

# **Refuse Sort Results & Implications for the University of Michigan**

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## **Background**

In March 2007, the need for a refuse sort of campus buildings was determined. The reasons for this sort were three-fold: (1) determine the amount of recyclables being lost to refuse, (2) identify recyclable materials commonly found in the refuse in order to develop more targeted educational campaigns and (3) determine the amount of organic waste present in the refuse as a feedstock for a possible anaerobic digester project.

In order to determine the composition of the entire Ann Arbor campus' refuse in a timely manner and because the campus supports many different types of activities, campus buildings were divided into 6 categories:

- Administrative (e.g. Wolverine Tower, Student Activities Building, etc.)
- Classroom (e.g. Angell Hall, Mason Hall, Modern Languages Building, etc.)
- Research (e.g. BSRB, MSRBs, Life Sciences Institute, etc.)
- Residence Hall (e.g. South Quad, Couzens Hall, Mary Markley Hall, etc.)
- Unions (e.g. Michigan Union, Michigan League, Pierpont Commons, etc.)
- Recreational (e.g. Intramural Sports Building, Central Campus Recreation Building, etc.)

Once buildings were classified by these categories, a representative building was chosen from each. Buildings were chosen by the Recycling Coordinator, the Waste Management Services (WMS) Operations Foreman and other WMS staff. As some locations share a refuse dumpster, some categories included refuse from multiple buildings. In these instances, all buildings using the selected refuse dumpster fell into the same building-type category. The selected building categories and buildings were:

- Administrative: Student Activities Building (SAB)
- Classroom: Angell/Mason/Haven/Tisch Halls
- Research: Life Sciences Institute (LSI)
- Residence Hall: Mary Markley Hall
- Unions: Pierpont Commons
- Recreational: Central Campus Recreation Building (CCRB)

## **Methodology**

The week of March 19, 2007 was randomly selected for the refuse sort. Buildings were then randomly assigned to each day of the week. One building's refuse was sorted each day except for Tuesday, when both Markley and CCRB were sorted. Refuse from these buildings was sorted in separate areas at different times so as not to skew the data.

Crews of 5 to 10 people (depending on time of day) sorted the refuse into 12 different waste categories. The categories, with a brief description of what each category includes, are:

- White Office Paper: standard white printing paper
- Newspaper: newspapers, other materials on newsprint
- Cardboard: clean pizza boxes, assorted cardboard boxes
- Mixed Recyclable Paper: magazines, colored paper, notebook paper, boxboard, etc.
- Non-Recyclable Paper: napkins, tissues, tissue paper, sanitary items, etc.
- Recyclable Plastics: #1 and #2 plastic bottles and jars
- Non-Recyclable Plastics: all other plastic items

- Non-Compostable Organic Waste: non-recyclable organic items not currently compostable within the UM Food Waste Composting Program. Includes post-consumer foods, fats, oils, greases, meats, etc.
- Compostable Organic Waste: non-recyclable organic items which are acceptable in the UM Food Waste Composting Program. Includes pre-consumer vegetative food waste, plain rice and bagels
- Recyclable Metal: All metal beverage containers, other scrap metal
- Recyclable Glass: Glass bottles and jars, ceramics
- Trash: All items that do not fall into the above categories including composite materials, non-recyclable glass, etc.

