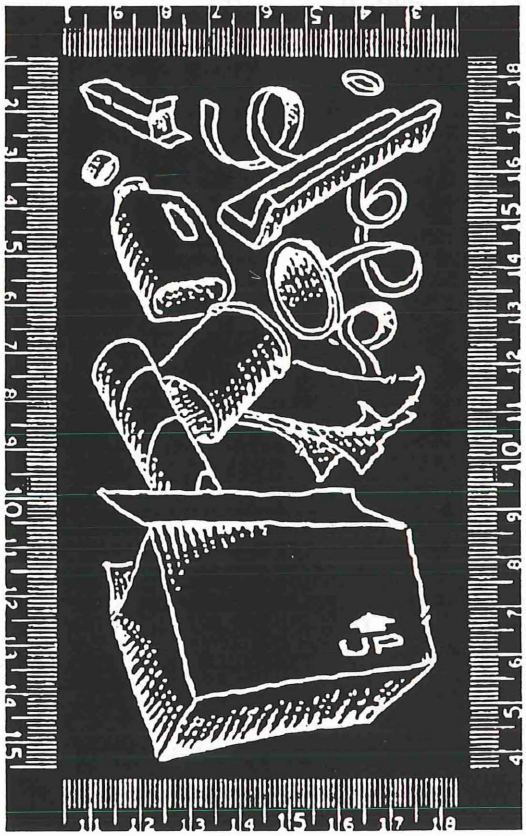
This document is made available electronically by the Minnesota Legislative Reference Library as part of an ongoing digital archiving project. http://www.leg.state.mn.us/lrl/lrl.asp

940459

Report on

Packaging Discards



July 1994

Minnesota Office of Environmental Assistance

Pursuant to 1992 Minn. Laws Chap. 593
Art. 1, Sec. 13

Pursuant to Minn. Stat. 115A.5501
Subd. 4

Executive Summary

In 1992, the Minnesota Legislature enacted a goal calling for a 25 percent reduction in packaging delivered to mixed municipal solid waste management facilities from 1992 to December 31, 1995. [Minn. Stat. § 115A.5501.] Because it is a disposal abatement goal, it can be met through any or all of the methods of reduction, reuse and recycling. The statute does not establish any consequences if the goal is not reached.

The statute originally assigned measurement and analytical duties to the Minnesota Pollution Control Agency (MPCA) and the Metropolitan Council, and compilation and reporting to the Office of Waste Management (OWM). During the 1994 legislative session all duties were transferred to the newly established Office of Environmental Assistance (OEA).

Because only 1992 and 1995 are essential years for determining whether the goal is met, this report is designed to keep the Legislature informed, to document reporting methods, and to serve as a cross check on the 1992 information. This document provides the Legislature with its second annual report on the packaging goal. The following is a summary of key findings in this report:

■ As reported in last year's report, the MPCA and Metropolitan Council conducted mixed municipal solid waste (MSW) composition sorts throughout the state from 1990 to 1992. These are known as the "SCORE sorts." The SCORE sorts, although not designed to specifically measure packaging, were used in 1993 by the MPCA and OWM to estimate the amount of packaging in discarded MSW and develop a 1992 packaging discard baseline against which to measure progress toward the 1995 goal.

■ The MPCA did not conduct any waste composition studies in 1993. However, the Metropolitan Council in 1993 hired R. W. Beck and Associates (Beck) to conduct packaging composition sorts at the Brooklyn Park transfer station (BPTS) in Hennepin County seasonally for the years 1993 through 1995. The BPTS was one of the original SCORE sort locations.

Beck conducted four sorts at the BPTS in 1993. These sorts were conducted on the following dates:

Winter Sort:	March 29-April 2
Spring Sort:	May 24-May 28
Summer Sort:	Aug. 23-Aug. 27
Fall Sort:	Nov.8-Nov. 12

Though three different types of waste loads reach the BPTS -- commercial, residential, and mixed -- only commercial and residential types were used in determining the actual packaging composition.

■ Beck had to deviate from the SCORE sort data categories, using 28 packaging categories rather than the 31 solid waste categories used for the SCORE sorts.

■ For commercial waste managed at the BPTS, the total packaging composition for 1993 was 33.9 percent, compared to 34.1 percent in the 1992 base data. Taking into consideration the fact that this data was collected only at the BPTS, as well as the conversions from the SCORE data, more sorts will be needed

RECEIVED
SEP 2 3 1994
LEGISLATIVE REFERENCE LIBRARY
STATE CAPITOL
ST. PAUL, MN 55155

to determine if any significant packaging reduction is actually occurring in the commercial sector.

■ For residential waste generators, a five percent reduction was seen in packaging composition at the BPTS compared to the 1992 data. For 1993, Beck reported residential packaging composition to be 20.7 percent. The 1992 data showed a 25.7 percent residential packaging composition ratio. Similar to the commercial packaging waste data, more sorts will be necessary to determine if an actual reduction is taking place in the residential sector.

■ The 1994 Legislature transferred statutory responsibility for measurement of packaging composition in Greater Minnesota from the MPCA to the OEA. In addition, the 1994 Legislature transferred the Metropolitan Council's solid and hazardous waste responsibilities to the OEA. The net effect of these decisions has consolidated all packaging measurement responsibilities with the OEA.

■ The OEA plans to contract for several packaging composition sorts throughout the state between fall 1994 and the end of 1995. The location of fall 1994 sorts will likely include: the BPTS, a metro area landfill, a Greater Minnesota landfill, a Greater Minnesota transfer station, and a waste-to-energy facility located in Greater Minnesota.

■ For 1995, the OEA plans to contract for two packaging composition sorts done at the same locations as the 1994 fall sorts. These will be conducted in the spring and fall. In addition to these sorts, two sorts are planned at demolition/construction waste landfills -- one metro and one in Greater Minnesota -- because the 1994 Legislature amended the types of facilities to be measured to include waste sent to such facilities.

■ The OEA will seek to have composition studies conducted at as many of the original SCORE solid waste composition study sites as possible. The OEA estimates that the additional sorts will cost approximately $150,000. The funds will come from the OEA's Fiscal Year 1995 budget.

■ The 1994 Legislature also required the OEA to, in this report, discuss the reliability of the data collected and the methodology used to determine the margin of error for the data.

■ There are two key data reliability problems to address: 1) the differences between the broad solid waste categories used for the SCORE composition sorts and the specific packaging categories used for the BPTS and all future sorts, and 2) the addition of demolition/construction facilities to the list of facilities analyzed in measuring progress toward the 1995 packaging abatement goal.

■ The OEA believes the best solution to the sorting categories problem is to continue using 1992 as the base year, but to acknowledge that the 1992 data is not as reliable as the packaging-specific sorts.

■ The OEA believes the best approach to the addition of demolition/construction facilities to the types of facilities to be analyzed is to conduct packaging composition sorts at two demolition/construction facilities in 1995 and report the data in the 1996 packaging report. However, the data should not be used in measuring whether the goal is met because such facilities were not included in the 1992 baseline data.

■ The determination of a margin of error is important because, under the statute, the margin of error is to be applied toward meeting the goal in 1995. At a 90 percent confidence level, the margin of error for the 1992 base data is extremely wide. The methodology used for the 1992 base data was a standard statistical calculation. In 1993, Beck used a specially-designed computer program to calculate margins of error (also known as confidence intervals) at the 90 percent level while the sorts where conducted. The interval for the commercial sector was 25.1 percent to 44 percent packaging. The interval for residential waste was 14.6 to 27.9 percent packaging.

■ Because the margin of error is fairly wide for the 1993 data, and is extremely wide for the 1992 base in particular, one option would be to eliminate the statutory language that requires the margin of error to be applied in favor of meeting the goal. The mean (or average) of all composition sorts would then become the sole measurement in determining whether the goal has been met.

■ The state continues to pursue several efforts to reduce the amount of packaging in the mixed municipal solid waste stream, including several efforts by the OEA and the establishment of a new packaging hierarchy by the 1994 Legislature. The Legislature should consider amending the hierarchy in 1995 to include post-consumer recycled content.

Original Legislative Goal

In 1992, the Minnesota Legislature enacted the following packaging reduction goal as part of its amendments to the Waste Management Act. [Minn. Statutes, chapter 115A].

