CONSTRUCTION WASTE

Construction waste is normally combined with demolition waste and described as "construction and demolition" (C&D). There are many definitions for C&D. Virtually every state has a slightly different definition for C&D waste. The EPA's *Characterization of Building-Related construction and Demolition Debris in the United States* (EPA530-R-98-010) contains a partial list of these varied state definitions. For the purpose of this study, C&D waste is defined as the waste resulting from new construction, remodeling, or the demolition of a structure.

However there are some differences between construction and demolition waste. Construction waste loads were usually transported to the landfill in open top roll-off containers, dump trucks, or open trailers. The construction loads tended to be lighter, less weathered, more homogeneous (all wood, dry wall, etc), and contained more cardboard boxes (usually from fixtures) than the demolition waste loads. In most cases it was relatively easy to visually differentiate between the construction and demolition loads. The most difficult loads to identify were from remodeling projects. These loads contained some new material and some demolition materials. In those cases, the load was analyzed and the waste components assigned percentages. For instance a remodeling load might be estimated to be 60% construction and 40% demolition. The materials within each of these components were then estimated.

Although most loads could be easily identified visually, drivers were interviewed when possible to determine where the load originated. If a load was identified as construction waste, the percentage of each material within the load was visually estimated. Visual estimates were made during and after the load was dumped. After each load was dumped the project manager walked around the waste to identify waste materials and assign material percentages. Typically, the percentage of the predominate material was estimated first (for instance wood might be estimated at 60% of the load) and secondary materials followed, (dry wall material might be 30%, and the remaining 10% might be cardboard). Materials were estimated until 100% of the load was assigned. Obviously this was a non-scientific analysis because all data was subjective. However, materials were relatively easy to differentiate and the same person did all the estimates in order to maintain consistency. The following materials were observed and estimated as part of the construction waste component:

Wood: Waste materials that are predominately *new* wood from new construction. This may include plywood, chipwood, dimensional lumber (2x4's, etc.) shavings and sawdust.

Drywall: Gypsum wallboard that is a waste product from *new* construction.

Masonry: Inert materials such as brick, concrete, rock, and dirt that originated at a construction site. This masonry material was "cleaner" and "newer" than the demolition masonry materials.

Metal: Metallic materials that were a waste product of *new* construction. This material consisted of new metal studs and metal beams and pipes

Plastic: Plastic waste materials used in *new* construction. This included PVC plumbing pipe, PVC siding, Styrofoam insulation, and plastic sheet.

Cardboard: Cardboard boxes, box board, and cardboard packing material.

Other: Any waste materials originating from *new* construction which do not fit into the one of the categories above. These materials include fiberglass insulation, electrical wiring, paper, and MSW from job sites

The Construction Waste Component

About 5.5 percent of the solid waste in Missouri landfills is construction waste. However this percentage varies greatly from metropolitan to rural areas. The percentage of each construction waste material (wood, drywall, etc.) within each of the population groups is very similar but the amount of construction waste in large metropolitan areas is much higher than the rural areas.

The large metropolitan areas (St. Louis and Kansas City) account for about 58% of Missouri's total waste but 88% of the state's construction waste. Likewise, the rural areas account for 34% of the total waste but only 5% of the construction waste. There seems to be several reasons for this difference.