**Figure 1: WMS Staff Sorting Refuse**

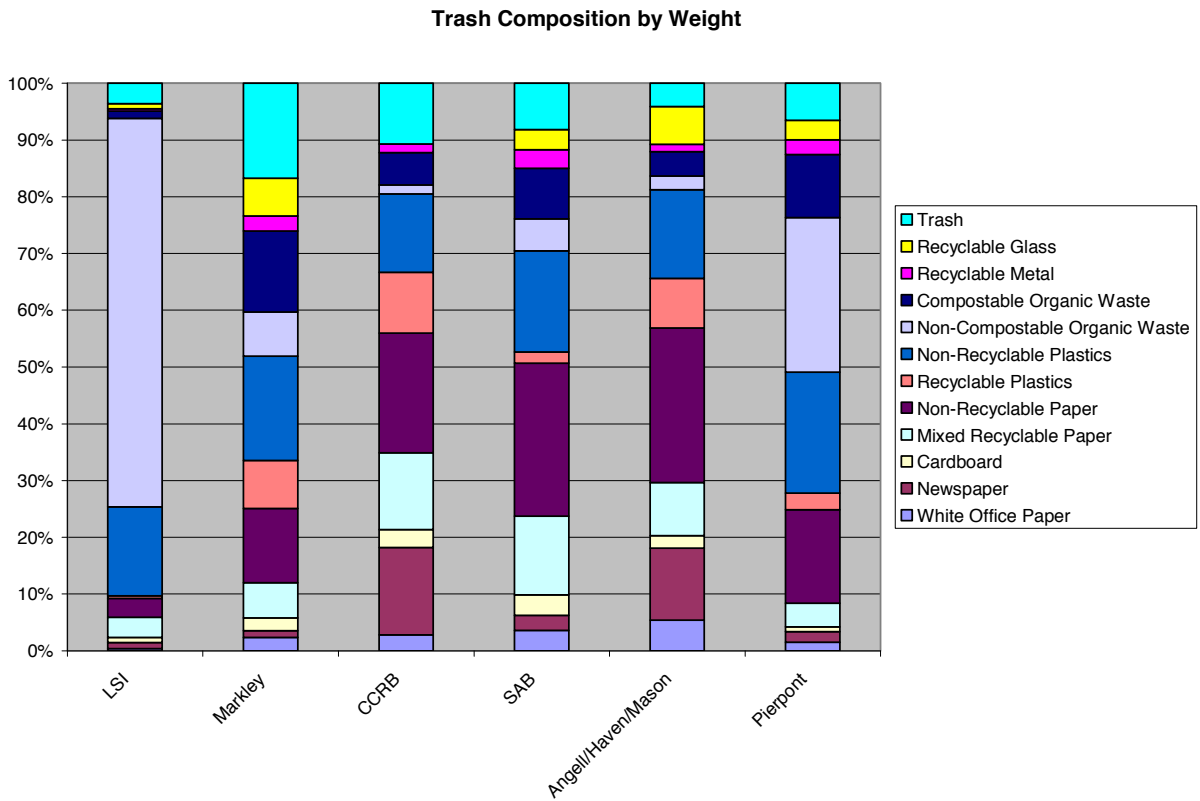


After sorting was complete, sorted bags were then weighed. Bag weight and volume were recorded and the data were later entered into an Excel spreadsheet. Once this was completed, a list of WMS refuse stops was obtained and each refuse dumpster location on campus was assigned to a building category based upon the activity taking place there.

### Results

As we recorded the waste categories by weight and volume, the results will include both. The distribution of waste by weight varied by building, as expected.

