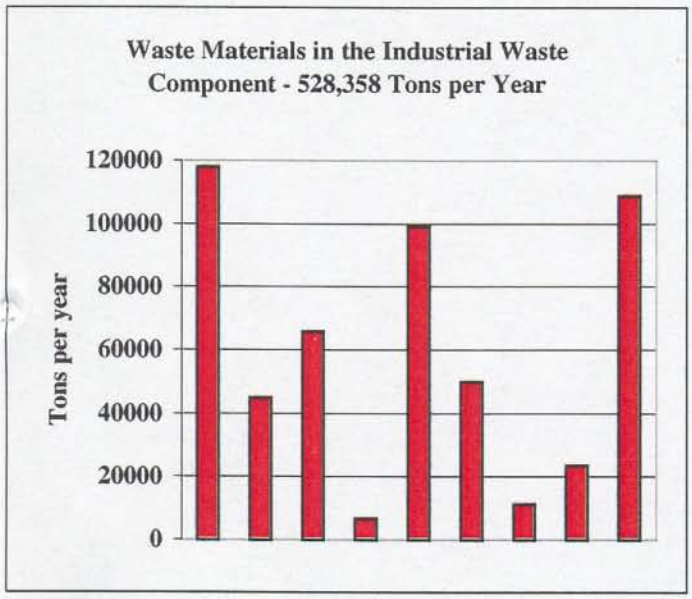

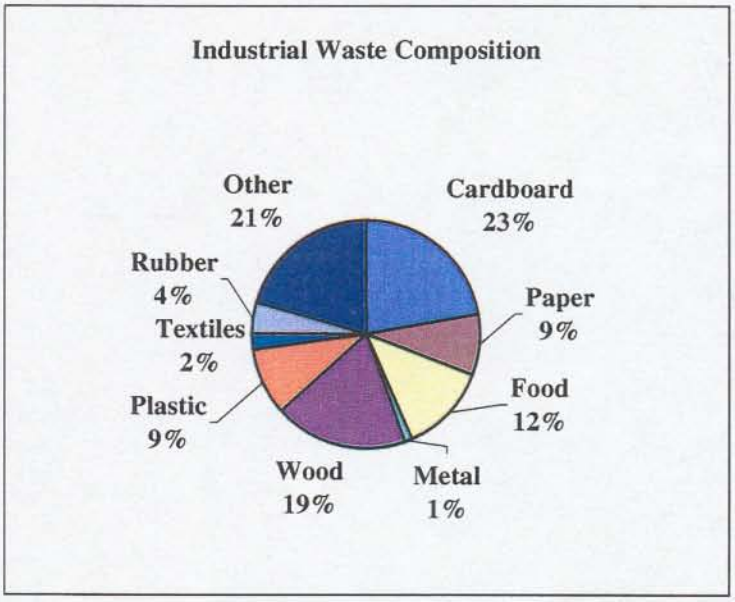