> "It is the goal of the state that there be a minimum 25 percent statewide per capita reduction in the amount of discarded packaging delivered to solid waste composting, incineration, refuse derived fuel and disposal facilities by December 31, 1995, based on a reasonable estimate of the amount of packaging that was delivered to solid waste composting, incineration and disposal facilities in calendar year 1992." [Minn. Stat. § 115.5501, subd. 1.]

The goal was a component of earlier legislative proposals on packaging that attempted to set out a system of recovery targets, to be enforced with fees for items not meeting their targets.

Because the goal is directed at disposal abatement, it can be met through any or all of the methods of reduction, reuse and recycling. The statute sets no consequence if the goal is not reached in 1995.

For the purpose of promoting the goal to businesses and the public, the Office of Waste Management (OWM) labeled this initiative the "25 by 95" goal.

Measurement and reporting duties were assigned to the Minnesota Pollution Control Agency (MPCA), the OWM and the Metropolitan Council. These agencies were to compare packaging discards per person in the years 1992 and 1995, in order to determine whether the quantity of packaging in mixed solid waste dropped by at least one-quarter during that period. They also were to carry out studies and reports for the interim years of 1993 and 1994.

Only 1992 and 1995 are essential years for determining whether the goal is met. This report, which relates to the figures from 1993 and next year's report analyzing the 1994 data, should be regarded as chiefly for keeping the Legislature informed on reporting methods, and serving as a cross-check on the 1992 and 1995 information.

1994 Statutory Changes

As a result of the 1994 legislative session, Minn. Stat. § 115A.5501 was substantially amended to:

- Consolidate all responsibility for measurement of the packaging goal with the new Office of Environmental Assistance (OEA). [Chapter 639, art. 5, sec. 2(b) and Chapter 632, art. 1, sec. 30.]

■ Add demolition/construction waste facilities to the types of facilities that must be measured in determining packaging abatement progress. [Chapter 585, sec. 10.]

■ Require the OEA, in its 1994 packaging report to the Legislative Commission on Waste Management, to discuss the reliability of data gathered and the methodology used to determine a statistically reliable margin of error in measuring the goal. [Chapter 585, sec. 7.]

■ Require the OEA to, in 1996, recommend appropriate goals for further reducing discarded packaging if the 1995 goal is met. [Chapter 585, sec. 9.]

Review of 1992 Base Year Figures

The MPCA and Metropolitan Council conducted solid waste composition studies throughout Minnesota from 1990 through 1992. These were part of a research effort dating to the 1989 SCORE (Select Committee on Recycling and the Environment) legislation. [1989 Minnesota Laws, First Special Session, Chapter 1, art. 22, sec. 3.] The methodology and waste categories were designed according to the Legislature's chief interests, which specifically mentioned recyclables and noncombustibles. There was no mention of packaging as a particular focus of the study. The legislation required that final results of the study be presented by November 1, 1992.

To distinguish subsequent sorts specifically intended to determine packaging composition, this report labels the original, statewide set of sorting studies authorized in 1989 as the "SCORE waste composition sorts." Waste composition studies directed at packaging will be called "packaging composition" sorts.

All sorts done through 1992 by the MPCA and Metropolitan Council were based on SCORE requirements and the need for consistency in measurements. In 1993, the OWM, MPCA and Metropolitan Council agreed to have the MPCA estimate the packaging component within each of the 31 SCORE-based sorting categories and add those figures to produce a total estimate of packaging for 1992, the base year.

In its 1993 "Report on Packaging Discards," the OWM reported that in 1992 packaging represented 35 percent of total waste deposited into the mixed municipal solid waste stream. [See Table 1.] This totaled approximately 427 pounds per person. Because this estimate was based upon 1991 census figures for population, and 1992 census data is now available, the revised estimate of per-capita packaging discards using 1992 population data is 416 pounds per person.

1993 Packaging Composition sorts

The Metropolitan Council hired R.W. Beck and Associates, of Denver, Colorado, at a cost of $150,000 to conduct a packaging sort in the Twin Cities metropolitan area for the period 1993 through 1995. In cooperation with the MPCA and OWM, the Council decided to have four week-long seasonal sorts conducted at the Brooklyn Park Transfer Station (BPTS) in Hennepin County. The BPTS was one of the 1992 SCORE waste composition sort sites.

This was the only "packaging composition" study conducted in 1993. The MPCA did not perform any waste sorts during 1993.

Beck conducted four packaging composition sorts at the BPTS on the following dates in 1993:

Winter Sort:	March 29 - April 2
Spring Sort:	May 24 - May 28
Summer Sort:	Aug. 23 - Aug. 27
Fall Sort:	Nov. 8 - Nov. 12

Beck followed the same sampling plan and protocol for the "packaging composition" sorts as those used by the MPCA and Metropolitan Council in obtaining the 1992 baseline data. The fundamental difference between the two methods is the solid waste category list used in conducting the sort.

For each sample, the waste was sorted into 28 packaging categories and an "other" category (all waste which was not packaging) and the weights for each sample were entered on specially prepared data sheets. After each sort, the data was entered, by generator type, into a computer spreadsheet program. This program, which was specially designed for solid waste composition work, computes arithmetic means and upper and lower confidence intervals for each of the packaging materials in the study.

Three types of waste loads arrive at the BPTS: commercial, residential, and mixed. Since the "mixed waste" samples are few for each season and are not meaningful within the context of this analysis, the mixed waste results will not be reviewed in this report; instead the focus will be on the "commercial" and "residential" waste samples that were analyzed. [Packaging Composition Study For the Metropolitan Council Of The Twin Cities Area; Solid Waste Composition Results For 1993. R. W. Beck and Associates. June 1994. Attached.]

In Minnesota, between 55 and 60 percent of municipal solid waste generated comes from commercial sources, while between 40 and 45 percent is derived from residential sources.

The classification of mixed municipal solid waste in the 1993 sorts consisted of the following broad packaging categories for both commercial and residential sources: paper, plastic, glass, metals, household hazardous waste packaging, and other packaging.

1993 Commercial Sort Results

The 1993 packaging composition percentages for commercial generators were extremely close to those estimated for 1992. In 1992 total packaging composition for commercial generator types was 34.1 percent; whereas in 1993 the percentage was 33.9 percent. However, the percentages of certain categories were significantly different from those in 1992. For example, total paper percentage for 1993, 19.4 percent, was much higher than the 13.4 percent estimated in the 1992 base year. More specifically, corrugated paper was 3 percent higher in 1993 than 1992. [See Figure 1 for the 1993 composition of commercial packaging at BPTS.]

Overall, the seasonal commercial composition showed little variation except for the summer sort results. This data showed a packaging composition of 28 percent, compared to 36 to 38.5 percent for the other three sorts. The variation of the packaging results in the summer season from the data in the other seasons is probably a natural occurrence due to seasonal differences in commercial waste characteristics.

1993 Residential Sort Results

The 1993 residential packaging composition result of 20.7 percent was significantly lower than the 1992 base of 25.7 percent. In addition, the 1993 residential packaging composition results from season to season were more consistent than the commercial stream, ranging between 19.7 percent in summer and 21.6 percent in winter and fall. [See Figure 2 for the 1993 composition of residential packaging at BPTS.]

Packaging Composition Sorts in 1994 and 1995

Beck has already completed two sorts this year at the BPTS. Two more sorts are scheduled at the BPTS in 1994. Because the only data for measuring progress toward the 1995 packaging abatement goal has been the BPTS sorts, the OEA is planning to contract for more sorts at several different locations throughout the state from fall 1994 through fall 1995. Current OEA plans include adding a fall sort at a landfill in the Twin Cities metro area, and fall sorts at three locations in Greater Minnesota, including a landfill, a transfer station, and a waste-to-energy facility. The OEA will attempt to select locations that were previously used in obtaining the original SCORE waste composition data.

For 1995, the OEA plans to contract for packaging sorts at the following locations:

- Two sorts each (spring and fall) at the BPTS and at the same metro area landfill chosen for the fall 1994 sort.

- Two sorts each (spring and fall) at the same three Greater Minnesota locations selected for the fall 1994 sorts.