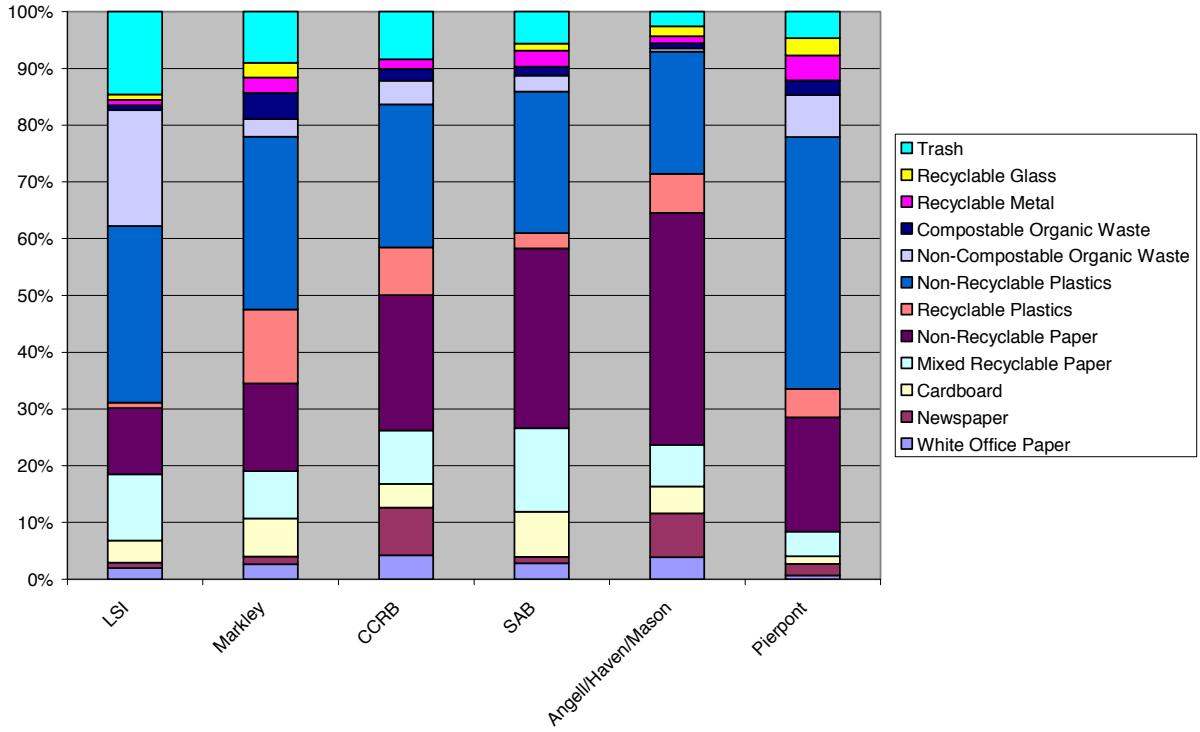
**Table 1**



The same is true for the distribution by volume.

**Table 2**

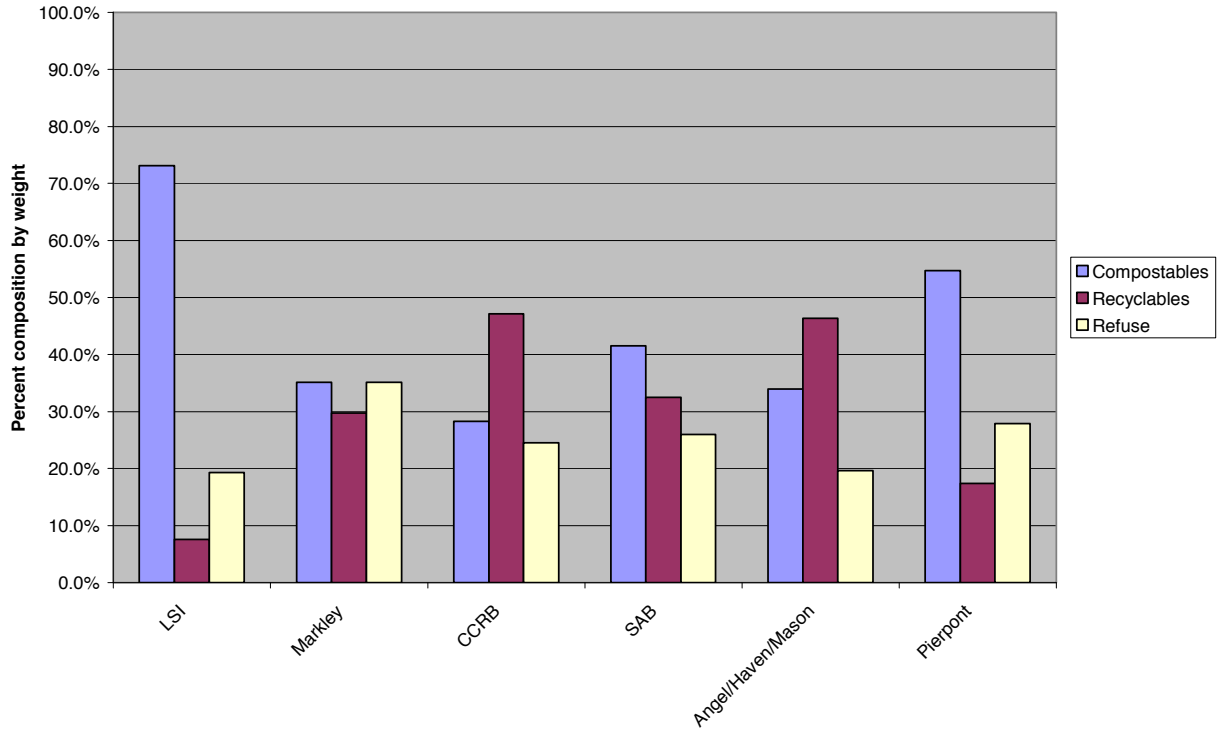
**Trash Composition by Volume**



By combining a number of the categories, we can see the data in terms of recyclable material, compostable material (currently compostable and potentially compostable) and actual refuse.