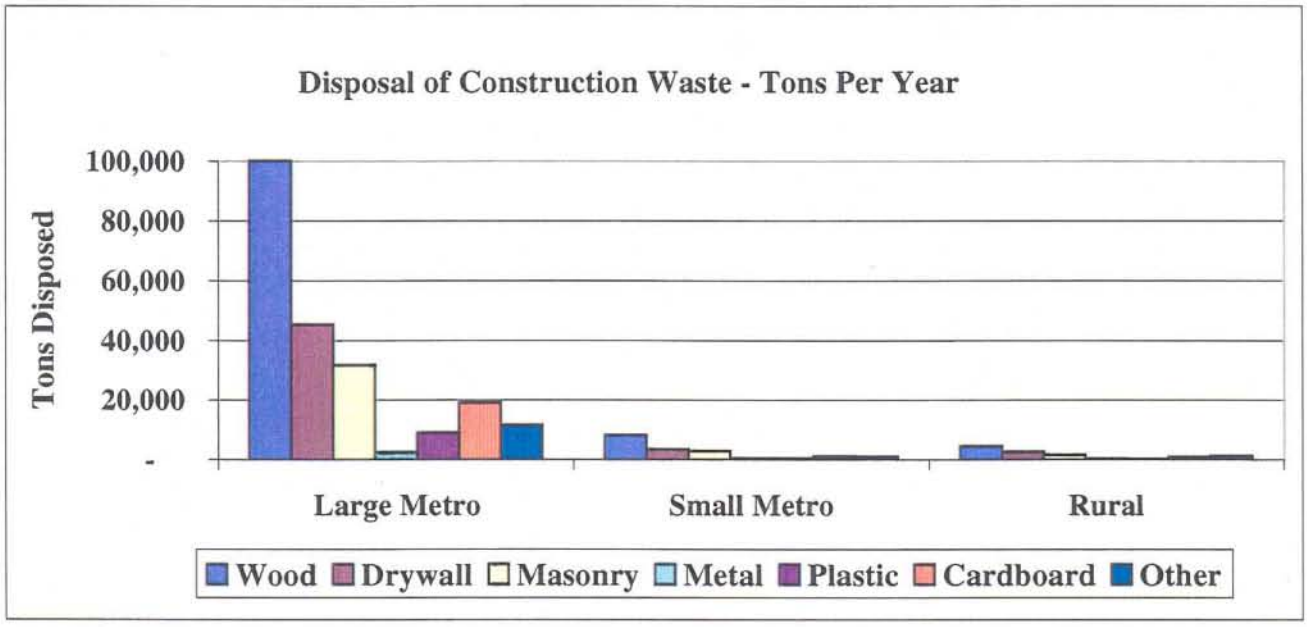
1. There is more construction in the metropolitan areas than the rural areas.
2. The metropolitan areas have more regulations concerning waste disposal and enforcement of illegal dumping activities.
3. Many rural areas allow open burning and therefore much of the carbon-based waste is burned and not disposed in landfills.
4. Many urban construction contracts require proper disposal in landfills, whereas many rural construction contracts leave disposal options unstated.

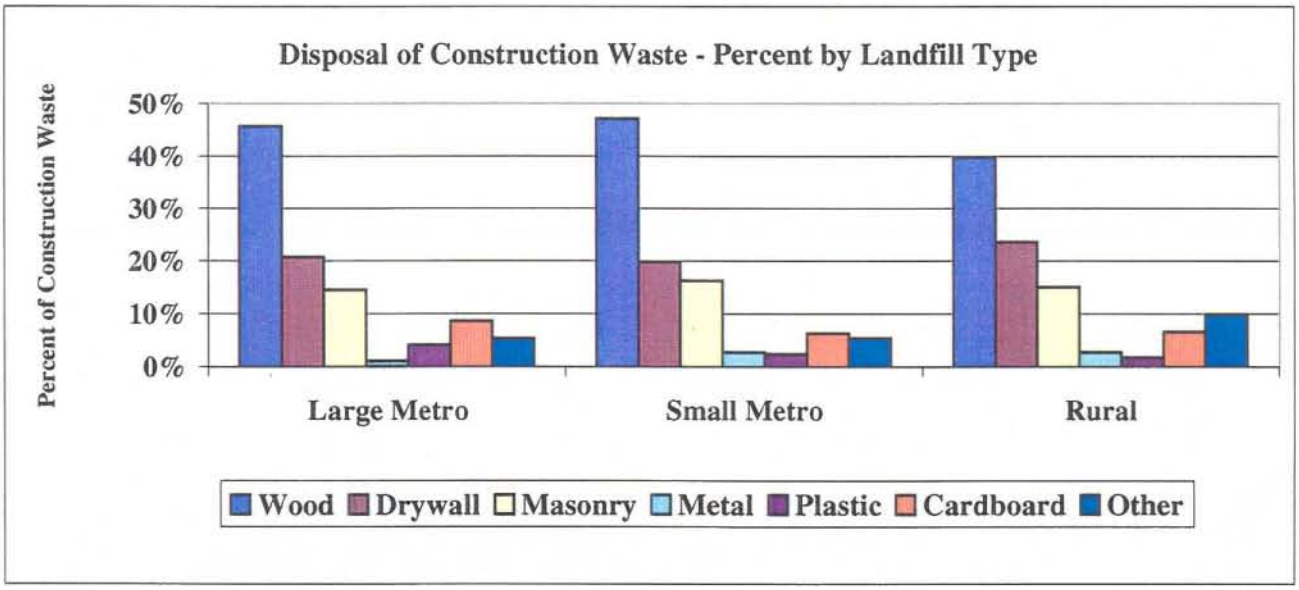
Recovery of some construction waste may be possible in the larger metropolitan areas where there are large construction waste volumes. However recovery in rural areas, where volumes are very low, seems to be impractical.