- In addition, the OEA will contract for sorts at two demolition/construction landfills in 1995 -- one in the metro area and one in Greater Minnesota -- because the 1994 Legislature added these types of facilities to those that must be measured in determining whether the packaging abatement goal is met.

The OEA estimates the cost of these additional sorts to be $150,000. The funds will come from the OEA's Fiscal Year 1995 budget.

Data reliability and methodology to determine a statistically reliable margin of error

As requested by the 1994 Legislature, this section discusses the reliability of the data that has been collected and the methodology used to determine a statistically reliable margin of error.

Reliability of Data

Currently, only two sets of data exist to measure progress in meeting the 1995 packaging abatement goal: 1) the estimates derived from the 1990-92 SCORE solid waste composition sorts that serve as the 1992 baseline, and 2) the 1993 packaging composition sorts conducted by Beck at BPTS.

The most significant data reliability problem surrounds the fact that the 1992 baseline data against which the goal is to be measured was derived from waste composition studies that were not specifically designed to measure the amount of packaging in municipal solid waste. Meanwhile, the 1993 BPTS data, as well as the additional planned sorts, focus on packaging.

Although the sampling plan and protocol used in collecting the 1993 data were essentially the same as those used in developing the 1992 data, the key difference was the solid waste category list. The 1992 data was derived from sorts using 31 different categories of municipal solid waste. These categories included all major waste materials in the stream. Only a few of these categories, such as aluminum cans and ferrous food cans, could be specifically considered packaging waste.

In contrast, in conducting the 1993 BPTS sorts Beck used 28 packaging categories and one "non-packaging" category in sorting the waste.

As long as 1992 continues to be the base year, this problem will continue to exist. One potential solution to improve data reliability would be to establish 1993 as the new base year, using the BPTS data to establish the new baseline. The 1995 goal could then be extended to December 31, 1996. A problem with this approach, however, is that the BPTS data does not reflect potential differences in packaging composition in Greater Minnesota. Thus, the 1993 BPTS would be difficult to use as a base against which to measure statewide progress toward meeting the goal.

The OEA believes the best approach is to continue using the 1992 estimates as the baseline. In doing so, it must be acknowledged that the baseline was derived from broad municipal solid waste composition sorts, unlike all subsequent packaging-specific sorts.

However, the 1993 BPTS data -- when considered independently of the aforementioned problems -- appears quite reliable and presents a good basis upon which to conduct future packaging composition sorts. Consistent sampling procedures and methodologies were used, and the same procedures and protocol will continue to be used in future packaging composition sorts. As additional sorts are completed data reliability should improve.

The OEA has not attempted to calculate a statewide per capita packaging amount for 1993. This is because a statewide percentage based upon sorts at one metro area location would be unreliable. In its 1995 report, the OEA will have the benefit of one season of statewide packaging sorts with which to calculate a statewide per capita amount for 1994.

Addition of Demolition/Construction Facilities

Another problem with data reliability is presented with the addition of demolition/construction facilities to the list of waste management facilities that must be analyzed in determining progress on meeting the 1995 goal.

The 1992 baseline data did not involve sorts at demolition/construction facilities. However, the SCORE waste composition sort data showed demolition/construction waste as 2.9 percent of discarded MSW. The OWM and MPCA, in turn, estimated that none of the demolition/construction waste disposed of at MSW facilities was packaging. Thus, the 1992 packaging abatement base does not set any demolition/construction facility standards against which to measure packaging

abatement progress at such facilities. Furthermore, Beck's 1993 and 1994 sorts will not address demolition/construction facility waste, meaning their will be no sorts at such facilities until 1995.

The only information available on this subject is contained in the MPCA's "Construction Debris and Nonhazardous Industrial Waste Report," dated August 9, 1993. In the report, the MPCA reviewed demolition/construction composition studies conducted in three states and the province of Ontario, and reported on a survey of 12 demolition landfills and processing facilities throughout Minnesota. The resulting estimate of waste composition at the 12 surveyed facilities did not include any estimates of packaging composition.

The OEA believes the best approach to this problem is gather packaging specific data at demolition/construction facilities in 1995, and report the results to the Legislature in the 1996 Packaging Discards Report. The 1996 report would present recommendations for further action, but defer from counting demolition/construction facilities in determining whether the 1995 abatement goal has been met.

Methodology Used to Determine Margin of Error

A discussion of the margin of error in the data is important because, under Minn. Stat. 115A.5501, subd. 4, in determining whether the 1995 goal has been met, the OEA must apply the margin of error in favor of meeting the goal.

In its report on the 1993 sorts to the Metropolitan Council (attached), Beck provided a discussion of the statistical principles used in analyzing solid waste composition. The report notes that the terms which are most commonly used are the "mean," the "confidence interval," and the related "level of confidence".

The mean is simply the mathematical average of the actual samples taken. For example, the previously reported BPTS figures of 33.9 percent packaging in the commercial stream and 20.7 percent packaging in the residential stream are the "mean" averages of the actual sorts.

"Confidence interval" is an expression of statistical accuracy and is another term for "margin of error." It provides the upper and lower limits of the true mean based on the sampled mean and variance of the observed sampled data. For example, a sample mean may be five percent, with a confidence interval of four to six percent. This implies that the true population mean is between four percent and six percent.

Given the limited sample size used in calculating the mean, it is also important to know the "level of confidence," which is an expression of certainty that the true mean falls within the stated confidence interval. For example, if the level of confidence is 90 percent, one is 90 percent certain that the true mean is within the stated confidence interval.

The term "90 percent confidence interval" combines the "confidence interval" and "level of confidence." Using the example above, this would indicate a 90 percent certainty that the true mean would fall within the four to six percent range. A 90 percent level of confidence has been accepted as the normal practice in solid waste composition studies.

As was discussed in the OWM's "1993 Report on Packaging Discards," the margin of error for the 1992 baseline data was very wide. For commercial waste, the per capita figure was between 50 and 1,106 pounds of packaging per year. For residential waste, the margin was between 203 and 798 pounds of packaging per year. Both of these margins were at a 90 percent confidence level. These margins were developed by the MPCA using Tukey's-T, a standard test of measurement consistency.

When Beck conducted the 1993 sorts at BPTS, the weights of each sample were entered on specially prepared data sheets, which were entered by generator type into a special computer program. The program was designed by Beck to compute arithmetic means and upper and lower confidence levels for each of the packaging materials. The program applies a "difference of means test" using the Student-t distribution. While this method is less sophisticated than the test used by the MPCA, it does conform to common practice in statistical analysis.

For the 1993 BPTS commercial waste stream the sample mean is 33.9 percent with a 90 percent confidence interval of 25.1 percent to 44.0 percent. For the 1993 BPTS residential waste stream the sample mean is 20.7 percent with a 90 percent confidence interval of 14.6 percent to 27.9 percent.

Based on the sample results and discussions wit the MPCA and Beck regarding the validity of their measurement protocol, the OEA believes both studies followed standard practices in the development of their measures and confidence intervals. Thus, the margins of error reported are statistically reliable within the limits of their respective research designs.

However, in light of the fact that the 1992 margins of error are so wide, and the 1993 "confidence intervals" range from 13 to 19 percent, the need to apply the margin of error in favor of meeting the 1995 goal presents a significant problem. One potential solution would be to eliminate the statutory language

that requires the margin of error to be applied in favor of meeting the goal, and rely upon the mean of all composition sorts as the sole measurement yardstick.

State Packaging Abatement efforts

OWM Efforts

Over the past two years, the OWM has undertaken several initiatives to abate the amount of packaging generated in Minnesota. These efforts include:

■ Completion in February 1994 of a "Reusable Transport Packaging Directory" that lists hundreds of suppliers of such reusable transport packaging as plastic boxes and pallets.

■ Continued implementation of the Saving Money and Reducing Trash (SMART) Shopping campaign that provides consumers information on how to purchase products with reduced packaging.

■ Participation with the Minnesota Chamber of Commerce in the development and implementation of the "Minnesota Waste Wise" program. The goal of this program is to increase waste prevention and recycling among every type and size of business in Minnesota. Currently Minnesota Waste Wise has enrolled 126 companies, with a goal of 1000.

■ Creation of the Minnesota Materials Exchange Alliance, which serves as a statewide umbrella organization and uses computerized listings to match companies that have waste materials with other companies that want to use those materials.