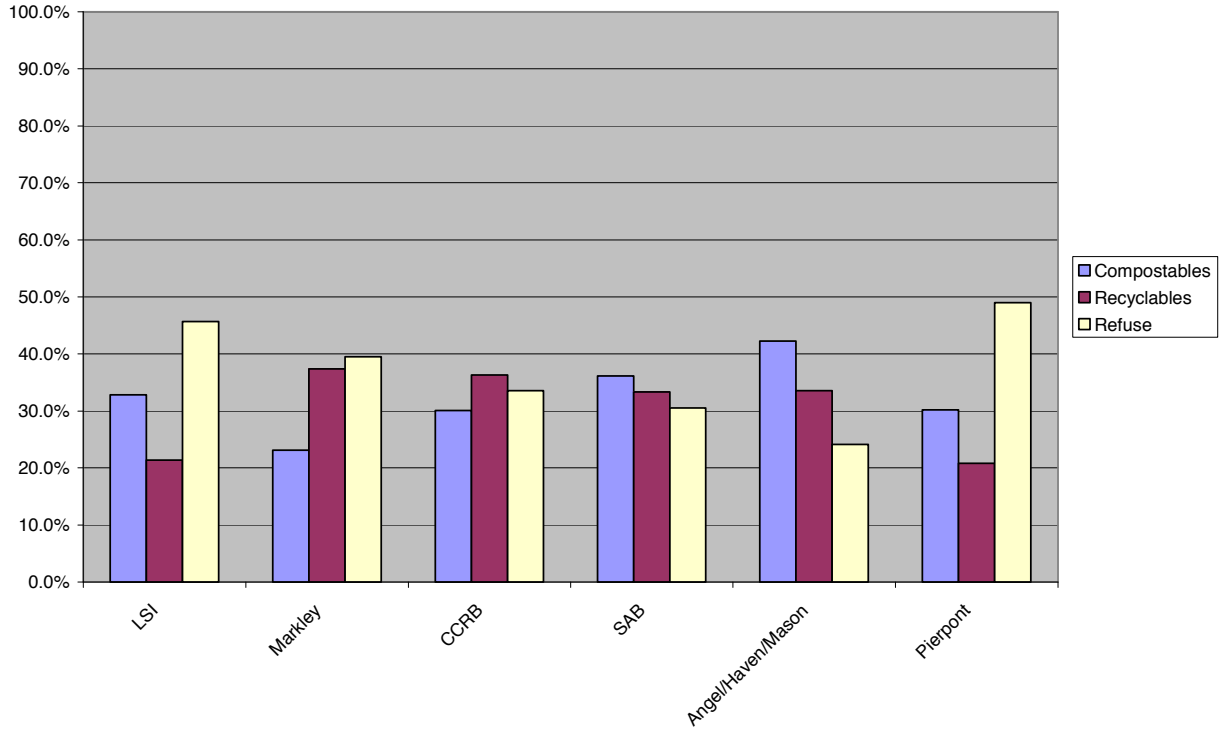
**Table 3**

**Trash Analysis by Waste Category Based Upon Weight**



**Table 4**

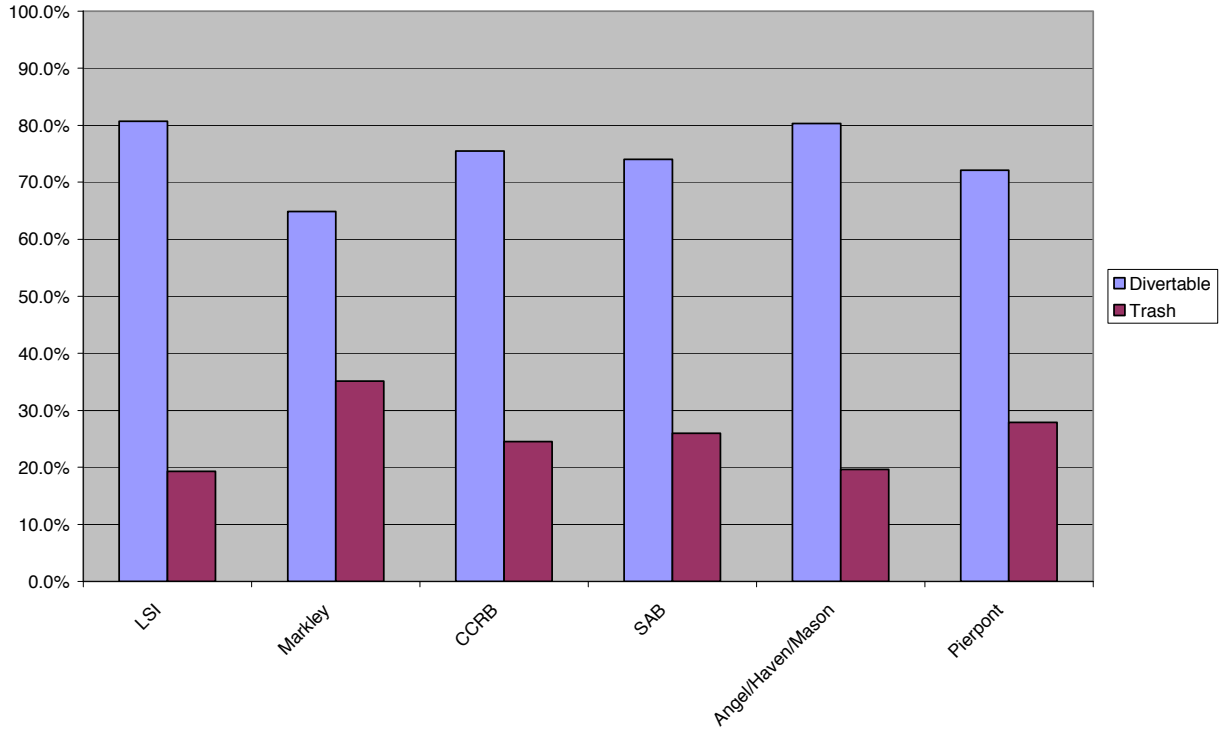
**Trash Analysis by Waste Category Based Upon Volume**



Finally, by combining even more categories, we can view the data by material that is divertible from the landfill and that which is not. In this case, divertible refers to items that are currently recyclable as well as items that could be composted using currently available technologies.