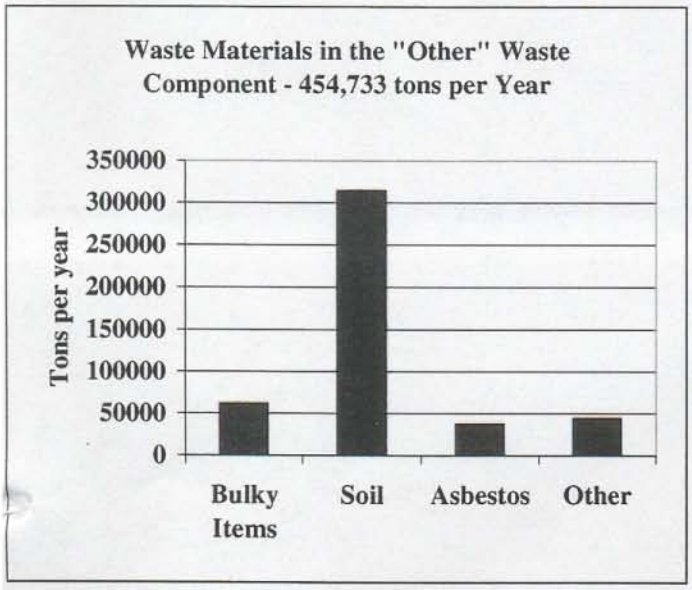

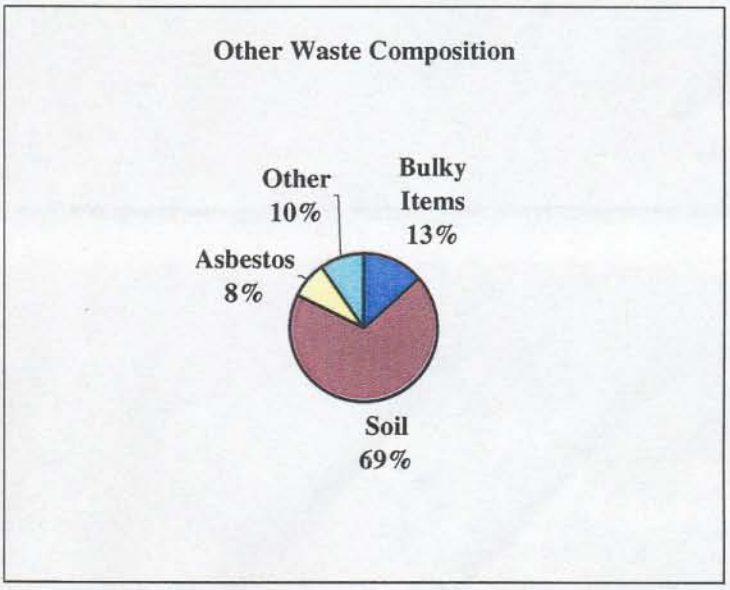
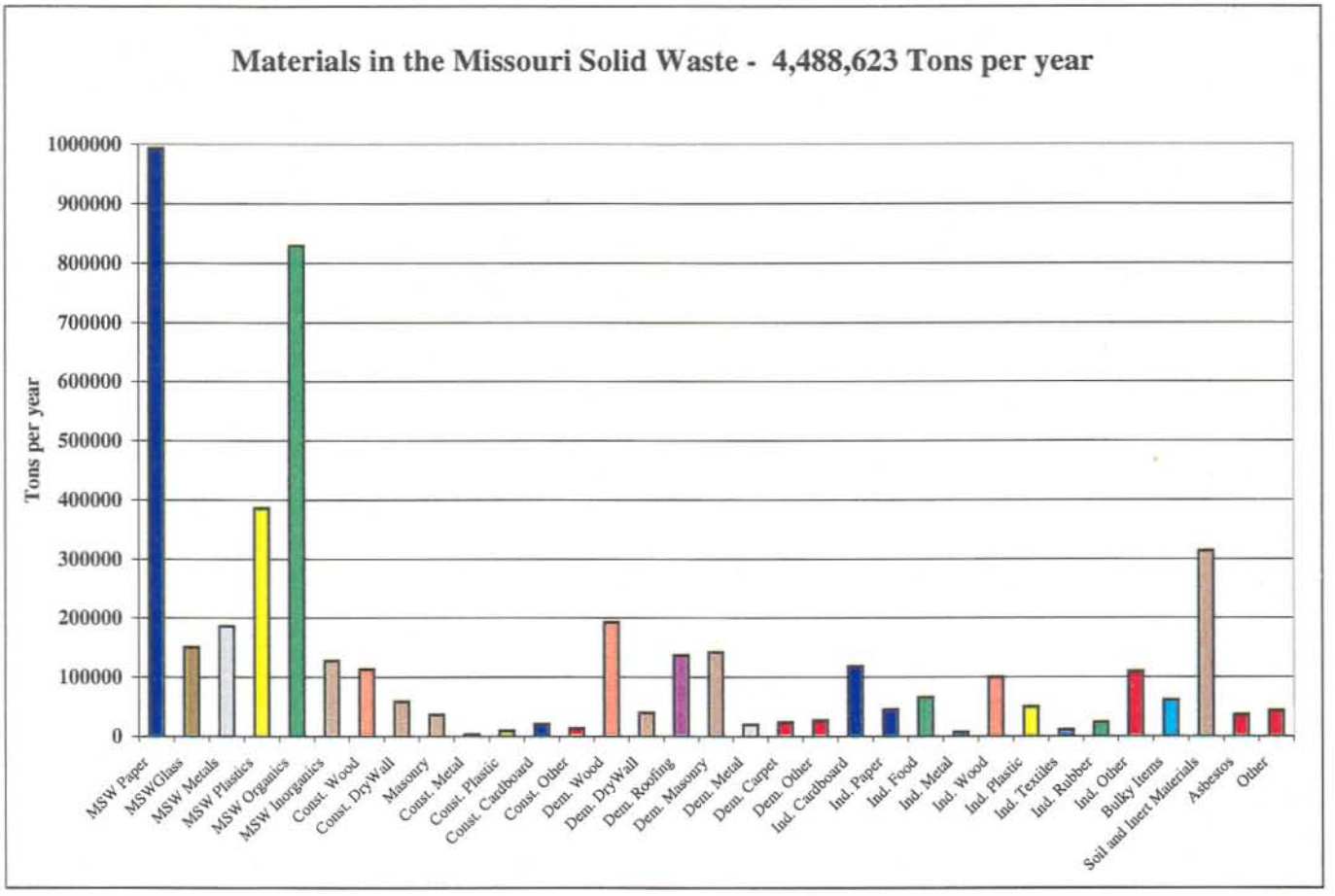