These and other efforts will be continued by the new OEA.

1994 Packaging Hierarchy

The 1994 Legislature established a hierarchy to guide the use of packaging in Minnesota. [Chapter 585, sec. 11.] The hierarchy declares that it is imperative to reduce the amount and toxicity that must be managed as solid waste and establishes a goal that items be distributed without any packaging where feasible. When packaging is necessary, the following categories are listed in order of preference:

1. Minimal packaging that contains no intentionally introduced toxic materials and is designed to be and actually is reused at least five times.

2. Minimal packaging that contains no intentionally introduced toxic materials, that is recyclable, and is regularly collected through recycling collection programs available to at least 75 percent of the residents of the state.

3. Minimal packaging that does not comply with numbers 1 and 2 above

because it is required under federal or state law and for which there does not exist a commercially feasible alternative that does comply with numbers 1 and 2 above.

4. Packaging that contains no intentionally introduced toxic materials but does not comply with numbers 1 through 3 above.

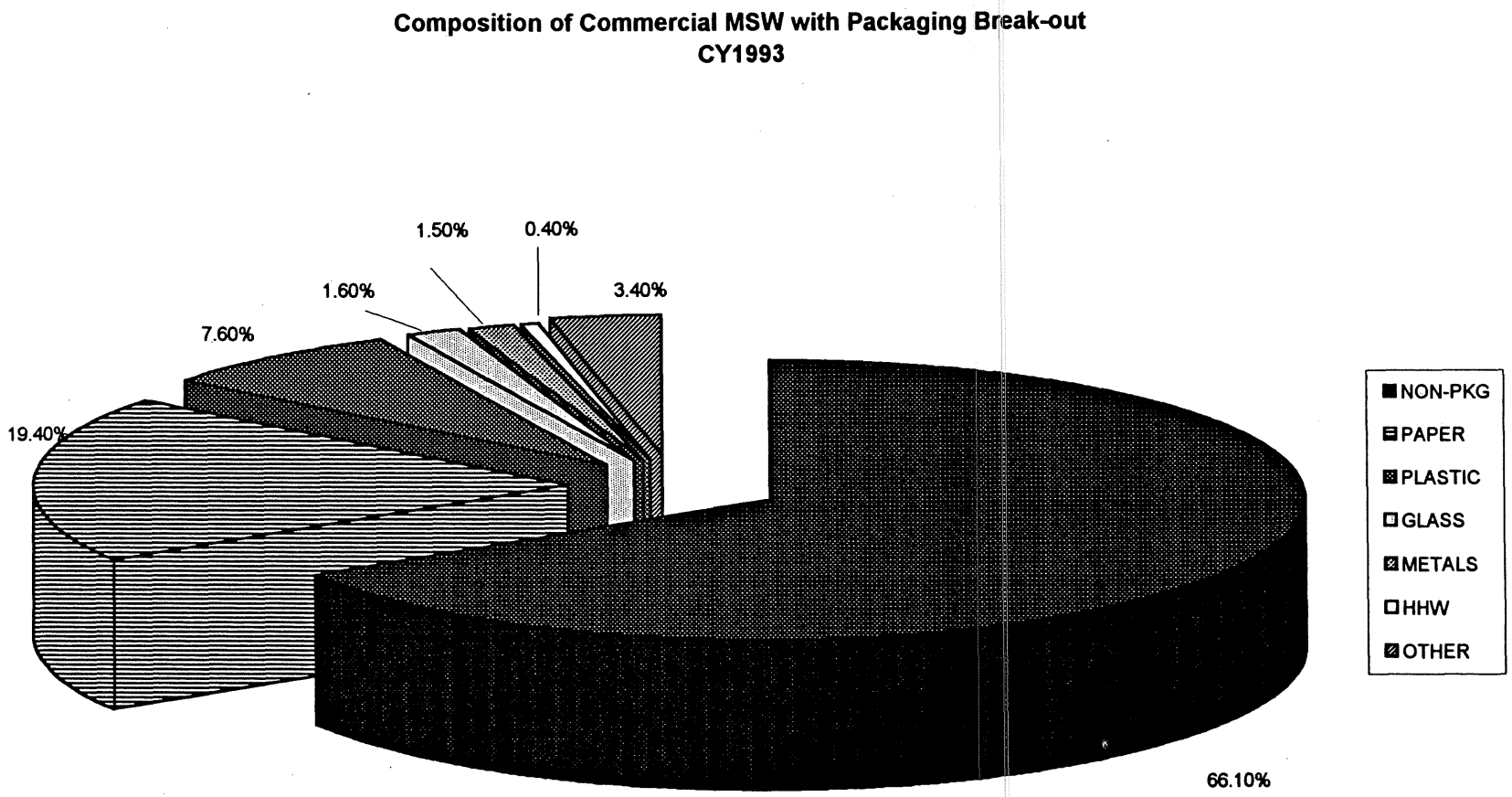
5. All other packaging.

The OEA believes the establishment in law of the packaging hierarchy provides an excellent guide that business, government, and consumers can look to in seeking to reduce packaging. The hierarchy could be improved, however, by adding a category that promotes packaging containing post consumer recycled materials as either the second or third preference in the hierarchy.

Table 1

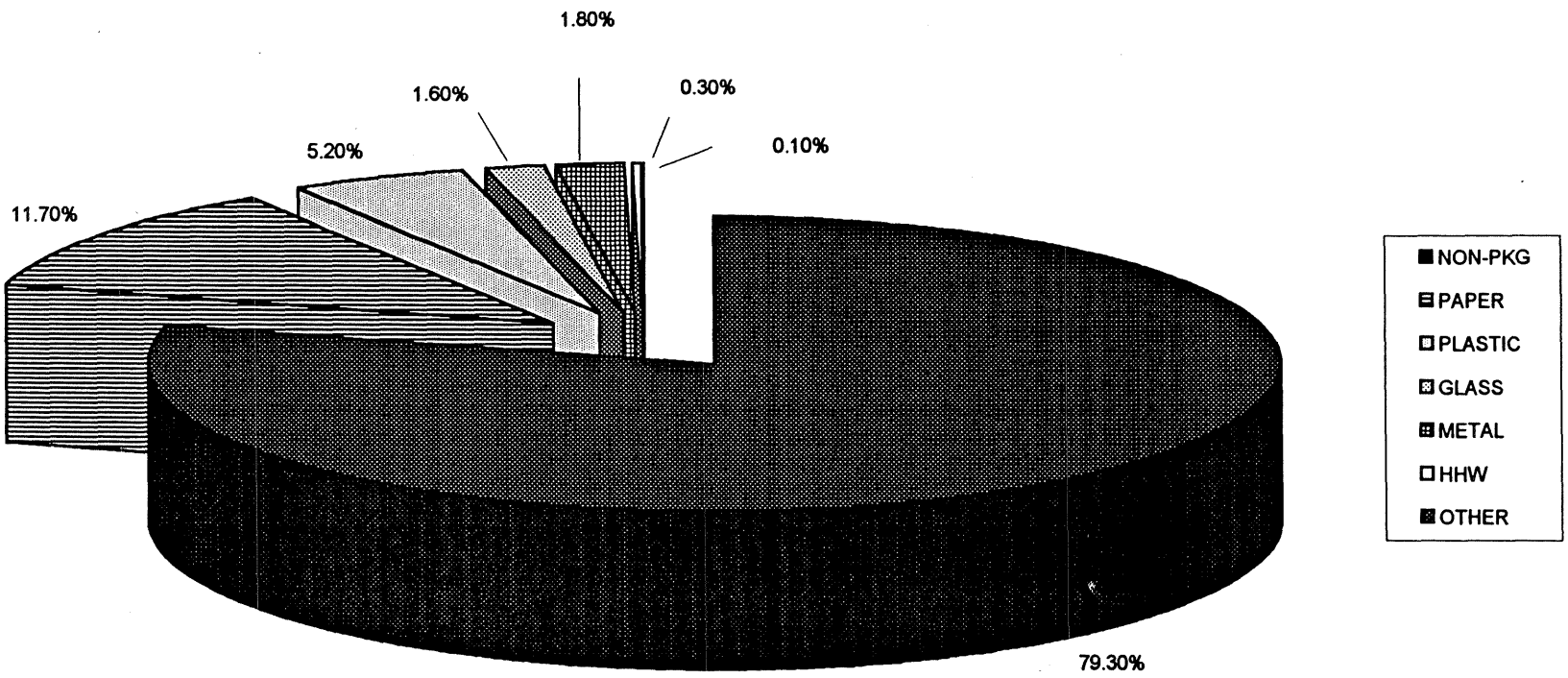
Estimate of Packaging Materials Entering Minnesota MSW Disposal Facilities, 1992				
			Estimated %	Estimated Tons
Waste Category	Percent by	MSW 1992	Packaging	Packaging
	Weight	(Tons)	by Weight	
Newsprint	4.0	107,246	0.0	0
High Grade Paper	4.4	117,971	0.0	0
Corrugated/Kraft	8.8	235,941	8.8	236,177
Magazines	2.9	77,753	0.0	0
Other Paper	20.0	536,230	10.0	268,383
HDPE	0.7	18,768	0.7	18,787
Plastic Film	4.7	126,014	4.0	107,353
PET	0.3	8,043	0.3	8,051
Polystyrene	1.1	29,493	1.1	29,522
Other Plastic	4.6	123,333	2.3	61,728
Aluminum Beverage Contai	0.5	13,406	0.5	13,419
Other Aluminum	0.4	10,725	0.0	0
Ferrous Food Cans	0.9	24,130	0.9	24,154
Other Ferrous	2.8	75,072	0.0	0
Other Non-Ferrous	0.5	13,406	0.0	0
Glass Food/Beverage Conta	2.0	53,623	2.0	53,677
Other Glass	1.1	29,493	0.0	0
Small Yard Waste	2.8	75,072	0.0	0
Large Yard Waste	0.1	2,681	0.0	0
Food Waste	13.3	356,593	0.0	0
Wood Waste	6.5	174,275	3.0	80,515
Tires	0.1	2,681	0.0	0
Diapers	2.4	64,348	0.0	0
Textiles	3.1	83,116	0.0	0
Other Organic Waste	3.7	99,203	1.0	26,838
Major Appliances	0.0	0	0.0	0
Small Appliances	0.8	21,449	0.0	0
Demolition/Construction	2.9	77,753	0.0	0
Hazardous Waste	0.8	21,449	0.4	10,735
Oil Filters	0.1	2,681	0.0	0
Other Inorganic Waste	3.8	101,884	0.0	0
Totals	100.1	2,683,833	35.0	939,342