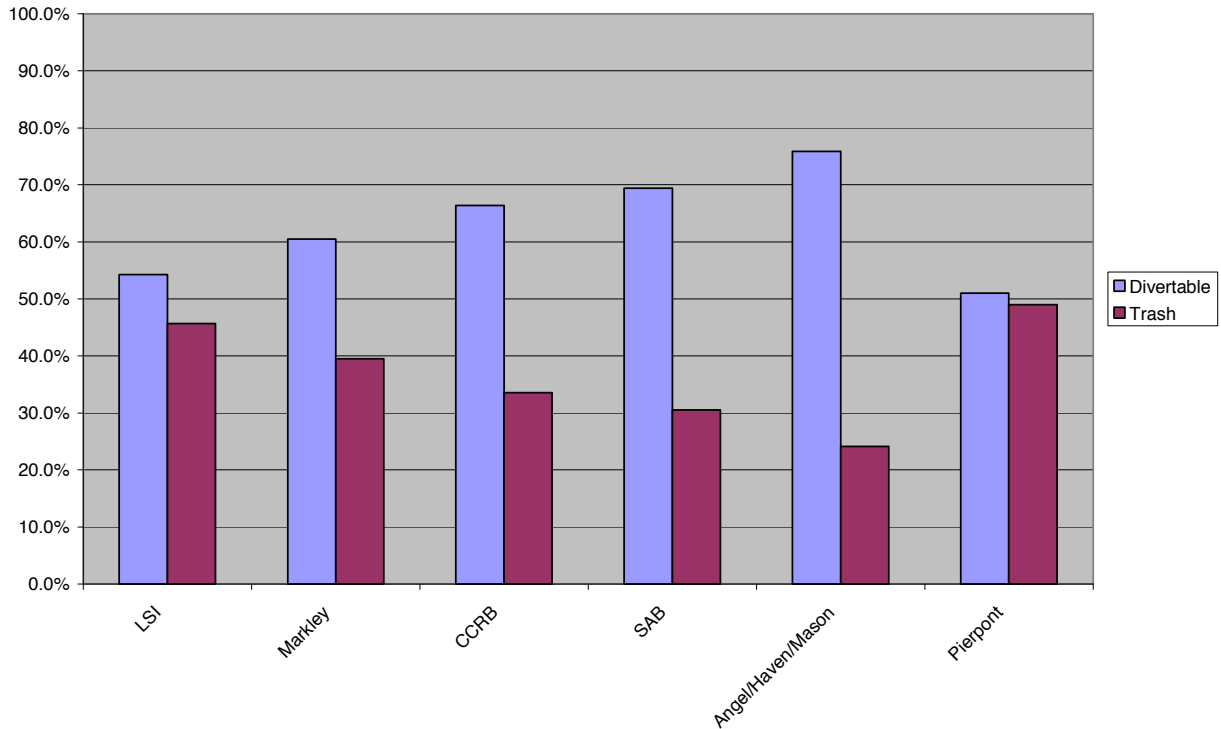
**Table 5**

**Percentage of Refuse That May Be Diverted from Landfilling, Based Upon Weight**



**Table 6**

**Percentage of Refuse That May Be Diverted from Landfilling, Based Upon Volume**



### **Discussion and Implications for the University of Michigan**

#### *Recyclable Materials*

Many mixed container recyclables were found in all refuse sorted. While not substantial in weight, they did take up a large volume. It is also worth noting that there was approximately a 10:1 ratio of non-deposit beverage containers to deposit beverage containers in this mix. It is important to note that a large number of the recyclable containers found in Markley's refuse were beer and liquor containers and this refuse was collected 3 days after St. Patrick's Day. Fear of receiving a "Minor In Possession" ticket may lead students living in the Residence Halls to throw these items in the trash rather than the recycling and the high amount of these types of containers may have been impacted by the proximity of the holiday and the day this refuse was collected and sorted. Additional mixed container recycling bins in all buildings on campus, with accompanying custodial training and route evaluations, are recommended. It is also recommended that a mixed container recycling educational campaign be rolled out for FY 2008.

Newspapers made up a greater percentage of the refuse in CCRB and Mason/Angell/Haven/Tisch Halls than in other buildings. This is not surprising as they would more likely be read between classes and while exercising. It is recommended that custodians be trained to place littered newspapers in paper recycling bins and that paper recycling bins are placed in convenient locations within classroom and recreational facilities.

Stacks and bags of white office paper were found in the refuse from Student Activities Building (SAB) and Mason/Angell/Haven/Tisch Halls. While it is possible that this paper was purposefully placed in the refuse by office occupants and students, it is also possible that the paper was placed in the refuse by custodians co-collecting paper and