The table and charts on page 125 illustrate the composition of construction waste materials in large metropolitan, small metropolitan, and rural landfills. The construction waste for each of the observed landfills can be found in the landfill chapters.

Construction Waste Components

	Large Metro		Small Metro		Rural		State Average	
Materials	**%**	**Tons**	**%**	**Tons**	**%**	**Tons**	**%**	**Tons**
Wood	46%	100,208	47%	8,253	40%	4,447	45%	112,908
Drywall	21%	45,467	20%	3,461	24%	2,630	21%	51,558
Masonry	14%	31,772	16%	2,837	15%	1,681	15%	36,290
Metal	1%	2,485	3%	476	3%	305	1%	3,266
Plastic	4%	9,002	2%	411	2%	195	4%	9,608
Cardboard	9%	18,925	6%	1,113	7%	740	8%	20,778
Other	5%	11,662	5%	950	10%	1,109	6%	13,721
Total	**100%**	**219,520**	**100%**	**17,500**	**100%**	**11,172**	**100%**	**248,192**





DEMOLITION WASTE

Demolition waste is normally combined with construction waste and described as "construction and demolition" (C&D). There are many definitions for C&D. Virtually every state has a slightly different definition for C&D waste. The EPA's *Characterization of Building-Related construction and Demolition Debris in the United States* (EPA530-R-98-010) contains a partial list of these varied state definitions. For the purpose of this study, C&D waste is defined as the waste resulting from new construction, remodeling, or the demolition of a structure.

The demolition component of C&D is quite different from the construction component. Construction waste materials tend to be more homogeneous (all new wood, or new drywall, etc.) and for the most part are easier to separate and recycle. The demolition waste materials tended to be mixed with a variety of materials, and more difficult to separate and recover.

Demolition loads fit into two broad categories; remodeling and debris.

The remodeling loads were often mixed with new construction materials. Residential remodeling loads had a higher percentage of wood while commercial remodeling projects contained more metal. Most remodeling loads arrived in open top roll-off containers or were self-hauled in pick-up or trailers.

Debris loads were essentially structures that were knocked down by heavy equipment and loaded onto dump trucks for transport to the landfill. Debris loads usually contained masonry materials (dirt, rock, concrete, and brick) that were mixed with wood, roofing, carpet, drywall and small amounts of metal. The materials were mixed and usually shredded, broken, and smashed. Therefore debris loads are much more difficult to recover materials. In many cases, a debris load consisted of dirt, rock, or masonry materials. These masonry loads were very heavy and tended to skew the overall numbers.

The following materials were observed and estimated as part of the demolition waste component:

Wood: Wood waste from the demolition or remodeling of a structure. The wood was typically weathered, painted, and in many cases attached to some other material.

Drywall: Gypsum wallboard, which has been removed from a structure.

Roofing: Shingles that were torn off of existing roofs in anticipation of putting new shingles on the structure. In most cases these shingles were delivered to the landfill in dump trucks or trailers and not mixed with any other materials.

Masonry: Inert materials such as brick, concrete, rock, and dirt that were removed from a demolition site. These materials were normally mixed with other demolition materials such as wood, drywall, etc.

Metal: Metallic items that were removed during the remodeling or demolition of a structure.

Carpet: Carpeting that was removed and disposed of during the remodeling and or demolition of a structure.

Other: Any other materials, not listed above, that was removed and disposed of during the remodeling and or demolition of a structure. These included insulation, roofing insulation board, plastics, and small amounts of MSW or bulky items.

