Office of Waste Reduction

Waste Reduction Programs for Commercial/Industrial Solid Waste

A Guide for Local Governments

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Waste Reduction Programs for Commerical/Industrial Solid Waste: A Guide for Local Governments

This manual was developed to assist local governments in the reduction of commercial and industrial wastes in their communities. Production of this manual is the responsibility of the Office of Waste Reduction (OWR) of the North Carolina Department of Environment, Health, and Natural Resources. OWR production staff for the manual was as follows:

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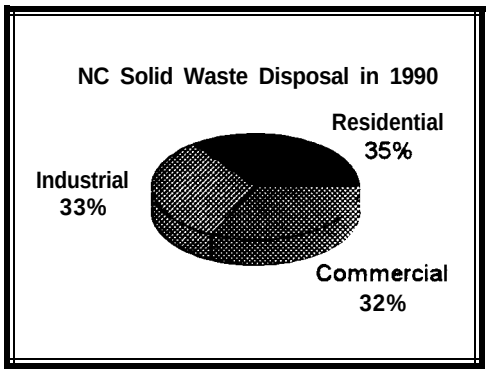
Introduction:
Focusing on Commercial/Industrial Solid Waste

Although waste from business and industry comprises 65 percent of the waste disposed in North Carolina, these sectors are often not targeted in local government solid waste reduction programs. This manual has been developed to help community recycling coordinators establish or expand programs that target commercial and industrial waste for reduction. It provides information that will help local governments work with the following kinds of businesses and institutions:

- **Offices**
- **Retailers/Wholesalers**
- **Hotels**
- **Service Industries**
- **Universities/Colleges**
- **Printers and Publishers**
- **Textile Mills**
- **Hospitals**
- **Restaurants**
- **Public/Private Schools**
- **Property Owners**
- **Manufacturing Industries**

The 1992 North Carolina Recycling and Solid Waste Management Plan (RSWMP) reported the following solid waste disposal rates for the residential, commercial, and industrial sectors in 1990:

Sector	Waste Disposed, tons
Commercial	2,505,267
Industrial	2,604,096
Residential	2,781,338
Total	7,890,701



Many businesses and industries have undertaken major recycling activities; in fact, the RSWMP estimated that in 1990 commercial and industrial sectors recycled approximately 1,562,000 tons of materials. However, even with this impressive rate of recycling, a high potential still exists for the commercial and industrial sector to reduce and recycle greater portions of their solid

waste streams. Business and industry were still discarding over 5 million tons during the 1990 reporting period.

This manual presents guidance for local government on promoting the reduction, reuse, and recycling of commercial/industrial materials currently disposed by landfilling or incineration. Included are tips on assessing commercial/industrial waste streams, descriptions and examples of programs and services local government can offer, directions for conducting on-site waste assessments, suggestions on how to make contacts with and present recycling options to business and industry, and specific guidance materials and case studies that can be distributed to commercial and industrial firms in the community.

Local governments have the potential to achieve substantial waste reduction through commercial and industrial waste programs.

Contents

Section 1.

C/I Solid Waste Streams

This section presents several approaches a local government can use to characterize its local commerical/industria1 (C/I) waste stream. A discussion of the types of general and process wastes prevalent in the C/I sectors includes a chart listing sector-specific reduction targets. Specific materials in the waste stream are identified, and common sources and other background information on these materials are presented as well as examples of waste generated by the textile industry.

Section I. Commerical/Industrial Solid Waste Streams

A. Determining Local C/I waste streams

One factor that makes each local solid waste situation unique is the nature of the local commercial and industrial (C/I) waste stream. Just as each local economy is different, so is each local waste stream. In some communities, commercial and industrial activity may be slight, and C/l waste may account for less than half of the wastes disposed. In other communities, C/I waste may dominate the waste stream, perhaps accounting for over 75 percent of the total wastes.

The first step in an effort to reduce C/l waste is to identify its specific components. In assessing the C/I waste stream, it is usually productive to move from the general to the specific. As the assessment progresses, the potential for C/l waste stream reduction, the waste reduction program options available, and the types of materials that can be targeted for recycling and waste reduction will become apparent.

Two of several approaches that a local government can use to characterize its C/I waste for the purposes of planning local waste reduction programs are discussed in this section. Whether these activities are performed by local government solid waste management staff or contracted out depends on the accuracy required, the resources available, and the size of the region in question.

Approaches for C/I Waste Stream Analysis

Approaches for determining the general nature of a community's C/l waste stream include:

- **Examining and characterizing the community's economy, and**
- **Examining the waste stream directly.**

Each approach yields critical information for program and policy decision-making. Information about the local economy helps determine program options and potential impact; direct examination of the waste stream provides additional information on specific materials to target.

Thus, a solid knowledge of both the local waste stream and the local economy provides the strongest foundation for a C/I waste reduction program.

Approach 1. Analyzing the Local Economy

An analysis of the local economy can be very general or very specific; at any rate, it should be based on the following questions:

- **The number and kinds of industry in the community.**
- **The number and kinds of businesses in the commercial sector.**
- **The location(s) of the businesses: are they concentrated in certain areas or scattered.**
- **Plans for business expansion or for bringing new businesses into the community.**

Local resources for information about the local economy would include the Chamber of Commerce, the Economic Development officers and commissions, and the Planning and Zoning Department.

To make best use of the information gathered, it should be organized into two documents:

- **A master list of businesses and industries arranged by category. Standard Industrial Classification (SIC) codes or more general groupings such as office, trade, and manufacturing can be used. The approximate number of employees (or size) in each businesses and industries also should be included.**
- **A map of business and industrial locations and districts.**

Approach 2: Analyzing the Local Waste Stream

Assessment of the C/I waste stream requires the following steps:

(1) Examining the county's or municipality's waste stream as a whole,
(2) Determining the portion that is generated by the C/I sectors, and
(3) Characterizing the specific components of the C/I waste stream.

These steps require the following procedures:

Step 1. Examine Records

Examine landfill tonnage records for the waste stream as a whole. Break down the total tonnage into the following categories:

Category	Tons/year	Percent of waste stream
Residential	?	?
Commercial	?	?
Industrial	?	?
Miscellaneous	?	?

Step 2. Gather C/I Waste Data

Once percentages for the overall waste stream that are commercial and industrial waste are determined, general information about the CA portion needs to be obtained:

- **The source(s) of the waste.**
- **The landfill hauler, i.e., private haulers, government service haulers, industry self-haulers.**
- **Equipment used to haul the waste, i.e., roll-offs, front, rear loaders.**
- **Hauling schedule: i.e., days that are consistently heavier than most.**
- **Seasonal variations in the C/I.**

These questions usually require more information than is contained in landfill records. Information requested of the landfill operator can be expanded to include specific information the origin of each load.

Step 3. Examine C/I Waste Stream

The specific nature of the C/l waste stream must be explored, and more information will be needed about the quantities and origins of the C/I waste to determine waste reduction options. Two methods for obtaining this information include direct observation of disposal and/or observation at points of generation.