refuse from offices. It is recommended that custodians be provided with the equipment necessary to collect these waste streams at the same time while keeping them separated. It is further recommended that recycling bin audits be conducted in administrative and classroom buildings to ensure that paper recycling bins are placed in convenient areas.

**Figure 2: A Stack of White Office Paper Found in a Bag of Refuse from SAB**



Piles of mixed paper were also found in the refuse from Mason/Angell/Haven/Tisch Hall. These piles looked as if they were flyers removed from the posting board in Mason Hall. It is recommended that paper recycling bins be located near the posting board so that these flyers can easily be recycled once removed.

**Figure 3: Mixed Paper Found in a Bag of Refuse From Angell/Mason/Haven/Tisch Halls**



#### *Compostable Materials*

All sorted refuse contained materials acceptable in the UM Food Waste Composting Program. Two of the buildings sorted, Markley and Pierpont Commons, are current participants in this program. While it is not practical at this point to include the classroom, administrative and recreational buildings in this program, it is recommended that the program be expanded to all Residence Halls and Unions. This recommendation is currently being pursued and a method to do so is being investigated. It is further recommended that Markley and Pierpont expand their participation in the program as they had 232.5 lbs and 181 lbs, respectively, of compostable food waste in their refuse.

While the fraction of the refuse that was compostable within UM's current program was between 1.3% and 14.3%, the amount of *potentially* compostable items was much higher. Potentially compostable materials include the non-compostable organic waste and non-recyclable paper categories, in addition to the compostable organic category. Items that fall within these

categories are all compostable using a variety of composting technologies. Tables 3 and 4 show the percentage of refuse that falls within this category. Most impressive is LSI, which boasts a large amount of compostable animal bedding.