The Demolition Waste Component

About 13 percent of the solid waste in Missouri landfills is demolition waste. This percentage varies greatly from metropolitan areas to rural areas. As was the case in construction waste, the metropolitan demolition component is much higher than rural demolition waste.

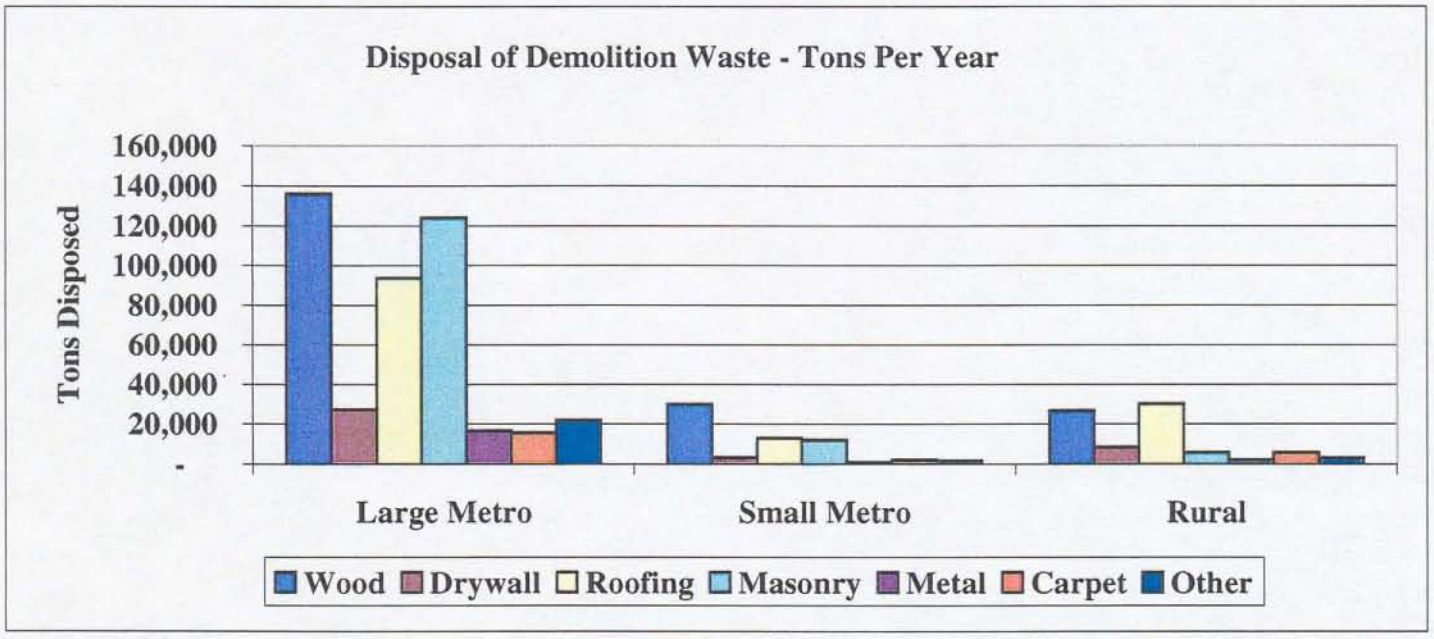
Unlike the construction waste component, the percentage of demolition waste materials (wood, dry wall, etc.) differed greatly from metropolitan areas to rural areas.