"Retreat to the Landfill"

Direct observation of dumped loads is perhaps the most immediate means of understanding the C/l waste stream. The following tips are helpful when this "retreat" is conducted:

- **Spend a set of different sample days at the landfill. Pick the heaviest days, especially for industrial loads.**
- **Directly examine loads as they are dumped. Select a vantage point that gives the best view point of discharged loads; for example, at the bottom of the working face.**
- **Make a chart to track the information (see "What to look for" below). A sample chart is shown at the end of this section.**

"What To Look For"

- **Note where loads come from and how they are brought in, e.g., industry self-haul, roll-offs, rear or front load trucks. (This information will give a preliminary sense of how businesses and industries are handling their waste. It is also a step toward understanding their costs.)**
- **Make note of large loads of homogenous materials, e.g., loads that are 75-percent cardboard or 80-percent textile wastes.**

- **In addition, make note of the most common materials found in all loads, e.g., if film plastics are found in several loads.**
- **If possible, take samples of process wastes and make note of where they come from.**

Follow up the "Landfill Retreat"

After direct observation of disposal is completed, data from that excursion should be matched with the other data collected to get the 'big picture" of the C/I waste stream.

- **Break out the loads that are heavy in certain materials and examine landfill records to determine, first, how often those loads come in and, next, how much each load weighs on average.**
- **Follow up the visits to the landfill with calls to haulers, businesses, and industries to determine how often loads are brought in. For mixed commercial loads, ask haulers to describe their routes and the particular businesses they service.**
- **Construct a list of the C/I generators with notations on the materials prevalent in their waste.**
- **Lay out a hierarchy of large generators and/or large groups of generators such as "restaurants."**
- **Consider using this information to map out the C/I waste generation in the community.**

A "Dumpster Safari"

An alternative to landfill observation is to visit the points of C/l waste generation in the community. A "dumpster safari" is a trek across a pre-established route to make first-hand inspections of the outside waste containers at commercial and industrial establishments. Such a journey is most effective, however, if it occurs on several sample days and also includes site visits and interviews with generators. These opportunities for direct contact can be as educational for businesses and industries as for the local government.

Some of the same rules apply to a "dumpster safari" as for a "landfill retreat," including:

- **Be alert for containers full of homogenous material, (e.g., a roll-off with 80 percent wood waste).**
- **Look out as well for commonly discarded materials, especially in concentrated areas, e.g., if all the industries in the industrial park have film plastics in their greenboxes.**

Involving the Generators

A point-of-generation survey that includes visits with generators will also reveal important information on the C/I waste:

- **The type of containers used by the various generators.**
- **Tonnages sent for disposal.**
- **The frequency of fill-up/the schedule for pick-up.**
- **The hauler.**
- **Current costs for rental, hauling, etc.**
- **In-house waste handling.**

These questions are important to help business and industry see the opportunity for cost avoidance. (Also see Section 3. Conducting a Solid Waste Reduction Assessment). The information on current waste handling practices and the kind of space businesses have available for recycling containers will help identify the kinds of recycling services that will work best.

Organize Data

After the site visits and field observations, the data must be organized as for the landfill observation:

- **Establish a master list of C/I generators arranged from largest to smallest generators or by groups of generators. As on the landfill chart, the list will note the wastes particular to each generator or group.**
- **Map out the points of generation, noting the kinds and quantities of waste available in certain areas. A map may show, for example, that an office paper collection route would be cost-effective in the downtown area.**

B. Types of General and Process Wastes Prevalent in the CA Sectors

In determining options for reducing the C/I waste stream, it is helpful to categorize the wastes into two basic types: general and process.

General Waste

"General waste" is defined in this manual as common wastes generated by a number of different C/I sectors. General wastes from the C/I sector are materials that may currently be recycled in residential recycling programs. General wastes such as corrugated cardboard and wood waste often make up the largest quantities of recyclables that enter a disposal facility. Other examples of these general wastes include wood pallets, food waste from general food preparations, plastic film wrap, polystyrene, and mixed paper.

Process Waste

"Process waste" is defined here as by-product waste generated by specific industrial operations. Process wastes will typically require a uniquely targeted waste reduction program. A variety of waste reduction management options exist for these high-volume, homogenous waste (see Section V. Options for Reducing Solid Waste). Examples of this waste include textile looper clips from hosiery operations, plaster molds for the ceramic industry, wood scraps from the furniture industry, and off-spec products from any manufacturing operation.

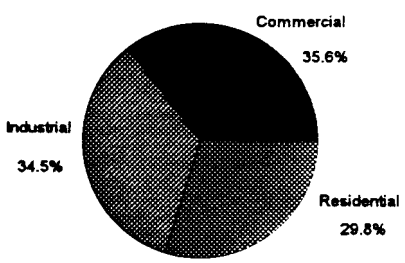
Composition of Typical C/I Waste Streams

Information about the types and quantity of waste generated from the C/I sector will enable a local government to precisely target its source reduction and recycling efforts. As mentioned in Section I, a waste generation profile can be established to identify large volumes of recyclables and the specific C/I sectors from which they originate. Whether a local government's waste reduction efforts target a particular sector, a specific waste material, or both, the development of an accurate waste generation profile is important.

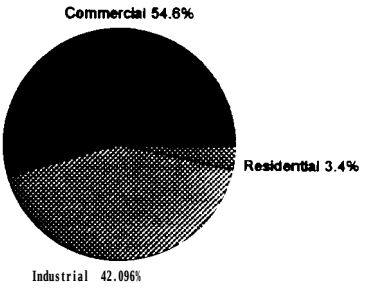
Waste Generation Profiles

Figures 1,2, and 3 present general characteristics of waste generated by specific commercial and industrial facilities in North Carolina and may be used as a preliminary estimate of the waste C/I sectors may be generating. A local government can compare these figures to its own findings from visual estimates or actual "source sampled" waste stream characterization studies. It is important to note that these data should be used only as a preliminary guide since waste quantities and composition for each sector can vary with location.

Data on N.C. Waste Generation	**Figure 1,1990-1991 Waste Characterization in NC, shows the North Carolina waste stream as a whole and the compostion of waste generated and recycled for 1990-1991 reporting year. Figure 2, Waste Disposed in North Carolina, presents a breakdown of the actual waste disposed by sector for 1992. Figure 3, Waste Composition in North Carolina, shows estimated waste stream composition for the C/I sectors.**



Generated



Recycled

Total tons generated: 8,409,776. Total tons recycled: 1.617,079

Figure 1. 1990-1991 Waste Characterization in North Carolina.

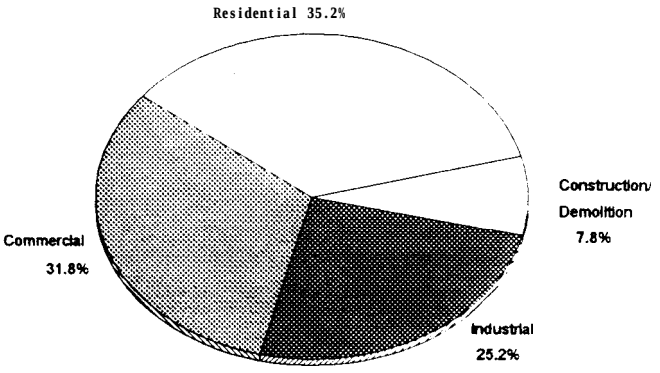
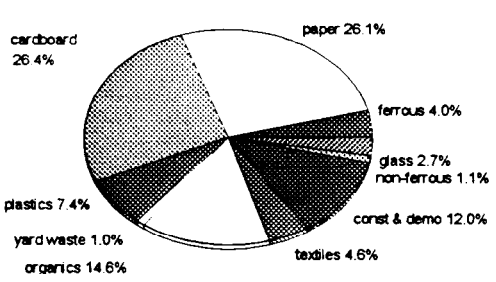
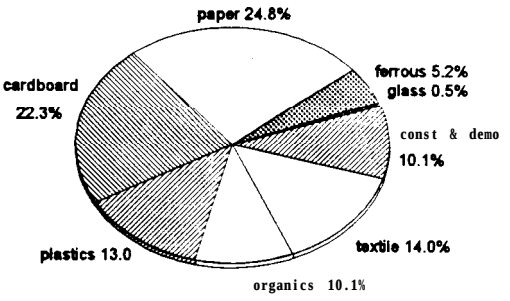


Figure 2. Waste Disposed in North Carolina

Source: North Carolina Recycling & Solid Waste Management Plan 1992.