*Purchasing Practices*

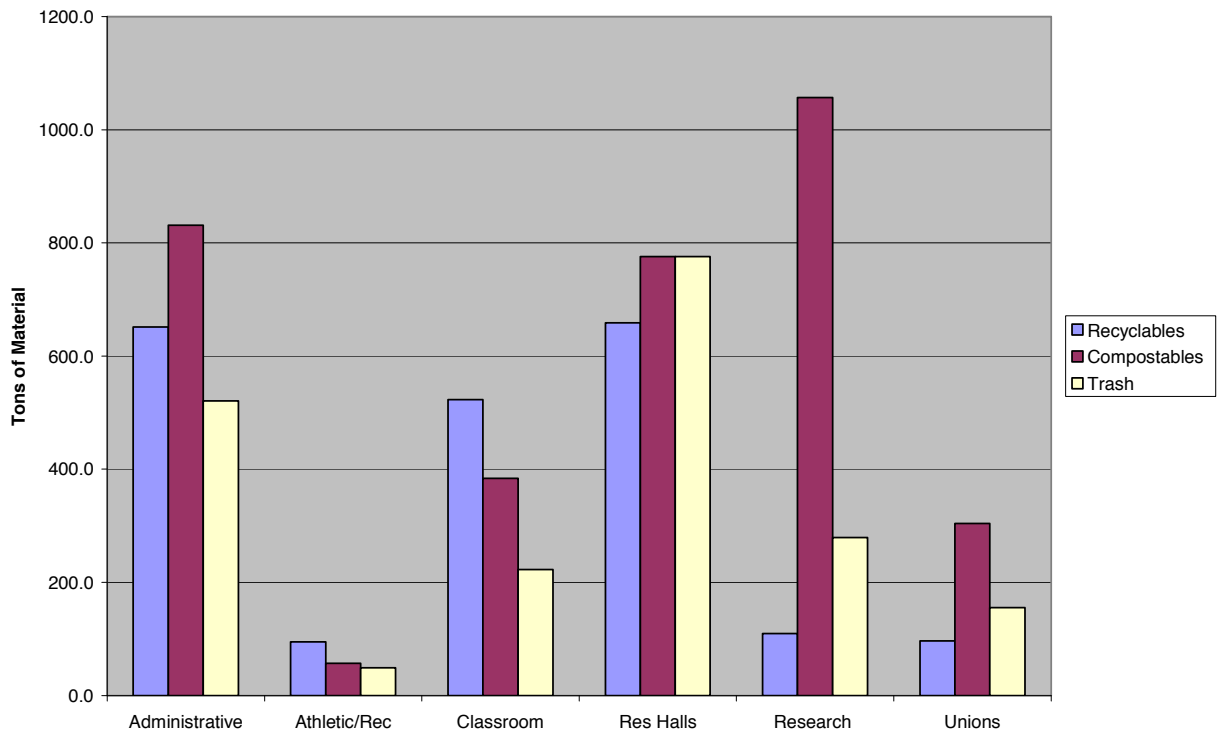
Refuse from SAB was comparably high in single-serve disposal items relative to the other buildings. These disposable items include single-serve coffee creamers and disposable cups. It is recommended that administrative buildings purchase “convenience” items in bulk rather than in single-serve quantities. This includes coffee creamers, instant beverages (e.g. hot cocoa) and sugar. It is further suggested that the University endorse the use of reusable mugs in break rooms over purchasing disposables for employee use. While there will be a higher initial upfront cost associated with the mugs, savings will be achieved in the long run in terms of avoided expense of purchasing disposables and refuse tip fees. Additionally, arguments exist against the use of reusable mugs since water is needed to clean them. By using a high-efficiency dishwasher or minimizing water used through hand-washing (e.g. turning off the tap while soaping the mug), environmental effects can be minimized. Additionally, it is important to note that water is also required for the manufacturing of disposable paper cups.

*Implications for the University of Michigan*

After applying the waste-type percentages to the FY 2006 refuse totals, by building and divided by building category, we can estimate the large fraction of UM’s refuse which is divertible.