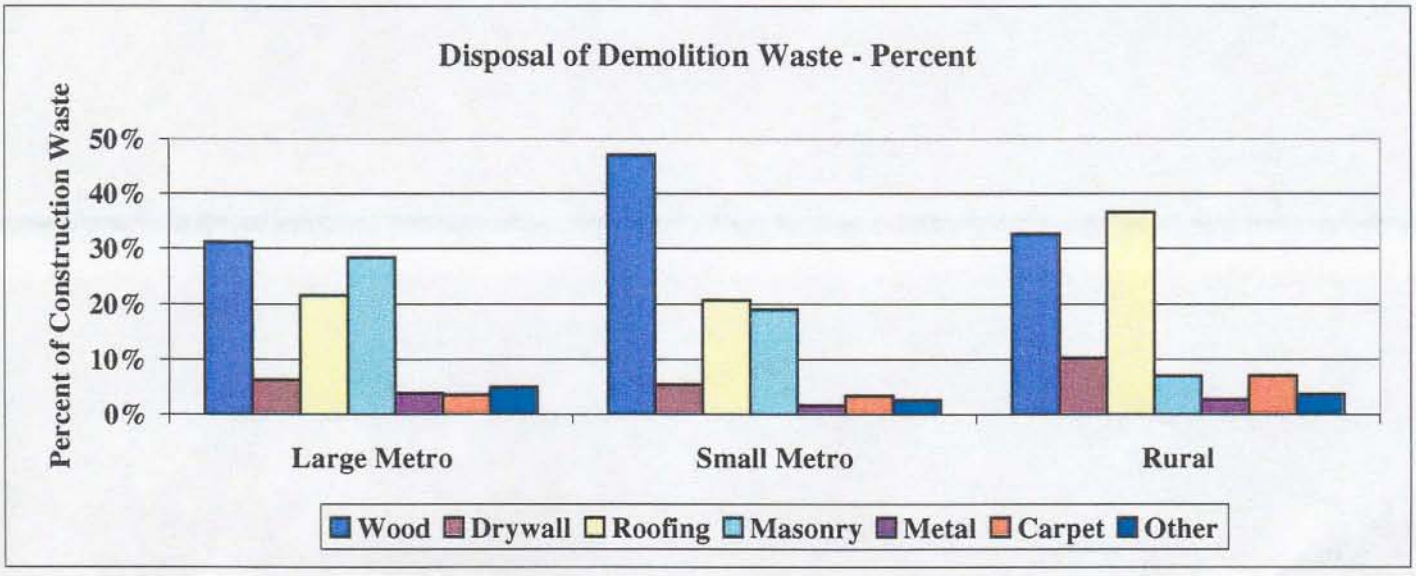
1. Roofing waste was significantly higher in rural areas. The age of many structures may be older in rural areas than the metropolitan areas, thereby requiring more repairs (tear off and re-roofing).
2. The percentage of masonry (dirt, rock etc.) was significantly less in rural areas. Ordinances and enforcement on demolition projects in rural areas may be less restrictive than metropolitan areas. Also, some masonry loads (dirt and rock, etc.) may be illegally disposed in rural areas
3. Wood waste was significantly higher in small metropolitan areas. During the observation period at the City of St. Joseph Landfill several trucks containing wood debris from a flood related demolition project were recorded. The unusually large amount of demolition debris received during the observation period may have inflated the amount of this material normally received by the landfill.

The table and graphs on the following page illustrate the distribution of demolition waste materials in Missouri landfills. The demolition waste for each of the observed landfills can be found in the landfill chapters.

Demolition Waste Component

	Large Metro		Small Metro		Rural		State Average	
Materials	%	Tons	%	Tons	%	Tons	%	Tons
Wood	31%	136,045	47%	29,980	33%	26,827	33%	192,852
Drywall	6%	27,392	5%	3,471	10%	8,413	7%	39,276
Roofing	22%	93,866	21%	13,155	37%	30,096	24%	137,117
Masonry	28%	123,924	19%	12,100	7%	5,770	24%	141,794
Metal	4%	16,651	2%	1,073	3%	2,265	3%	19,989
Carpet	4%	15,779	3%	2,188	7%	5,843	4%	23,810
Other	5%	21,961	3%	1,653	4%	3,027	5%	26,641
Total	100%	436,426	100%	63,620	100%	82,241	100%	582,287





INDUSTRIAL WASTE

Industrial waste is difficult to define. In the broadest sense all waste from commercial operations could fall into the industrial category. The waste from a fast food restaurant is technically industrial processed waste because the waste (food scraps, paper, plastics) are all part of the manufacturing process resulting from the creation of a product. However, it is difficult to separate some of this waste from the normal municipal solid waste (MSW).

In many cases, the waste from small manufacturing, commercial, and institutional generators is collected in packer trucks. These packer trucks make hundreds of stops each day and combine the waste from each stop. In many cases the same truck that picks up residential waste will also pick up commercial and institutional waste. In fact, these small waste commercial generators were included in the waste sorts of MSW conducted in 1996-97.