Commercial



Industrial

Average Urban and Rural Values.

Figure 3. Waste Composition in North Carolina
Source: North Carolina Recycling & Solid Waste Management Plan 1992.

Specific-Sector Waste Composition

The waste composition for a specific sector can also be estimated from current national literature. These sectors and percentages of material can be correlated to the economy profile developed by local governments.

Table 1, Waste Stream Characterization Examples, list types of C/I wastes generated by SIC code. These data are meant to provide a general idea of the potential for reduction programs.

The chart, "Sector Specific Reduction Targets," shows some examples of the types of recyclable materials that may be targeted. Please note that these percentages are not North Carolina-specific and should be used only as a rough guide.

Table 1. Waste Stream Characterization Examples
For Commercial and Industrial Sectors

Marerial(%)	SIC 20 Food Mfg [1]	SIC 21 Tobacco Products [3]	SIC 22 Textiles Mills	SIC 25 Furniture Mtg [3]	SIC 27 Printing Publishing [1]	SIC 30 Rub/Plastlc Products [3]	SIC 34 Metal Fabrlcate [3]	SIC 35/36 Mach/Elect! Mfg	SIC 50 Wholesale' Durable	SIC 51 Wholesale' Nondurable
Paper	30.4	17	19.2	15.9	61.5	10.7	30.6	55.3	30	34.1
Plastics	15.5	7.6	9.9	3	12.7	1.8.4	2.6	1.6	14.4	22.5
Wood & Yard	7.1	1 [6]	0.3 [6]	0.4 [6]	0.7	0 [6]	0.6 [6]	3.8 [6]	19	16.4
Other Organlcs	36.5	51.9	68.8	72.9	4.9	1.5	1.8	13	18.3	18.1
Glass	0.4	0	0.3	1	0.5	0	0.5	1	0.5	1,9
Metals	8.6	0.5	1.1	2	17.9	0.3	48.2	24.9	10	1.9
Haz/Special	0.6	n/a [4]	n/a [4]	n/a [4]	1.3	n/a [4] [5]	n/a [4]	n/a [4]	0.9	0.3
Misc.Inorganics	0.9	21.9	0.4	2.4	0.4	69.1	3.3	0.4	6.9	4.7
Total % by sector	100	99.9	100	97.6	99.9	100	87.6	100	100	99.9

Materlal (%)	SIC 52 Building Materials [1]	SIC 53 General Merchand [1]	SIC 54 Food Stores [1]	SIC 58F Fast Food [1]	SIC 58S Sit-down Restaurant [1]	SIC 70 Hotels [1]	SIC 80H Hospitals [1]	SIC 8OC Health Service [1]	SIC 82 Educatlor [2]	SIC 90 Government [2]	General Offices'
Paper	19.6	46.8	30.2	50.5	20.2	38.2	28.6	40.4	45.5	60.9	71.9
Plastics	10.2	16.4	11.6	13.6	4.6	7.5	13.5	11.3	10.5	7.5	7.4
Wood & Yard	34.6	12.8	7.9	0.3	1.8	3.6	3	7.7	0.7	0.1	0.4
Other Organics	11.4	13.6	46.3	33	60.2	35	26.7	31	22	11.4	10.3
Glass	0.6	0.9	2.5	1.1	10.8	9.6	1.2	0.9	4.7	2.9	2.7
Metals	6.5	6.4	1.3	1	2.4	5.3	2.4	3.7	4.4	9	2.4
Haz/Speclal	3.6	0.2	0.1	0.1	0.1	0.1	0.03	0.03	1.4	0.5	0.2
Mlsc Inorganlcs	13.5	3	0.3	0.2	0.1	0.3	24.3	4.97	10.5	0.1	4.5
Total % by sector	100	100.1	100.1	99.8	100.2	99.6	99.73	100	99.7	100.4	99.8

1 King County, WA, Waste Charterization Study, 1990-91
2 R.W. Beck, Stanley; DSW,. 1992
3 NC Recycling and Solid Waste Management Plan, 1992
4 Information not available on % hazardous waste gereration
5 Consisted mostly of rubber waste
6 Does not include wood waste In this figure

Sector-Specific Reduction Targets[1]

Sector	Targeted Material	Typical Percent of Total Sector Waste
Office'	Mixed Paper	15.3
	Ledger Paper	15.1
	Corrugated Cardboard	12.4
	Newspaper	8.5
	Organic compostahles	6.9
Wholesale/Retail	Food Wastes	20.9
	Corrugated Cardboard	19.1
	Film Plastics	6.6
Restaurants	Food Wastes	38.1
	Corrugated Cardboard	10.5
	Mixed Paper	8.9
	Newspaper	4.9
	High Grade Paper	3.6
Service	Mixed Paper	13.6
	Corrugated Cardboard	11.4
	Wood Waste	4.2
	Tires and Rubber	3.6
Metal Mfg	Wood wastes	26.7
	Ferrous metal	18.1
	Non-ferrous	14.9
	Corrugated Cardboard	8.8
Food Stores	Corrugated Cardboard	38.2
	Organic Compostables	23.2
	Ferrous metals	5.7
	Recyclable Glass	4.5
Schools	Organic Compostables	25.7
	Newspaper	11
	Corrugated Cardboard	6
	Ferrous metals	3.6

[1]SCS Engineering, 1991; Ventura County, CA, Source Sampling Study, 1992. [2]R. W. Beck, 1992.

C. Specific Materials in a Waste Stream

This section provides more detailed information on the identification, common sources, and other background information on specific materials found in the C/I waste stream. Also presented are examples of wastes generated by the textile industry. (Also see Section V. C. 1. for waste reduction options for these materials.)

Industrial and Commercial Wood Waste

Industrial wood waste can take many forms, and a local government may need to know more details about it before attempting to find markets or before establishing recycling or composting programs. Below are some important characteristics about wood waste to consider:

- Is the wood is treated or untreated?
- Does it have other possible contaminants, e.g., paint?
- Is it hard or soft wood?
- Is it "single piece" such as a 2 by 4 pine cut-off, or is it plywood, pressboard, or composite board?
- If it is plywood, pressboard, or composite, what kind of glues hold it together?

Companies that usually generate wood wastes include, furniture manufacturers, building materials retailers, boat building companies, fence contractors, roofing contractors, pallet companies, truss manufacturers, general contractors, lumber yards, cabinetmakers, landscapers, floor installers, shipping container builders, demolition companies. If a local economy includes a large number of these kinds of companies, wood waste may be prevalent in the C/I waste stream.