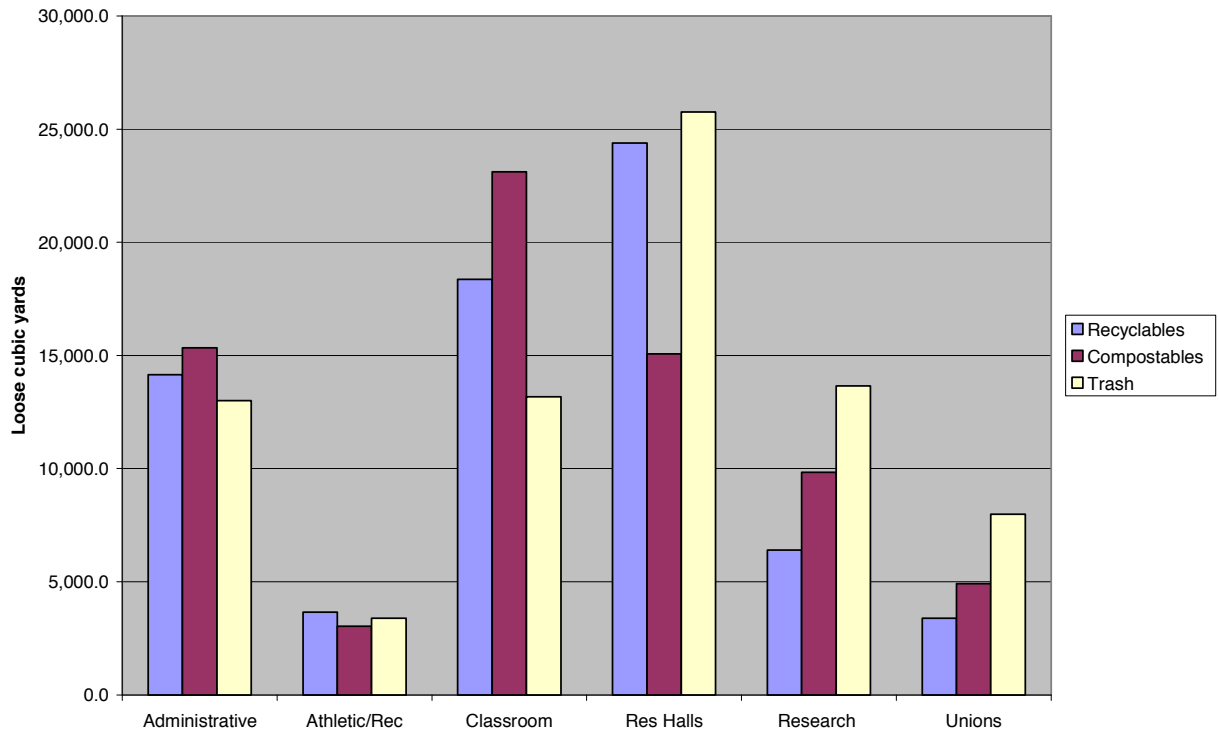
**Table 7**

**Projected Waste Totals Per Year by Weight for the University of Michigan by Building Type**



**Table 8**

**Projected Waste Totals Per Year by Volume for the University of Michigan by Building Type**



Based upon these projections, the University of Michigan could recycle approximately 2,100 additional tons of material each year. More impressively, by expanding composting technologies present on campus, approximately 3,400 tons of material each year could also be diverted from the landfill. UM's waste footprint can be significantly reduced through additional recycling education and outreach and through investment in new composting technologies. These technologies include in-vessel composting and anaerobic digestion, which generates methane in addition to compost. It is recommended that UM investigate available composting technologies including anaerobic digestion in order to decrease the amount of refuse being landfilled, increase the amount of compost available on campus and potentially generate biogas as a source of energy.

### **Conclusions**

Data gathered from this series of waste sorts has provided a great deal of insight into the current recycling program and justified the initial reasons for conducting such sorts.

- (1) Determine the amount of recyclables being lost to refuse: It is now estimated that 28.3% of refuse coming from UM's Ann Arbor campus, by weight, is recyclable.
- (2) Identify recyclable materials commonly found in the refuse in order to develop more targeted educational campaigns: While all types of recyclable materials were found in the refuse, the most prevalent were non-deposit beverage containers. A FY 2008 educational campaign targeting these materials is planned to address this.

(3) Determine the amount of organic waste present in the refuse as a feedstock for a possible anaerobic digester project: It is now estimated that 45.2% of refuse coming from UM's Ann Arbor campus, by weight, is potentially compostable. This figure seems to encourage discussion about alternative composting technologies, including anaerobic digestion, which can remove this fraction from UM's refuse stream.