For the purpose of this study industrial waste is defined as follows:

- Waste from an industrial, manufacturing, or commercial operation
- Waste that was visibly homogeneous (all the same type of material)
- Waste from a single waste generator and not combined with other generators

In most cases the industrial waste was delivered to the landfill in open top roll-off containers, roll-off compactor units, dump trucks, or oversized trailers. The materials within these vehicles and/or containers was a result of a manufacturing or industrial process. In many cases the waste materials were wooden pallets, crating material, strapping, or cardboard. These materials were not a direct waste product of the manufacturing process, but they were an indirect waste product of the manufacturer.

The following materials were observed and estimated as part of the industrial waste component:

Cardboard: Corrugated containers. Whole, flattened, shredded, or baled.

Paper: Paper materials included wrapping waste, overruns from printing, and office paper from a single waste generator.

Food: Human or animal food wastes resulting from processing or overruns.

Metal: Metallic waste material from a single waste generator. Does not include metal sludges, which were categorized as "other".

Wood: Includes wooden palates, crating, waste from wood processing and sawdust.

Plastics: All plastic resin waste including, processed waste, packing materials, and plastic resin sludges.

Textiles: Includes clothing, rags, and processed cloth waste.

Rubber: Includes auto and truck tires from tire shredders, and processed rubber waste materials and overruns.

Other: All industrial processed wastes that were not included above. The great majority of this category was waste products from metal processing plants. This included foundry sand, aluminum ore waste products, and carbon black.

The Industrial Waste Component

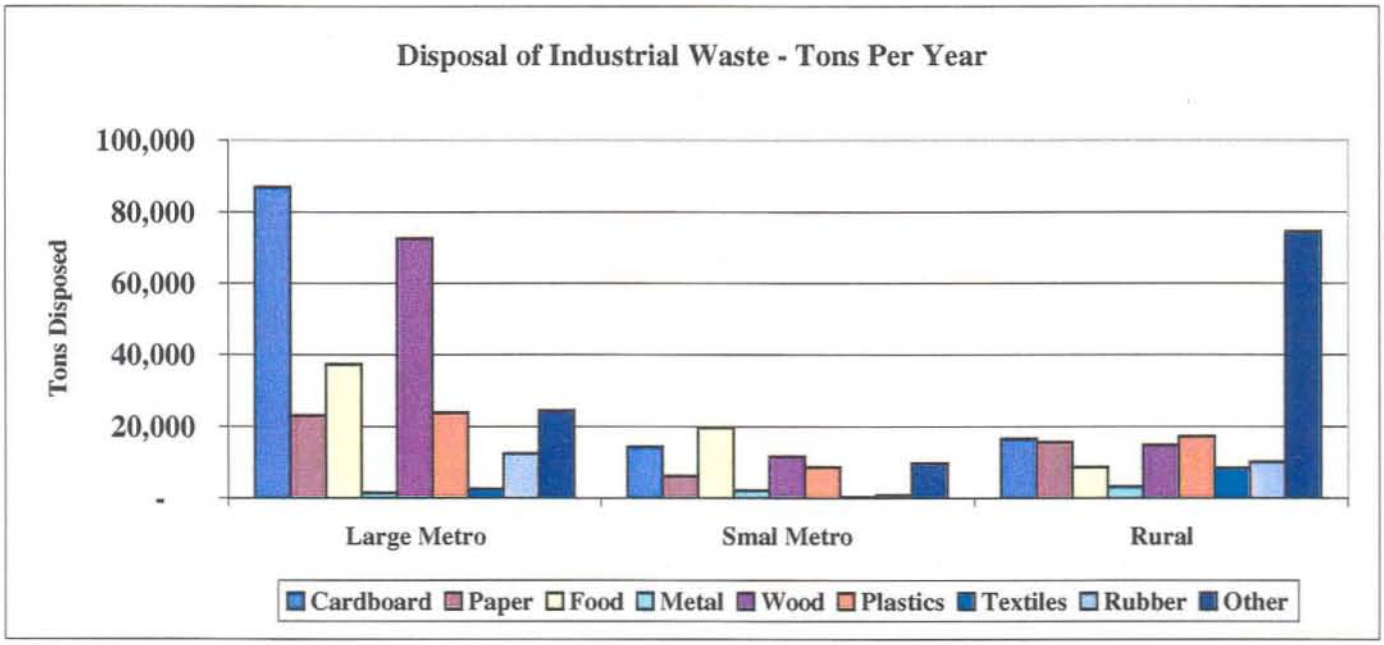
About 12 percent of the solid waste in Missouri landfills is industrial waste (as it is described above). The industrial waste component varied greatly from one landfill to another. Food wastes were considerably higher in the western portion of the state (Kansas City and St. Joseph). Large amounts of aluminum ore were received at the Lemons landfill in Dexter. Large amounts of rubber waste were received at the Peerless and Fred Weber landfills (from the Tire Shredders) and Butler County (from the Gates Rubber plant). Oak Ridge and Lamar received large amounts of foundry sand from local foundries.