Corrugated Cardboard

Corrugated cardboard (OCC) is one of the most common constituents of the C/I waste stream, and, with a national recovery rate of over 56 percent., it is one of the most frequently recycled and recyclable types of paper. Despite this impressive recovery rate, the Office of Waste Reduction estimates that there are still between 230,000 and 330,000 tons of OCC in North Carolina's waste stream. Although OCC is easy to identify in the waste stream, some characteristics of OCC that may have a bearing on its recyclability include wax or other coatings, excessive tape or other physical contaminants, and excessive wetness or chemical contamination. When assessing OCC as part of the waste stream,

local governments should note the presence of any of these characteristics and whether they pose a problem.

In addition, OCC markets often use a number of terms that may not be familiar to OCC generators or local governments. Below is a glossary of those terms:

Cardboard Glossary

Bogus medium. Corrugating medium made totally from recovered fiber.

Boxboard. A general term designating the paperboard used for fabricating boxes. Different boxboard grades are classified according to the composition of the top liner, filler (middle layer), and back liner. The category includes folding boxboard (cereal box), setup boxboard (shoe box), and foodboard (milk carton).

Containerboard. The component materials used in the fabrication of corrugated board (linerboard and medium).

Corrugated board. A board, usually 9-point corrugating medium, which has been fluted and pasted to flat sheets of board (linerboard) on both sides.

Corrugated container. A paperboard box made out of corrugated board.

Double-line kraft (DLK). Corrugated board cuttings generated during the conversion of the board to a container.

Greenfield. A new plant that is built as an independent, stand-alone facility not involving any prior construction, historically in undeveloped rural areas; hence, the association with "green fields." This approach is distinguished from the expansion of an existing plant by adding a paper machine, rebuilding an existing paper machine, adding new stock preparation such as a cleaning plant to use old corrugated containers, and other similar activities.

Kraft linerboard. A linerboard made from a feedstock that contains primarily virgin kraft wood pulp.

Kraft pulp. A fibrous material, generally derived from wood, that is produced by a process where the active ingredient is a mixture of sodium hydroxide and sodium sulfide. "Kraft" is commonly used interchangeably with "sulfate" and is derived from the German word for "strong" for the strength of the fibers that resulted from this pulping process.

Linerboard. A paperboard used as the facing material in the production of corrugated shipping containers.

Medium. Paperboard made from chemical and semichemical pulps, sometimes mixed with straw or recycled paperstock, that is converted to a corrugated or fluted board by passing it through a corrugating machine.

Paperboard. The general term for heavyweight grades of paper that are used for containers, boxes, cartons, and packaging materials. It is divided into containerboard, boxboard, and other paperboard.

Semichemical pulp. A fibrous material, generally derived from wood, that is produced by a mild chemical treatment of the raw material followed by a mechanical defiberizing operation. The term is commonly applied to papermaking fiber produced by the neutral sulfite process, and the result is neutral sulfite semichemical (NSSC) pulp.

Semichemical medium. A corrugating medium made from a feedstock that is primarily virgin wood pulp produced by a semichemical process.

Test linerboard. A term commonly used in Europe to refer to linerboard that is made exclusively out of recycled materials such as double-lined kraft cuttings and old corrugated containers. "Recycled linerboard" is the term more commonly used in the U.S.

Sources: American Paper Institute, The Dictionary of Paper, 1980; Miller Freeman Publications, 1990; John R. Lavigne, Pulp & Paper Dictionary, 1986: Resource Recycle 1992.

Pallets

Most pallets are usually constructed of untreated hardwoods and come in variety of sixes.; the the most popular sixes (inches) are 32 by 40,42 by 42,36 by 48,48 by 40,40 by 48, and 48 by 48. They are used by most facilities in the C/I sector.

Pallets may be two-way or four-way according to the number of sides by which the pallet can be lifted by a fork truck. New pallets may cost up to $8.50 each, but recycled pallets usually cost about half the price of a new one.

Probably the most common pallet that is recycled is a 48- by 40-inch four-way. Standard sized pallets have a better market for recycling. Pallets come in different qualities as well. In many cases, incoming packaging and labeling materials arrive on cheaper pallets, which have less value in the recycling markets.

The quality of pallets used is often determined by buyer's specifications. Many industries ship their final products out on new pallets but reuse old pallets for internal material-handling operations.

A program to recycle wood pallets should address the following questions.

- Are the pallets contaminated with chemicals, oils, etc.
- The size and types of pallets.
- The condition of the pallets.

Pallet Recycling/ Reuse

The number of pallet recyclers has been growing in North Carolina, especially as the price of virgin timber rises. These recyclers pick up pallets and refurbish them as necessary. Pallet recyclers are also generators of scrap wood from pallets that can no longer be repaired.

Many municipal waste management facilities and private waste management companies grind pallets in tub grinders to be used as fuel or mulch. The tub grinders are equipped with magnets to remove ferrous fasteners.

Some commercial and industrial facilities are experimenting with reusable plastic pallets for certain operations. Corrugated cardboard pallets are also available (also see Section 4. Pallet Management Strategies for Industries).

A good source of information about pallet recycling is the International Association of Pallet Recyclers (IAPR) ((612) 488-9059).

Office Paper

The Office of Waste Reduction estimates that North Carolina's waste stream contains between 150,000 and 220,000 tons of office paper, of which only about 27 percent is being recovered.

Office paper is often thought of only in terms of high grades such as white ledger or computer paper. However, a wide range of paper can be generated in an office setting, and an understanding of the local office paper waste stream for purposes of recycling should include an awareness of the different types.

The charts below present the average amount of paper generated in an office setting and definitions of office paper grades.

Definitions of Secondary Office Paper Catagories

High grade office paper (all white paper free of laser-printing)

- White (or colored bar) computer printout
- White continuous forms
- White ledger paper
- White tablet paper
- White or cream letterhead
- White adding machine tape

Medium grade office paper (any white paper contaminated with laser printing)

- White copy paper
- Any of the high grade paper with laser printing

Low grade office paper

- Colored ledger
- Colored copy paper
- Colored business forms
- Yellow legal pads or writing tablets
- Pink (or any color) telephone message pads
- Self-stick notes
- Envelopes (any, except kraft or manila)
- Carbon paper
- Carbonless (NCR) paper
- Fax (thermal) paper
- Blueprint paper

Any high or medium grade paper contaminated with self-stick notes or pressure-sensitive labels.

Other paper (paper that might be recylable, but is not generally included in an office collection program)

- Glossy magazines or catalogs
- Newspapers
- Groundwood computer printout
- Corrugated containers
- Paperboard packaging
- Tissue paper, paper towels, paper napkins
- Paper cups, plates or food trays
- Kraft paper or paper bags
- Manila or kraft envelopes

Trash (any non-paper item mixed with recyclable items)

- Plastic cups, plates, utensils, plastic or foil food
- Pens and pencils
- Typewriter or computer ribbons
- Food
- Cigarettes
- Aluminum or glass containers

Source: "An Up-Close Look at Office Waste," Resource Recycling, June 1991, Volume X, No. 6.

Note: Always check with local markets since collection requirements can vary with region.

Average Amount of Office Paper Generated Per Person Per Day, in pounds

	1976 EPA Study		1991 NERC Study		
	Finance/ Insurance	General	Finance/ Insurance[1]	General[2]	Govern-ment[3]
High Grade Paper	1.8	0.7	0.7	0.3	0.1
Medium Grade Paper	N.A.	N.A.	0.8	0.5	0.5
Low Grade Paper	0.2	0.3	0.2	0.2	0.1
Total Recyclable Office Paper	2.0	1.0	1.7	0.9	0.8
Other Paper	0.2	0.5	0.3	0.4	0.4
Trash	0.2	0.2	0.2	0.3	0.2
Total Waste Generated[4]	2.3	1.6	2.3	1.6	1.4

N.A. = Not available.