FIGURE 1: PACKAGING COMPOSITION RESULTS FOR 1993 BPTS
COMMERCIAL GENERATION TYPE



MN OFFICE OF ENVIRONMENTAL ASSISTANCE

FIGURE 2: PACKAGING COMPOSITION RESULTS 1993 BPTS
RESIDENTIAL GENERATION TYPE



MN OFFICE OF ENVIRONMENTAL ASSISTANCE

Attachment 1

PACKAGING COMPOSITION STUDY FOR THE METROPOLITAN COUNCIL OF THE TWIN CITIES AREA SOLID WASTE COMPOSITION RESULTS FOR 1993

Pursuant to the agreement (the "Agreement") entered between R. W. Beck and Associates ("R. W. Beck") and the Metropolitan Council of the Twin Cities Area (the "Council") on December 9, 1993, R. W. Beck conducted four packaging composition studies at the Brooklyn Park Transfer Station ("BPTS") in 1993. These studies were conducted on the following dates in 1993:

Winter Sort	March 29 - April 2;
Spring Sort	May 24 - May 28;
Summer Sort	August 23 - August 27;
Fall Sort	November 8 - November 12.

The sampling plan and sorting protocol used for each of these sorts are contained in the report entitled *Packaging Composition Study for the Metropolitan Council of the Twin Cities Area, May 1993* (the "May Report") prepared by R. W. Beck. In accordance with the Agreement, the sorting protocol used for each sort was consistent with the protocol used by the Minnesota Pollution Control Agency ("MPCA") in its State of Minnesota solid waste composition study (the "Statewide Study.") Since the R. W. Beck study mentioned immediately above uses 1992 Metropolitan Area solid waste composition data as a basis, the study is referred to in the remainder of this report as the "1992 Study."

Overall management for the 1993 sorts was provided by R. W. Beck personnel. On-site supervision was performed by R. W. Beck personnel and one of the sorting crew members. The lead member of the sorting crew, Michael Rogers, was the assistant supervisor at every sort with Bob Craggs from our Minneapolis office managing the overall sort. Although some of the crew members assisting Mr. Rogers were obtained through a temporary service, crew members formerly employed by the MPCA for its study were used to the extent possible. All crew members during the summer and fall sorts previously sorted for the MPCA. Each sort proceeded smoothly, and there were no injuries during the year.

1993 RESULTS

The number of samples for each season, by generator type, are enumerated in Table 1:

Table 1
Numbers of Samples by Season and Generator Type

Sampling Seasons	Generator Type			Totals
	Commercial	Residential	Mixed	
Winter	23	18	9	50
Spring	24	16	11	51
Summer	28	18	6	52
Fall	26	17	9	52
Annual Totals	101	69	35	205

For each sample, the waste was sorted into 28 packaging categories and an "other category (all waste which is not packaging)" and the weights for each sample were entered on specially prepared data sheets. After each sort, the data was entered, by generator type, into a Lotus spreadsheet program. This program, which was specially designed by R. W. Beck for solid waste composition work, computes arithmetic means and upper and lower confidence intervals for each of the packaging materials in the study.

Tables 2 and 3 show the results of the 1993 analyses for commercial waste and residential waste, respectively. Since the "mixed waste" samples are few for each season and are not meaningful within the context of this analysis, the mixed waste results are not shown in Tables 2 and 3. The residential and commercial results are shown for the four seasons of the sort during 1993 and also for the full year. Also shown in Tables 2 and 3 are the commercial and residential data for the year 1992. This 1992 data, which was taken directly from Table 10 in the 1992 Study, is based on the sampling information originally obtained by the MPCA in its Statewide Study.

Computer printouts showing the upper and lower confidence intervals for the 1993 commercial and residential sorts are shown in Attachment 1. Attachment 1 also includes the results of the mixed waste analyses, along with the residential and commercial waste analyses. As shown in Attachment 1, "90 percent confidence intervals" are computed for each arithmetic mean. The meaning of the 90 percent confidence interval is that there is a 90 percent level of confidence that the true mean (i.e., the mean which would be computed given an infinite number of samples) falls within the confidence interval shown. Another confidence interval may be computed. However,

the 90 percent confidence interval is the most commonly used level of confidence in the industry. The confidence interval is independent of the arithmetic mean. For a given arithmetic mean calculation, a number of confidence intervals may be computed, but the arithmetic mean will remain the same. A more detailed discussion of confidence intervals is contained in Attachment 2.

Some of the MPCA's 1992 Study data included standard deviation calculations and some only included mean calculations. The MPCA data did not include confidence interval calculations. For this reason, it was impractical to compare any statistical computations between the 1992 data and the 1993 data aside from arithmetic means.

The right hand column in the computer spreadsheets in Attachment 1 indicate zeros because the focus of this study is on percentages instead of tonnages.

Following is more discussion on the methodologies used in obtaining the 1992 and 1993 solid waste composition data.

Methodologies used in obtaining and analyzing the 1992 and 1993 Solid Waste Composition Data

As stated above, the sampling plan and protocol used in obtaining the 1993 data is contained in the May Report. And the sampling plan and protocol are essentially the same as those used by the MPCA in obtaining the 1992 data. The key difference between the methods used in obtaining the 1992 data and the 1993 data was the solid waste category list used in conducting the sampling. In the 1992 Study, the MPCA used 31 categories for sorting the waste. These categories included all major solid waste materials in the waste stream, such as newsprint, magazines, ferrous food cans, yard waste, electric appliances and the like. Only a few of these categories, such as aluminum cans and ferrous food cans could specifically be considered packaging wastes.