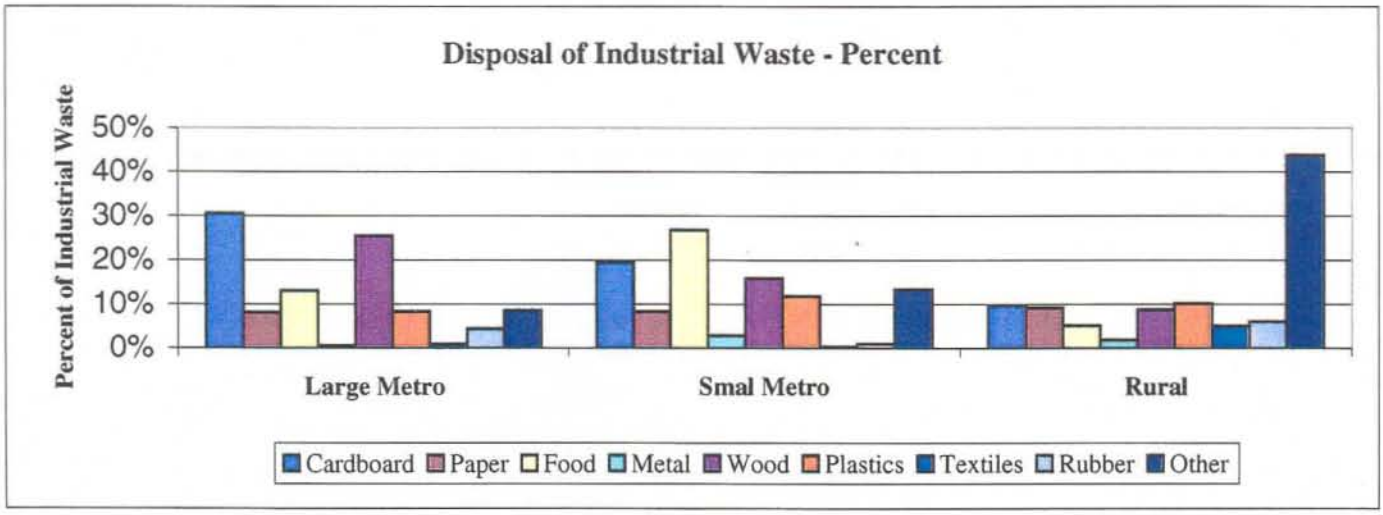
Cardboard (in the form of boxes) and wood (in the form of pallets, crates and sawdust from wood processing plants) accounted for more than 50% of the large metropolitan industrial waste. Food waste was the most prevalent industrial material in the small metropolitan landfills. Waste products from metal processing plants (aluminum smelting by products, foundry sand, and carbon black) accounted for almost half of the rural industrial waste component.

The table and graphs on the following page illustrate the distribution of industrial waste materials in Missouri landfills. The industrial waste for each of the observed landfills can be found in the landfill chapters.