[1] Finance/insurance: insurance agents, financial advisors, insurance underwriters, commercial banks, investment banks.

[2] General: manufacturing companies, television stations, business consultants, data processing services, vocational centers, private universities, software companies, sales offices, public accounting firms, chambers of commerce.

[3] Government: state and local agencies, federal agencies, state universities.

[4] Totals may not add due to rounding.

Commercial and Industrial Plastic Recycling

Recycling plastics is much like recycling other materials: the plastic must be correctly collected and stored; separated into individual resin types, either by the collector or the processor; reclaimed into flakes or pellets; and then used in the manufacture of new products.

The Society of the Plastics Industry, Inc., (SPI) has developed a voluntary coding system that identifies plastics by resin type. This coding system was intended to identify resin types on bottles, and each code number represents a general resin family. Individual products other than bottles with the some code number may or may not be compatible in the process used by the local reclaimer. For example, blow-molded High Density Polyethylene (HDPE) bottles and injection-molded HDPE butter tubs are both coded No. 2 but have a difference in their Melt Flow Indices (MFI) which measures processing viscosity. Blow-molded containers have a low MFI, and injection molded containers have a high MFI

SPI Coding System

The SPI Code is usually found on the underside of a product enclosed within the recycling arrows.

- **Polyethylene Terephthalate, No. 1 - (PET).**
  PET is primarily used for soft drink, oil, and liquor bottles and food containers such as peanut butter jars. PET is clear and tough and has the ability to resist permeation of carbon dioxide. It is the most commonly recycled household plastic material.
- **Polyethylene, No. 2 - (HDPE).**
  HDPE, High Density Polyethylene, has a variety of uses such as for milk, water, and juice bottles; bleach, detergent and motor oil bottles; margarine tubs; and even grocery bags. HDPE is a low-cost, easy-to-form, and very break-resistant plastic.
- **Low-Density Polyethylene, No. 4 - (LDPE).**
  LDPE is used mainly as film in food bags such as for bread, trash bags, and stretch films.
- **Polyvinyl Chloride, No. 3 - (PVC).**
  PVC is used to make a range of products from heavy-walled pressure pipes to clear food packaging. PVC is chemical resistant and has excellent clarity.
- **Polypropylene, No. 5 - (PP).**
  PP is resistant to fatigue and chemicals. It has a wide range of commercial/industrial applications from bale wrap for textile

mills, fibers, filaments, overcaps, industrial bulk bags, and automotive batteries to many household uses such as margarine tubs, syrup bottles, and straws.

- **Polystyrene, No. 6 - (PS).**
  PS is a resin that has a wide range of physical properties. Polystyrene is commonly called Styrofoam and can be found in packaging peanuts, molded carton inserts, cups, plates, foam trays, etc.
- **Other Plastics, No. 7.**
  This code is used for the many other plastic resin families that are marketed today. They include plastics such as Polyurethene which is used in foam for insulation and furniture. Many of the plastics in this category can be recycled commingled or mixed with other resin families to produce a variety of products.

When commercial and industrial plastic are recycled, it is important to identify the plastic resin type in the individual products. The manufacturer of the product can provide information if the product is not coded or the physical properties are in doubt. The manufacturer needs to be informed that a plastic recycling program is being developed; he/she may be able to accept the plastic product back or provide information about a market.

Estimates from the Office of Waste Reduction indicate that there are between 80,000 and 115,000 tons of film plastic annually in North Carolina's waste stream. Desite its technical recyclability and growing markets, film plastic is only recovered at the rate of 2 percent annually.

Waste Indentification in the Textile Industry

Examples of Typical Process Waste Steams for the Textile Industry

Material	Source of Generation	Common Management
Cardboard Spools	Knitting operations	Returned to supplier, recycled, disposed.
Cones, Plastic & Cardboard	Knitting operations	Returned to suppliers (especially plastic ones), brokers de-label cones and resell, both cardboard and plastic are recycled, some plastic compressible tubes are chipped & recycled.
Looper Clips from Hosiery, (cotton, synthetic nylon, blends)	Hosiery sewing operations excess from toe closing	Disposed, sold in variable markets
Yam, Sewing String	Knitting, sewing operations	Yarn is separated and resold or returned to suppliers, miscellaneous threads are usually disposed or sometimes recycled
Rejects or thirds	Knitting, sewing, inspection	Sold, donated, or reused
Scrap fabric (various fibers)	Cutting operations, weaving	Large enough scraps are sold as rags or wipes, small scraps are sometimes disposed because markets are lacking or unstable.
Plastic Bag Packaging	In-coming spool packaging; End-product packaging waste	Disposed, recycling is difficult due to low volumes
Corrugated Cardboard Boxes	Receiving, in-house use, shipping	Reused in-house for inventory storage and product handling, intra-company use, recycled
Label Backing Waste	Packaging areas, label application	Disposed
Lint (cotton, blends),	Dryer screens/trimmers vacuums, knitting and sewing operations, floor sweepings	Disposed
Wooden Pallets	Shipping, receiving, chemical storage	Reused, recycled, given to employees, chipped
Drums: steel, plastic and fiber	Dye house chemicals, maintenance	Returned to supplier, recycled, disposed (especially fiber)
Salt Bags, paper	Dye house	Disposed
Sludge Materials, latex wet fiber	"Backing" equip., dye machine filter	Disposed, reclaimed
Used Machine Oils	Knitting machines, maintenance clean-up operation	Absorbents are disposed, larger volumes of oil; may be sent off site for energy recovery