In order to make meaningful comparisons between the 1992 Study data and the packaging study data, it was necessary to convert the 1992 data into the 28 packaging categories and an "other" category as for the packaging data. This was accomplished, where possible, for waste categories such as aluminum cans and ferrous food cans by using the 1992 data directly. In most categories, however, such as for all paper packaging, most plastic packaging, all glass packaging, most metal packaging, some household hazardous waste packaging and wood packaging, R. W. Beck used data published in a number of solid waste composition studies to make the conversions. For example, the total "glass food/beverage containers" category in the 1992 study was segmented into "clear containers," "brown containers," and "green containers" using data from the other studies.

The studies used to make these conversions included:

- Solid Waste Characterization Study for Albuquerque, New Mexico, R. W. Beck and Associates, June 1992

- Waste Management Options Analysis, Submitted to Eau Claire County Solid Waste Management Committee, Gershman, Brickner & Bratton, Inc., March 26, 1990

- Statewide Resource Recovery Feasibility and Planning Study, Volume II Solid Waste Characterization Report, Missouri Environmental Improvement and Energy Resources Authority, December 1987

- Waste Composition Study for the Regional Municipality of Ottawa-Carleton, Stanley Industrial Consultants, Ltd., R. W. Beck and Associates, and DSM Environmental Services, November 1992

- Waste Stream Characterization Study, Presented to Solid Waste Department, Metropolitan Service District, Portland Oregon, Stearns, Conrad and Schmidt Consulting Engineers, Inc., December 1987

- Waste Characterization for San Antonio, Texas, Cal Recovery Systems, Inc., June 1990

- Characterization of Municipal Solid Waste in the United States 1992 Update, Final Report, prepared for the U. S. Environmental Protection Agency, by Franklin Associates, Ltd., July 1992

1993 Commercial Packaging Composition

As shown in Table 2, the total 1993 commercial packaging composition percentages were relatively consistent from one season to the next, with the exception of the summer season. During the winter, spring and fall seasons the total packaging composition remained within a relatively small range, from roughly 36 percent to 38.5 percent. But in the summer, the packaging composition percentage was only 28 percent. There is no apparent reason for the deviation of the summer numbers from the others.

A review of the confidence intervals for commercial materials for all seasons of the year revealed that the summer data was actually less variable than the data for the other three seasons (i.e., the confidence intervals for the summer season were narrower than for the other seasons). Also, there were more commercial samples for the 1993 summer season, which would help explain less variability within the summer results. Therefore, given that the summer data appears statistically reliable, the variation of the packaging results in the summer season from the data in the other seasons is probably a natural occurrence due directly to seasonal differences in commercial waste characteristics.

To attempt to explain the seasonal commercial waste differences discussed above, we reviewed the BPTS data in the Statewide Study. This review did not reveal any reasons why the summer percentages behaved as they did in 1993. In fact, the total

paper category in the MPCA data indicated a much higher percentage of paper instead of a smaller number which would be implied in the low packaging percentage for the 1993 summer data.

As we obtain additional results, in 1994 and 1995, we will attempt to further explain the summer deviation.

One objective of this study is to determine if there is a trend toward lower packaging percentages through the four seasons. A review of the seasonal total packaging percentages for the commercial waste did not indicate a trend. However, trends are more likely to be reflected upon examining the three year series of data, which will eventually result from this study.

Another matter of interest was the comparison between the 1993 data and the 1992 data. As shown in the first and last columns of Table 2, the total packaging percentages between 1993 and 1992 were virtually identical (33.9 percent for 1993 and 34.1 percent for 1992). However, examination of percentages in some specific categories for 1992 and 1993 revealed differences which were quite large. For example, the total paper percentage for 1993, 19.4 percent, was much higher than the 13.4 percent for 1992. One of the major contributing factors to this percentage difference in the paper category was corrugated paper, which was three percentage points higher in 1993 than in 1992. And another large difference was indicated in the wood packaging category, in which the results for 1992 were larger than those in 1993 by roughly three percentage points.

It is unclear to what extent the differences in results between 1992 and 1993 may be attributable to the differences in the ways the data were collected. Actual changes in packaging from one year to the next may be due to random variation. However, it can be expected that commercial data will show some variability from season to season and some from year to year. By its nature, commercial waste is quite non-homogeneous and will lead on occasions to a high level of variability. As more data are gathered in ensuing years, a clear trend in the data may develop.

1993 Residential Packaging Composition

The 1993 residential packaging composition results from season to season were remarkably consistent. As shown in Table 3, the total packaging percentages from season to season varied only slightly. Also, the results for total paper and total plastic varied only slightly from season to season.

There were some differences between seasonal results for total glass, metals, household hazardous waste and "other." However, the percentage compositions for these items were quite low and the variability in these items will not greatly affect the overall packaging composition.

Comparison of the 1993 residential results to the 1992 residential results by specific packaging category indicated that the percentages by category were quite similar, but the category percentages in the 1993 data were generally smaller than those for 1992.

For example, total paper for 1993 was 11.7 percent, whereas the total paper percentage for 1992 was 12.0 percent. And for the plastics category, the percentage for 1993 was 5.2 percent versus 6.1 percent for 1992. The cumulative result for total packaging was that the 1993 result, 20.7 percent was lower than the 1992 percentage, 25.7 percent, by a full five percentage points.

It is unclear if these differences are an indication of a reduction of packaging in the Twin Cities Metropolitan Area. As in the commercial data, the confidence intervals for some of the materials are relatively wide. As more data is gathered in years 1994 and 1995, a trend in the data may lead to a more definitive judgement as to trends in the residential composition.

Overall Conclusions

The overall results indicate consistent sampling procedures and methodology. Even though there is some variation from season to season in the commercial packaging data, the annual packaging percentage results for both residential and commercial generator types appear to reflect the actual composition of the waste during 1993.

The agreed upon approach to measuring the change in disposed packaging material was to use the 1992 study as a baseline for determining the Metropolitan area's progress toward the reduction goals. However, based on the differences in the methods used in gathering and analyzing the 1992 and 1993 data, the 1992 data may not be an appropriate means for comparison. The 1992 data may be useful to measure major changes in composition percentages, but the 1993 data may serve as better baseline data for categories in which large changes are not apparent. Yet, at the present time, we do not recommend changing the baseline so as to use 1993 instead of 1992 data. Following the gathering and analyzing of the 1994 data, we will revisit this issue.

Overall, using the 1992 data as the baseline, it appears that there may have been a change in packaging disposal patterns in the residential waste stream. Due to the wide confidence intervals in the 1993 commercial data, it is difficult to determine a trend in disposal for this specific generator type. Future year's data, along with the 1992 and 1993 data, will be evaluated in upcoming reports to determine whether a definite trend exists in solid waste composition packaging percentages for both the residential and commercial generator types.

PACKAGING COMPOSITION RES S FOR 1993
BROOKLYN PARK TRANSFER ... TION
Commercial Generation Type
(Mean Percentages)