Industrial Waste Component

	Large Metro		Small Metro		Rural		State Average	
Materials	%	Tons	%	Tons	%	Tons	%	Tons
Cardboard	31%	87,000	20%	14,397	10%	16,662	22%	118,059
Paper	8%	23,025	8%	6,149	9%	15,761	9%	44,935
Food	13%	37,333	27%	19,698	5%	8,691	12%	65,722
Metal	0%	1,414	3%	2,110	2%	3,216	1%	6,740
Wood	26%	72,612	16%	11,741	9%	14,960	19%	99,313
Plastics	8%	23,926	12%	8,703	10%	17,363	9%	49,992
Textiles	1%	2,496	0%	253	5%	8,516	2%	11,265
Rubber	4%	12,507	1%	752	6%	10,261	4%	23,520
Other	9%	24,438	13%	9,844	44%	74,629	21%	108,911
Total	100%	284,752	100%	73,546	100%	170,060	100%	528,358





OTHER WASTE

The "Other" category includes all the materials that do not fit neatly into one of the previously discussed waste components. This is a category that is often overlooked by solid waste management planners but represents a very significant portion of the waste stream.

The following materials were observed and estimated as part of the "other" waste component:

Bulky items: Includes furniture, mattresses, box springs, bicycles, large appliances, and any other household item that will not fit into a normal size trash bag.

Soil: Includes contaminated and non-contaminated soil. This soil was unloaded in a separate area of the landfill and normally used for daily cover. If the soil was unloaded on the face and mixed immediately it was classified as demolition masonry.

Asbestos: Insulation made with asbestos fibers and declared to be special waste. This item was handled with special care at the landfill. In most cases the asbestos loads were estimated by volume and therefore a 3:1 ratio was used to convert volumes to weight.

Other: This category included everything that did not fit into any of the components and material categories mentioned previously. Materials included municipal sewage sludge, unidentifiable sludge, commercial yard waste and stumps, and all other unidentifiable materials.

The "Other" Waste Component

The other waste component was the most surprising part of the study. Most solid waste planners understand the importance of MSW, C&D, and industrial waste. However, during observation periods over 10% of the total solid waste received at landfills fell into the "other" category. By far the highest percentage material was soil (69%).

We don't normally think of soil as solid waste but it was received as waste, reported to DNR as waste, and put into the landfill as waste. There were two main categories of soil.

Contaminated soil came from remediation projects (soil around underground tanks, soil from a hazardous spill area, etc.). The contaminated soil was normally set off to the side of the working face and allowed to "air out" for a period of time. At some later time this materials was used for daily cover.

Clean soil was also delivered to the landfill and listed as solid waste. Some landfills gave special rates to contractors that brought clean soil to the landfill because it saved the landfill the expense of hauling daily cover. However at each of the observed landfills, this clean soil, used for daily cover, was reported as solid waste and the surcharge paid to DNR.

About 13% of the Other waste component were bulky items. These were normally furniture, mattresses, and other large items that could not be neatly put into a trash bag for pick up. Clean-up contractors or individuals hauling their own bulky items in a pick-up or trailer brought many of the bulky items to the landfill. Many rural communities have a "clean-up" week and the amount of bulky material received was higher during these times. The City of Kansas City has two trucks with grapple arms that pick up bulky items in the Kansas City area year round.

Asbestos was recorded at 0.8% but that figure is misleading. Asbestos is charged for by the cubic yard. Therefore if a 40-yard closed container is hauled with asbestos, the landfill charges for 40 yards. The universal conversion rate is 3:1 (3 cubic yards equal 1 ton). However asbestos is normally light and therefore those conversion rates tend to inflate the actual figures.

The remainder of the Other waste component was sewage sludge, commercial yard waste, stumps, and organic materials from non-industrial processes. The sewage sludge was very heavy and most loads weighed over 15 tons.

The table and graphs on the following page illustrate the distribution of other waste materials in Missouri landfills. The other waste for each of the observed landfills can be found in the landfill chapters.

The Other Waste Component

	Large Metro		Small Metro		Rural		State Average	
Materials	%	Tons	%	Tons	%	Tons	%	Tons
Bulky Items	11%	41,096	8%	5,071	81%	14,616	13%	60,783
Soil	69%	257,316	88%	56,290	0%	-	69%	313,606
Asbestos	9%	33,826	2%	1,369	7%	1,250	8%	36,445
Other	11%	40,038	2%	1,490	13%	2,270	10%	43,798
Total	**100%**	**372,276**	**100%**	**64,321**	**100%**	**18,136**	**100%**	**454,733**