Material	Density (pounds per cubic yard)	Source
PAPER		
Newspaper		
Drum	415	8
Loose, bin	360-500	4
Loose, bin	475	6
Loose, stacked	600	1
Baled, downstroke	650	8
Baled, downstroke	775	15
Baled, horizontal, single ram	700	15
Baled, horizontal, double ram	800	5, 15
Corrugated containers		
Loose	100	3, 11
Compacted, packer truck	200-300	11
Compacted, landfill (1)	508	3, 4
Baled, downstroke	450-520	5, 8, 15
Baled, horizontal, single ram	650	15
Baled, horizontal, double ram	750	5, 15
High grade		
Ledger, loose, bin	300-400	6
Mixed ledger and computer printout, drum	290	8
Ledger, baled	700-750	5, 8, 15
Mixed paper, loose	150	12
GLASS CONTAINERS		
Whole		
Bin	500-600	1, 4, 6, 8
Drum	500-550	8
Flint bottles	500-515	6, 8
Green bottles	550-650	6, 8
Amber bottles	540-550	6, 8
Semi-crushed (manually broken)		
Bin	1,000	6
Drum	1,080	1, 4
Crushed, maximum size 1½" (mechanically broken)		
Bin	1,600	6
Drum	1,980	1, 4
Furnace ready, maximum size ¼".	2,700	6
METAL		
Aluminum cans		
Whole	74	1, 4
Whole	50	6, 7, 14
Flattened	250	1, 4, 5
Flattened	175	6
Flattened	135-215	14
Baled	350-540	14, 16
Densified	1,080	14
Shreds	400	16
Ferrous cans		
Whole	150	1, 4, 6
Drum, one-third are flattened	235	8
Flattened	350-400	8
Baled	850	1, 4, 5, 6
Densified	1,600	14
Household batteries		
Drum	2,150	13
White goods		
Uncompacted	199	3
Compacted, landfill	994	3
PLASTICS		
PET soda bottles		
Whole	34	6, 7
Whole, some flattened	30-45	10
Flattened	75	6
Baled	400	10
Baled and perforated	600-700	14
Granulated	500-600	8
HDPE		
Natural, whole	25-30	6, 10
Natural, flattened	65	6
Colored, whole	45	6, 10
Colored, flattened	90	6
Baled	400	10
Granulated	500-600	8
ORGANICS		
Brush		
Loose	250	4
Loose	350	9
Chipped, 3" screen	550-650	9
Chips	500	1
Compost		
Raw	350	13
20 percent moisture	1,000	9
70 percent moisture	1,900	9
Finished	1,400	13
Food		
Kitchen waste	800-900	2
Solid fats & liquid fats drum	1,485	1, 4
Grass clippings		
Loose	400	1
Loose	665-740	4, 9
Compacted	1,050-1,110	4, 9
Leaves		
Loose	250	1
Loose	400	4, 9
Vacuumed	350	1
Vacuumed	500	9
Vacuumed	700	4
Compacted	450	1
Compacted	665	9
Yard waste		
Loose (2)	296	3
Loose	600	2
Compacted	1,037	3
CONSTRUCTION & DEMOLITION		
Asphalt, milled, ripped, crushed	1,380	4
Concrete, brick & block	4,000	4
Wood waste		
Pallets	286	4
Other than pallets	364	4
Loose dimensional lumber	244	3
Compacted dimensional lumber	695	3
OTHER MATERIALS		
TEXTILES		
Loose	240	13
Baled	480	13
COMMINGLED RESIDENTIAL RECYCLABLE CONTAINERS		
Glass, plastic and metal containers	140-220	6
RESIDENTIAL SOLID WASTE		
Compacted, sideloader	456	3
Compacted, landfill density	1,264	3

(1) A standard landfill compactor was used to compress the material to a density representative of a landfill.

(2) Primarily non-woody material with preponderance of weeds and dried vegetable matter. Grass clippings were not a major contributor. This density could be considered light for a normal composition of yard waste.

Sources:

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7. Esther R. Bowring, "A comparison of commingled collection containers," *Resource Recycling*, April 1990.
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15. Colton Equipment, West Linn, Oregon, 1991.

Landfill Observation Chart: Commercial and Industrial Waste

Date: _____ **Day of Week:** _____

(Enter types of waste observed.)

Hauler/Company	Roll-Offs	Front-Load	Rear-Load	Self-Haul
Example: XYZ Industry				50% Cardboard; 20% Pallets; 15% Film; 15% Misc.
Example: Joe's Hauling	30% Cardboard; 20% Office Paper; 20% Food; 20% Misc.			

Standard Industrial Classification Codes	**In determining the local C/I waste stream, local government may study the business sectors to estimate the types and amounts of wastes generated. The Standard Industrial Classification (SIC) code system organizes all businesses and industries into standardized groups.** **Information on the number, types, and sizes of industries in a location usually may be obtained from chambers of commerce, economic development offices, and planning and zoning departments. These organizations usually reference business and industries by SIC codes.**

SIC Code Industry

AGRICULTURE

AGRICULTURAL PRODUCTION—CROPS

0111 Wheat
0112 Rice
0115 Corn
0116 Soybeans
0119 Cash grains, nec
0131 Cotton
0132 Tobacco
0133 Sugar cane and sugar beets
0134 Irish potatoes
0139 Field crops, except cash grains, nec
0161 Vegetables and melons
0171 Berry crops
0172 Grapes
0173 Tree nuts
0174 Citrus fruits
0175 Deciduous tree fruits
0179 Fruits and tree nuts, nec
0181 Ornamental nursery products
0182 Food crops grown under cover
0191 General farms, primarily crops

AGRICULTURAL PRODUCTION—LIVESTOCK

0211 Beef cattle feedlots
0212 Beef cattle, except feedlots
0213 Hogs
0214 Sheep and goats
0219 General livestock, nec
0241 Dairy farms
0251 Broiler, fryer, and roaster chickens
0252 Chicken eggs
0253 Turkeys and turkey eggs
0254 Poultry hatcheries
0259 Poultry and eggs, nec
0271 Fur-bearing animals and rabbits
0272 Horses and other equines
0273 Animal aquaculture
0279 Animal specialties, nec
0291 General farms, primarily animal

AGRICULTURAL SERVICES

0711 Soil preparation services
0721 Crop planting and protecting
0722 Crop harvesting
0723 Crop preparation services for market
0724 Cotton ginning
0741 Veterinary services, for livestock
0742 Veterinary services, specialties
0751 Livestock services, except veterinary
0752 Animal specialty services
0761 Farm labor contractors
0762 Farm management services
0781 Landscape counseling and planning
0782 Lawn and garden services
0783 Ornamental shrub and tree services

FORESTRY

0811 Timber tracts
0831 Forest products
0851 Forestry services

FISHING, HUNTING, AND TRAPPING

0912 Finfish
0913 Shellfish
0919 Miscellaneous marine products
0921 Fish hatcheries and preserves
0971 Hunting, trapping, game propagation

MINING

METAL MINING

1011 Iron ores
1021 Copper ores
1031 Lead and zinc ores
1041 Gold ores
1044 Silver ores
1061 Ferroalloy ores, except vanadium
1081 Metal mining services
1094 Uranium, radium, vanadium ores
1099 Metal ores, nec

COAL MINING

1221 Bituminous coal and lignite - surface
1222 Bituminous coal - underground
1231 Anthracite mining
1241 Coal mining services

OIL AND GAS EXTRACTION

1311 Crude petroleum and natural gas
1321 Natural gas liquids
1381 Drilling oil and gas wells
1382 Oil and gas exploration services
1389 Oil and gas field services, nec

NONMETALLIC MINERALS, EXCEPT FUELS

1411 Dimension stone
1422 Crushed and broken limestone
1423 Crushed and broken granite
1429 Crushed and broken stone, nec
1442 Construction sand and gravel
1446 Industrial sand
1455 Kaolin and ball clay
1459 Clay and related minerals, nec
1474 Potash, soda and borate minerals
1475 Phosphate rock
1479 Chemical and fertilizer mining, nec
1481 Nonmetallic minerals services
1499 Miscellaneous nonmetallic minerals, nec

CONSTRUCTION

GENERAL BUILDING CONTRACTORS

1521 Single-family housing construction
1522 Residential construction, nec
1531 Operative builders
1541 Industrial buildings and warehouses
1542 Nonresidential construction, nec

HEAVY CONSTRUCTION, EXCLUDING BUILDINGS

1611 Highway and street construction
1622 Bridge, tunnel, and elevated highway
1623 Water, sewer, and utility lines
1629 Heavy construction, nec

SPECIAL TRADE CONTRACTORS

1711 Plumbing, heating, air conditioning
1721 Painting and paper hanging
1731 Electrical work
1741 Masonry and other stonework
1742 Plastering, drywall, and insulation
1743 Terrazzo, tile, marble, mosaic work
1751 Carpentry work
1752 Floor laying and floor work, nec
1761 Roofing, siding, and sheet metal work
1771 Concrete work
1781 Water well drilling
1791 Structural steel erection
1793 Glass and glazing work
1794 Excavation work
1795 Wrecking and demolition work
1796 Installing building equipment, nec
1799 Special trade contractors, nec