Solid Waste Category	1992 Composition (1)	1993 Results (2) Winter	Spring	Summer	Fall	Annual Results
TOTAL PAPER	13.4%	21.0%	20.0%	16.8%	20.4%	19.4%
Uncoated Corrugated Boxes	7.4%	10.3%	11.4%	7.7%	12.5%	10.4%
Coated Corrugated Boxes	0.2%	3.3%	1.1%	0.3%	1.1%	1.4%
Uncoated Boxboard Containers	2.1%	3.2%	1.8%	4.9%	3.4%	3.4%
Coated Boxboard Containers	1.0%	1.6%	0.5%	0.9%	0.8%	0.9%
Other Paper Packaging	2.2%	1.8%	4.9%	2.9%	2.4%	3.0%
Envelopes	0.5%	0.8%	0.3%	0.2%	0.2%	0.4%
TOTAL PLASTIC PACKAGING	9.3%	8.1%	4.8%	6.9%	10.6%	7.6%
PET	0.2%	0.2%	0.2%	0.2%	0.1%	0.2%
HDPE	0.5%	0.5%	0.7%	0.9%	0.8%	0.7%
Polystyrene Containers	0.9%	0.5%	0.3%	0.7%	0.5%	0.5%
Polystyrene Packing	0.3%	0.4%	0.1%	0.0%	0.0%	0.1%
Plastic Pallet Wrap	0.5%	0.4%	0.2%	0.2%	0.3%	0.3%
Other Plastic Film	3.6%	3.9%	2.5%	3.6%	5.3%	3.9%
Other Plastic Packaging	3.3%	2.2%	0.9%	1.2%	3.6%	0.2%
TOTAL GLASS	1.5%	1.7%	1.6%	2.1%	1.1%	1.6%
Clear Containers	0.9%	1.2%	1.1%	1.7%	0.7%	1.2%
Brown (amber) Containers	0.3%	0.3%	0.4%	0.2%	0.1%	0.2%
Green Containers	0.3%	0.2%	0.2%	0.3%	0.3%	0.3%
TOTAL METALS	2.6%	1.9%	1.6%	1.2%	1.2%	1.5%
Aluminum Beverage Containers	0.5%	0.6%	0.4%	0.4%	0.3%	0.4%
Aluminum Foil	0.0%	0.1%	0.1%	0.1%	0.0%	0.1%
Other Aluminum Containers	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Steel Beverage Containers	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Ferrous Food Containers	0.6%	0.5%	0.4%	0.4%	0.3%	0.4%
Other Metal Packaging	1.1%	0.6%	0.8%	0.3%	0.5%	0.6%
TOTAL HOUSEHOLD HAZARDOUS WASTE	0.7%	0.6%	0.6%	0.1%	0.2%	0.4%
Full Non-Aerosol Containers	0.3%	0.4%	0.2%	0.0%	0.1%	0.2%
Empty Non-Aersol	0.3%	0.0%	0.3%	0.0%	0.0%	0.1%
Aerosol Containers Containing Household Hazardous Waste (3)	0.1%	0.0%	0.1%	0.0%	0.1%	0.1%
Aerosol Containers Not Containing Household Hazardous Waste (3)	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%
TOTAL OTHER	6.6%	5.0%	5.9%	1.0%	2.4%	3.4%
Wooden Pallets and Crates	3.3%	4.6%	5.8%	0.7%	1.9%	3.1%
Other Wooden Packaging	3.3%	0.4%	0.1%	0.3%	0.5%	0.3%
TOTAL PACKAGING	34.1%	38.4%	34.6%	28.0%	35.8%	33.9%
OTHER NON-PACKAGING	65.9%	61.6%	65.4%	72.0%	64.2%	66.1%
TOTALS	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

1) From Solid Wate Composition Study conducted at the BPTS by MPCA in 1992.
2) Sort results obtained in 1993 by R. W. Beck.
3) Weights may include contents as well as container weights; contents not removed to obtain net weights for safety reasons.

Table 3

PACKAGING COMPOSITION RESULTS FOR 1993
BROOKLYN PARK TRANSFER STATION
Residential Generation Type
(Mean Percentages)

Solid Waste Category	1992 Composition (1)	1993 Results (2) Winter	Spring	Summer	Fall	Annual Results
TOTAL PAPER	12.0%	12.9%	11.1%	11.0%	12.0%	11.7%
Uncoated Corrugated Boxes	6.0%	4.9%	3.8%	5.5%	6.2%	5.1%
Coated Corrugated Boxes	0.1%	0.4%	0.6%	0.1%	0.5%	0.4%
Uncoated Boxboard Containers	2.2%	3.1%	3.5%	3.7%	3.0%	3.3%
Coated Boxboard Containers	1.0%	2.0%	1.1%	0.7%	1.1%	1.2%
Other Paper Packaging	2.2%	1.5%	1.5%	1.0%	1.0%	1.2%
Envelopes	0.5%	0.9%	0.5%	0.2%	0.2%	0.4%
TOTAL PLASTIC PACKAGING	6.1%	5.1%	5.2%	5.2%	5.5%	5.2%
PET	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%
HDPE	0.7%	0.6%	0.6%	0.7%	0.6%	0.6%
Polystyrene Containers	0.6%	0.3%	0.5%	0.4%	0.6%	0.4%
Polystyrene Packing	0.2%	0.1%	0.1%	0.0%	0.1%	0.1%
Plastic Pallet Wrap	0.4%	0.3%	0.1%	0.1%	0.3%	0.2%
Other Plastic Film	2.9%	2.5%	2.6%	2.9%	2.8%	2.7%
Other Plastic Packaging	1.0%	1.2%	1.3%	0.8%	1.0%	1.1%
TOTAL GLASS	2.2%	1.6%	0.2%	1.7%	1.3%	1.6%
Clear Containers	1.5%	1.3%	1.5%	1.4%	1.0%	1.3%
Brown (amber) Containers	0.3%	0.1%	0.4%	0.2%	0.1%	0.2%
Green Containers	0.4%	0.2%	0.2%	0.1%	0.2%	0.2%
TOTAL METALS	3.1%	1.3%	1.3%	1.7%	2.8%	1.8%
Aluminum Beverage Containers	0.5%	0.4%	0.4%	0.3%	0.4%	0.4%
Aluminum Foil	0.0%	0.2%	0.1%	0.1%	0.1%	0.1%
Other Aluminum Containers	0.3%	0.0%	0.0%	0.1%	0.1%	0.1%
Steel Beverage Containers	0.1%	0.1%	0.0%	0.0%	0.8%	0.2%
Ferrous Food Containers	1.0%	0.5%	0.7%	0.4%	0.8%	0.6%
Other Metal Packaging	1.2%	0.1%	0.0%	0.8%	0.6%	0.4%
TOTAL HOUSEHOLD HAZARDOUS WASTE	0.7%	0.5%	0.4%	0.2%	0.1%	0.3%
Full Non–Aerosol Containers	0.3%	0.2%	0.0%	0.0%	0.0%	0.1%
Empty Non–Aersol	0.3%	0.2%	0.2%	0.0%	0.0%	0.1%
Aerosol Containers Containing Household Hazardous Waste (3)	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%
Aerosol Containers Not Containing Household Hazardous Waste (3)	0.0%	0.1%	0.2%	0.1%	0.1%	0.1%
TOTAL OTHER	1.6%	0.2%	0.0%	0.0%	0.0%	0.1%
Wooden Pallets and Crates	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
Other Wooden Packaging	0.8%	0.2%	0.0%	0.0%	0.0%	0.1%
TOTAL PACKAGING	25.7%	21.6%	20.0%	19.7%	21.6%	20.7%
OTHER NON–PACKAGING	74.3%	78.4%	80.0%	80.3%	78.6%	79.3%
TOTALS	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

) From Solid Wate Composition Study conducted at the BPTS by MPCA in 1992.
) Sort results obtained in 1993 by R. W. Beck.
) Weights may inclu ntents as well as container weights; contents not removed to obtain net weights fety reasons.

COMMERCIAL GENERATOR TYPE
1993 (FOUR SEASONS)

SUMMARY AREA – NO DATA INPUT REQUIRED
Waste Composition Analysis

Sample Size = 101 loads
Total Weight Sorted = 23,710 pounds
Average Weight Sorted per Sample = 235 pounds

City Name: BROOKLYN PARK
Generator Type: COMMERCIAL – 1993 (4 Seasons)