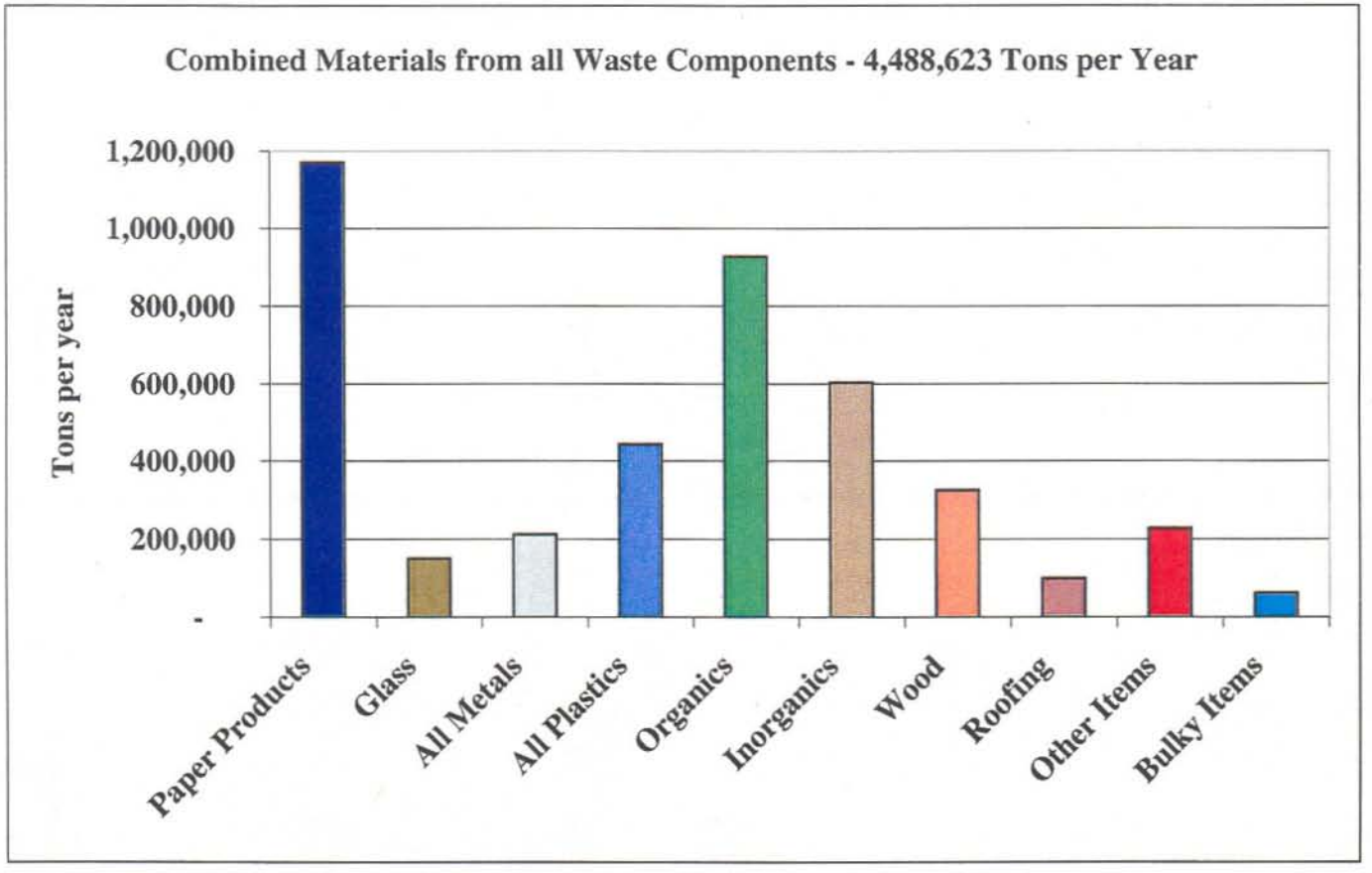
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