MANUFACTURING

FOOD AND KINDRED PRODUCTS

2011 Meat packing plants
2013 Sausages and other prepared meats
2015 Poultry slaughtering and processing
2021 Creamery butter
2022 Cheese, natural and processed
2023 Dry, condensed, evaporated products
2024 Ice cream and frozen desserts
2026 Fluid milk
2032 Canned specialties
2033 Canned fruits and vegetables
2034 Dehydrated fruits, vegetables, soups
2035 Pickles, sauces, and salad dressings
2037 Frozen fruits and vegetables
2038 Frozen specialties, nec
2041 Flour and other grain mill products
2043 Cereal breakfast foods
2044 Rice milling
2045 Prepared flour mixes and doughs
2046 Wet corn milling
2047 Dog and cat food
2048 Prepared feeds, nec
2051 Bread, cake, and related products
2052 Cookies and crackers
2053 Frozen bakery products, except bread
2061 Raw cane sugar
2062 Cane sugar refining
2063 Beet sugar
2064 Candy and other confectionery produc
2066 Chocolate and cocoa products
2067 Chewing gum
2068 Salted and roasted nuts and seeds
2074 Cottonseed oil mills
2075 Soybean oil mills
2076 Vegetable oil mills, nec
2077 Animal and marine fats and oils
2079 Edible fats and oils, nec
2082 Malt beverages
2083 Malt
2084 Wines, brandy, and brandy spirits
2085 Distilled and blended liquors
2086 Bottled and canned soft drinks
2087 Flavoring extracts and syrups, nec
2091 Canned and cured fish and seafood
2092 Fresh or frozen prepared fish
2095 Roasted coffee
2097 Manufactured ice
2098 Macaroni and spaghetti
2099 Food preparations, nec

TOBACCO PRODUCTS

2111 Cigarettes
2121 Cigars
2131 Chewing and smoking tobacco
2141 Tobacco stemming and redrying

TEXTILE MILL PRODUCTS

2211 Broadwoven fabric mills, cotton
2221 Broadwoven fabric mills, man-made
2231 Broadwoven fabric mills, wool
2241 Narrow fabric mills
2251 Women's hosiery, except socks
2252 Hosiery, nec
2253 Knit outerwear mills
2254 Knit underwear mills
2257 Weft knit fabric mills
2258 Lace and warp knit fabric mills
2259 Knitting mills, nec
2261 Finishing plants, cotton
2262 Finishing plants, man-made
2269 Finishing plants, nec
2273 Carpets and rugs
2281 Yarn spinning mills
2282 Throwing and winding mills
2284 Thread mills
2295 Coated fabrics, not rubberized
2296 Tire cord and fabrics
2297 Nonwoven fabrics
2298 Cordage and twine
2299 Textile goods, nec

Note. nec = not elsewhere classified.

SIC CODES
(Continued)

SIC Code	Industry
APPAREL AND OTHER TEXTILE PRODUCTS	
2311	Men's and boys' suits and coats
2321	Men's and boys' shirts
2322	Men's and boys' underwear and nightwear
2323	Men's and boys' neckwear
2325	Men's and boys' trousers and slacks
2326	Men's and boys' work clothing
2329	Men's and boys' clothing, nec
2331	Women's and misses' blouses and shirts
2335	Women's, juniors' and misses' dresses
2337	Women's and misses' suits and coats
2339	Women's and misses' outerwear, nec
2341	Women's and children's underwear
2342	Bras, girdles, and allied garments
2353	Hats, caps, and millinery
2361	Girls' and children's dresses, blouses
2369	Girls' and children's outerwear, nec
2371	Fur goods
2381	Fabric dress and work gloves
2384	Robes and dressing gowns
2385	Waterproof outerwear
2386	Leather and sheep lined clothing
2387	Apparel belts
2389	Apparel and accessories, nec
2391	Curtains and draperies
2392	House furnishings, nec
2393	Textile bags
2394	Canvas and related products
2395	Pleating and stitching
2396	Automotive and apparel trimmings
2397	Schiffli machine embroideries
2399	Fabricated textile products, nec
LUMBER AND WOOD PRODUCTS	
2411	Logging
2421	Sawmills and planing mills, general
2426	Hardwood dimension and flooring mills
2429	Special product sawmills, nec
2431	Millwork
2434	Wood kitchen cabinets
2435	Hardwood veneer and plywood
2436	Softwood veneer and plywood
2439	Structural wood members, nec
2441	Nailed wood boxes and shook
2448	Wood pallets and skids
2449	Wood containers, nec
2451	Mobile homes
2452	Prefabricated wood buildings
2491	Wood preserving
2493	Reconstituted wood products
2499	Wood products, nec
FURNITURE AND FIXTURES	
2511	Wood household furniture
2512	Upholstered household furniture
2514	Metal household furniture
2515	Mattresses and bedsprings
2517	Wood TV and radio cabinets
2519	Household furniture, nec
2521	Wood office furniture
2522	Office furniture, except wood
2531	Public building and related furniture
2541	Wood partitions and fixtures
2542	Partitions and fixtures, except wood
2591	Drapery hardware and blinds and shades
2599	Furniture and fixtures, nec
PAPER AND ALLIED PRODUCTS	
2611	Pulp mills
2621	Paper mills
2631	Paperboard mills
2652	Set-up paperboard boxes
2653	Corrugated and solid fiber boxes
2655	Fiber cans, drums, and similar products
2656	Sanitary food containers
2657	Folding paperboard boxes
2671	Paper coated and laminated, packaging
2672	Paper coated and laminated, nec
2673	Bags - plastics, laminated and coated
2674	Bags - uncoated paper and multiwall
2675	Die-cut paper and board
2676	Sanitary paper products
2677	Envelopes
2678	Stationery products
2679	Converted paper products, nec
PRINTING AND PUBLISHING	
2711	Newspapers
2721	Periodicals
2731	Book publishing
2732	Book printing
2741	Miscellaneous publishing
2752	Commercial printing, lithographic
2754	Commercial printing, gravure
2759	Commercial printing, nec
2761	Manifold business forms
2771	Greeting cards
2782	Blankbooks and looseleaf binders
2789	Bookbinding and related work
2791	Typesetting
2796	Plate making services
CHEMICALS AND ALLIED PRODUCTS	
2812	Alkalies and chlorine
2813	Industrial gases
2816	Inorganic pigments
2819	Industrial inorganic chemicals, nec
2821	Plastics materials and resins
2822	Synthetic rubber
2823	Cellulosic man-made fibers
2824	Organic fibers, noncellulosic
2833	Medicinals and botanicals
2834	Pharmaceutical preparations
2835	Diagnostic substances
2836	Biological products, except diagnostic
2841	Soap and other detergents
2842	Polishes and sanitation goods
2843	Surface active agents
2844	Toilet preparations
2851	Paints and allied products
2861	Gum and wood chemicals
2865	Cyclic crudes and intermediates
2869	Industrial organic chemicals, nec
2873	Nitrogenous fertilizers
2874	Phosphatic fertilizers
2875	Fertilizers, mixing only
2879	Agricultural chemicals, nec
2891	Adhesives and sealants
2892	Explosives
2893	Printing ink
2895	Carbon black
2899	Chemical preparations, nec
PETROLEUM AND COAL PRODUCTS	
2911	Petroleum refining
2951	Asphalt paving mixtures and blocks
2952	Asphalt felts and coatings
2992	Lubricating oils and greases
2999	Petroleum and coal products, nec
RUBBER AND MISCELLANEOUS PLASTIC PRODUCTS	
3011	Tires and inner tubes
3021	Rubber and plastics footwear
3052	Rubber and plastics hose and belting
3053	Gaskets, packing and sealing devices
3061	Mechanical rubber goods
3069	Fabricated rubber products, nec
3081	Unsupported plastics, film and sheet
3082	Unsupported plastics, profile shapes
3083	Laminated plastics, plate and sheet
3084	Plastics, pipe
3085	Plastics, bottles
3086	Plastics, foam products
3087	Custom compound purchased resins
3088	Plastics, plumbing fixtures
3089	Plastics products, nec
LEATHER AND LEATHER PRODUCTS	
3111	Leather tanning and finishing
3131	Footwear, cut stock
3142	House slippers
3143	Men's footwear, except athletic
3144	Women's footwear, except athletic
3149	Footwear, except rubber, nec
3151	Leather gloves and mittens
3161	Luggage
3171	Women's handbags and purses
3172	Personal leather goods, nec
3199	Leather goods, nec
STONE, CLAY, AND GLASS PRODUCTS	
3211	Flat glass
3221	Glass containers
3229	Pressed and blown glass, nec
3231	Products of purchased glass
3241	Cement, hydraulic
3251	Brick and structural clay tile
3253	Ceramic wall and floor tile
3255	Clay refractories
3259	Structural clay products, nec
3261	Vitreous plumbing fixtures
3262	Vitreous china table and kitchenware
3263	Semivitreous table and kitchenware
3264	Porcelain electrical supplies
3269	Pottery products, nec
3271	Concrete block and brick
3272	Concrete products, nec
3273	Ready-mixed concrete
3274	Lime
3275	Gypsum products
3281	Cut stone and stone products
3291	Abrasive products
3292	Asbestos products
3295	Minerals, ground or treated
3296	Mineral wool
3297	Nonclay refractories
3299	Nonmetallic mineral products, nec
PRIMARY METAL INDUSTRIES	
3312	Blast furnaces and steel mills
3313	Electrometallurgical products
3315	Steel wire and related products
3316	Cold finishing of steel shapes
3317	Steel pipe and tubes
3321	Gray and ductile iron foundries
3322	Malleable iron foundries
3324	Steel investment foundries
3325	Steel foundries, nec
3331	Primary copper
3334	Primary aluminum
3339	Primary nonferrous metals, nec
3341	Secondary nonferrous metals
3351	Copper rolling and drawing
3353	Aluminum sheet, plate, and foil
3354	Aluminum extruded products
3355	Aluminum rolling and drawing, nec
3356	Nonferrous rolling and drawing, nec
3357	Nonferrous wire drawing and insulating
3363	Aluminum die-castings
3364	Nonferrous die-castings, except aluminum
3365	Aluminum foundries
3366	Copper foundries
3369	Nonferrous foundries, nec
3398	Metal heat treating
3399	Primary metal products, nec
FABRICATED METAL PRODUCTS	
3411	Metal cans
3412	Metal barrels, drums, and pails
3421	Cutlery
3423	Hand and edge tools, nec
3425	Saw blades and handsaws
3429	Hardware, nec