Waste Categories	Mean Percentage		90% Confidence Interval Lower	90% Confidence Interval Upper	Tons per Material		90% Confidence Interval (Tons) Lower	90% Confidence Interval (Tons) Upper
TOTAL PAPER	19.4%		14.7%	24.6%	0		0	0
Uncoated Corrugated Boxes		10.4%	7.5%	13.6%		0	0	0
Coated Corrugated Boxes		1.4%	1.0%	1.9%		0	0	0
Uncoated Boxboard Containers		3.4%	2.3%	4.7%		0	0	0
Coated Boxboard Containers		0.9%	0.7%	1.2%		0	0	0
Other Paper Packaging		3.0%	2.2%	3.9%		0	0	0
Envelopes		0.4%	0.3%	0.5%		0	0	0
Total Plastic Packaging	7.6%		5.4%	10.1%	0		0	0
PET		0.2%	0.1%	0.2%		0	0	0
HDPE		0.7%	0.5%	1.0%		0	0	0
Polystyrene Containers		0.5%	0.4%	0.7%		0	0	0
Polystyrene Packaging		0.1%	0.1%	0.2%		0	0	0
Plastic Pallet Wrap		0.3%	0.2%	0.3%		0	0	0
Other Plastic Film		3.9%	2.7%	5.3%		0	0	0
Other Plastic Packaging		2.0%	1.4%	2.6%		0	0	0
Total Glass	1.6%		1.2%	2.1%	0		0	0
Clear Containers		1.2%	0.8%	1.5%		0	0	0
Brown (amber)Containers		0.2%	0.1%	0.3%		0	0	0
Green Containers		0.3%	0.2%	0.4%		0	0	0
Total Metals	1.5%		1.1%	1.9%	0		0	0
Aluminum Beverage Containers		0.4%	0.3%	0.5%		0	0	0
Aluminum Foil		0.1%	0.0%	0.1%		0	0	0
Other Aluminum Containers		0.0%	0.0%	0.0%		0	0	0
Steel Beverage Containers		0.0%	0.0%	0.0%		0	0	0
Other Ferrous Food Containers		0.4%	0.3%	0.5%		0	0	0
Other Metal Packaging		0.6%	0.4%	0.7%		0	0	0
Household Hazardous Waste	0.4%		0.3%	0.5%	0		0	0
Full Non–Aerosol Containers		0.2%	0.1%	0.2%		0	0	0
Empty Non–Aerosol		0.1%	0.1%	0.1%		0	0	0
Aerosol Containers		0.1%	0.0%	0.1%		0	0	0
Containing Houseold Hazardous Waste								
Aerosol Containers		0.1%	0.0%	0.1%		0	0	0
Not Containing Houseold Hazardous Waste								
Total Other	3.4%		2.4%	4.7%	0		0	0
Wooden Pallets and Crates		3.1%	2.1%	4.3%		0	0	0
Other Wooden Packaging		0.3%	0.2%	0.4%		0	0	0
Total Packaging	33.9%		25.1%	44.0%				
Other Non–Packaging	66.1%		55.9%	75.5%	0		0	0
TOTALS	100.0%				0			

RESIDENTIAL GENERATOR TYPE
1993 (FOUR SEASONS)

SUMMARY AREA – NO DATA INPUT REQUIRED

Waste Composition Analysis

Sample Size = 69 loads

Total Weight Sorted = 15,396 pounds

Average Weight Sorted per Sample = 223 pounds

C ame: BROOKLYN PARK

Generator Type: RESIDENTIAL – 1993 (4 Seasons)

Waste Categories	Mean Percentage		90% Confidence Interval Lower	90% Confidence Interval Upper	Tons per Material		90% Confidence Interval (Tons) Lower	90% Confidence Interval (Tons) Upper
TOTAL PAPER	11.7%		8.3%	15.6%	0		0	0
Uncoated Corrugated Boxes		5.1%	3.6%	7.0%		0	0	0
Coated Corrugated Boxes		0.4%	0.2%	0.5%		0	0	0
Uncoated Boxboard Containers		3.3%	2.3%	4.6%		0	0	0
Coated Boxboard Containers		1.2%	0.9%	1.6%		0	0	0
Other Paper Packaging		1.2%	0.9%	1.6%		0	0	0
Envelopes		0.4%	0.3%	0.6%		0	0	0
Total Plastic Packaging	5.3%		3.7%	7.0%	0		0	0
PET		0.2%	0.1%	0.3%		0	0	0
HDPE		0.6%	0.4%	0.8%		0	0	0
Polystyrene Containers		0.4%	0.3%	0.6%		0	0	0
Polystyrene Packaging		0.1%	0.1%	0.1%		0	0	0
Plastic Pallet Wrap		0.2%	0.1%	0.2%		0	0	0
Other Plastic Film		2.7%	1.9%	3.6%		0	0	0
Other Plastic Packaging		1.1%	0.8%	1.4%		0	0	0
Total Glass	1.6%		1.1%	2.3%	0		0	0
Clear Containers		1.3%	0.9%	1.8%		0	0	0
Brown (amber)Containers		0.2%	0.1%	0.3%		0	0	0
Green Containers		0.2%	0.1%	0.2%		0	0	0
Total Metals	1.8%		1.2%	2.4%	0		0	0
Aluminum Beverage Containers		0.4%	0.3%	0.5%		0	0	0
Aluminum Foil		0.1%	0.1%	0.2%		0	0	0
Other Aluminum Containers		0.1%	0.0%	0.1%		0	0	0
Steel Beverage Containers		0.2%	0.1%	0.4%		0	0	0
Other Ferrous Food Containers		0.6%	0.4%	0.8%		0	0	0
Other Metal Packaging		0.4%	0.2%	0.5%		0	0	0
Household Hazardous Waste	0.3%		0.2%	0.4%	0		0	0
Full Non–Aerosol Containers		0.1%	0.0%	0.1%		0	0	0
Empty Non–Aerosol		0.1%	0.1%	0.1%		0	0	0
Aerosol Containers		0.0%	0.0%	0.0%		0	0	0
Containing Houseold Hazardous Waste								
Aerosol Containers		0.1%	0.1%	0.1%		0	0	0
Not Containing Houseold Hazardous Waste								
Total Other	0.1%		0.1%	0.1%	0		0	0
Wooden Pallets and Crates		0.0%	0.0%	0.0%		0	0	0
Other Wooden Packaging		0.1%	0.0%	0.1%		0	0	0
Total Packaging	20.7%		14.6%	27.9%				
C Non–Packaging	79.3%		64.6%	90.8%	0		0	0
TOTALS	100.0%				0			

Attachment 2

STATISTICAL PRINCIPLES

STATISTICAL PRINCIPLES FOR USE IN APPLYING THE SOLID WASTE COMPOSITION ANALYSES

Due to the variability of solid waste materials, estimates of solid waste composition are only approximate in nature. Similar to the methods used by statisticians in obtaining opinion polls, limited samples of solid waste must be used to describe the characteristics of the entire "population." It would be desirable to poll each individual in a country to determine exact numbers on views or opinions. But a representative sampling method must be used instead because of the very great expense in polling every person.

The same principle applies to solid waste composition. Since the entire quantity of solid waste being generated cannot be economically measured or characterized, representative samples must be obtained and these samples must be analyzed to estimate the composition of the entire waste stream.

Sampling methods for characterizing solid waste have evolved to a significant degree since the early 1970's. Now, we feel confident that we are using mathematically advanced, yet practical and economically viable techniques to characterize solid waste.

The terms which are most commonly used to characterize solid waste (and terms used in the solid waste composition analyses in Attachment 1), are the "mean," the "confidence interval" and the related "level of confidence". The mean is simply the mathematical average. The confidence interval and level of confidence require a bit more explanation.

The confidence interval is an expression of statistical accuracy. It provides the upper and lower limits of the "actual" mean based on the sampled mean and variance of the observed sampled data. For example, a sample mean for newspaper may be 5 percent for a certain generator, with a confidence interval of 4 percent to 6 percent. This implies that the true population mean for paper is between 4 percent and 6 percent.

Given the limited sample size used in calculating the mean, it is also important to know how much faith we have that the true mean does fall within the 4 percent to 6 percent range. The term used to quantify the amount of faith we have in the confidence interval is the "level of confidence," an expression of how certain we are that the true mean falls within the stated confidence interval. For example, if the level of confidence is 90 percent, we are 90 percent certain that the true mean is within the stated confidence interval. Combining the terms confidence interval and level of confidence, we use the phrase "90 percent confidence interval." Applying this term to

the previous example, we would be 90 percent certain that the true mean would fall within the 4 percent to 6 percent range.

We could calculate an 80 percent, or 95 percent, or any other level of confidence, but the 90 percent level of confidence has been accepted as the normal practice in solid waste composition studies. However, the level of confidence and confidence interval have an inverse relationship. For example, for an 80 percent level of confidence, the confidence interval will be smaller than if the level of confidence were 90 percent. And for a 95 percent level of confidence, the confidence interval will be wider than for a 90 percent level of confidence.

In general, the more samples that are sorted, the narrower the confidence interval becomes for a given level of confidence. Again using the example from above, let's assume that the 90 percent confidence intervals were originally calculated based on 25 samples. It may be that if we sort 40 samples instead, the 90 percent confidence interval would narrow to 4.5 percent to 5.5 percent, still with an associated mean of 5 percent. With more samples, we still have a 90 percent level of confidence, but the statistical accuracy is improving.