Note: nec = not elsewhere classified.

SIC CODES
(Continued)

SIC Code	Industry
3431	Metal sanitary ware
3432	Plumbing fixture fittings and trim
3433	Heating equipment, except electric
3441	Fabricated structural metal
3442	Metal doors, sash, and trim
3443	Fabricated plate work (boiler shops)
3444	Sheet metal work
3446	Architectural metal work
3448	Prefabricated metal buildings
3449	Miscellaneous metal work
3451	Screw machine products
3452	Bolts, nuts, rivets, and washers
3462	Iron and steel forgings
3463	Nonferrous forgings
3465	Automotive stampings
3466	Crowns and closures
3469	Metal stampings, nec
3471	Plating and polishing
3479	Metal coating and allied services
3482	Small arms ammunition
3483	Ammunition, except for small arms, nec
3484	Small arms
3489	Ordnance and accessories, nec
3491	Industrial valves
3492	Fluid power valves and hose fittings
3493	Steel springs, except wire
3494	Valves and pipe fittings, nec
3495	Wire springs
3496	Miscellaneous fabricated wire products
3497	Metal foil and leaf
3498	Fabricated pipe and fittings
3499	Fabricated metal products, nec
	INDUSTRIAL MACHINERY AND EQUIPMENT
3511	Turbines and turbine generator sets
3519	Internal combustion engines, nec
3523	Farm machinery and equipment
3524	Lawn and garden equipment
3531	Construction machinery
3532	Mining machinery
3533	Oil and gas field machinery
3534	Elevators and moving stairways
3535	Conveyors and conveying equipment
3536	Hoists, cranes, and monorails
3537	Industrial trucks and tractors
3541	Machine tools, metal cutting types
3542	Machine tools, metal forming types
3543	Industrial patterns
3544	Special dies, tools, jigs, and fixture
3545	Machine tool accessories
3546	Power driven hand tools
3547	Rolling mill machinery
3548	Welding apparatus
3549	Metalworking machinery, nec
3552	Textile machinery
3553	Woodworking machinery
3554	Paper industries machinery
3555	Printing trades machinery
3556	Food products machinery
3559	Special industry machinery, nec
3561	Pumps and pumping equipment
3562	Ball and roller bearings
3563	Air and gas compressors
3564	Blowers and fans
3565	Packaging machinery
3566	Speed changers, drives, and gears
3567	Industrial furnaces and ovens
3568	Power transmission equipment, nec
3569	General industrial machinery, nec
3571	Electronic computers
3572	Computer storage devices
3575	Computer terminals
3577	Computer peripheral equipment, nec
3578	Calculating and accounting equipment
3579	Office machines, nec
3581	Automatic vending machines
3582	Commercial laundry equipment
3585	Refrigeration and heating equipment
3586	Measuring and dispensing pumps
3589	Service industry machinery, nec
3592	Carburetors, pistons, rings, valves
3593	Fluid power cylinders and actuators
3594	Fluid power pumps and motors
3596	Scales and balances, except laboratory
3599	Industrial machinery, nec
	ELECTRONIC AND OTHER ELECTRIC EQUIPMENT
3612	Transformers, except electronic
3613	Switchgear and switchboard apparatus
3621	Motors and generators
3624	Carbon and graphite products
3625	Relays and industrial controls
3629	Electrical industrial apparatus, nec
3631	Household cooking equipment
3632	Household refrigerators and freezers
3633	Household laundry equipment
3634	Electric housewares and fans
3635	Household vacuum cleaners
3639	Household appliances, nec
3641	Electric lamps
3643	Current-carrying wiring devices
3644	Noncurrent-carrying wiring devices
3645	Residential lighting fixtures
3646	Commercial lighting fixtures
3647	Vehicular lighting equipment
3648	Lighting equipment, nec
3651	Household audio and video equipment
3652	Prerecorded records and tapes
3661	Telephone and telegraph apparatus
3663	Radio and TV communication equipment
3669	Communications equipment, nec
3671	Electron tubes
3672	Printed circuit boards
3674	Semiconductors and related devices
3675	Electronic capacitors
3676	Electronic resistors
3677	Electronic coils and transformers
3678	Electronic connectors
3679	Electronic components, nec
3691	Storage batteries
3692	Primary batteries, dry and wet
3694	Engine electrical equipment
3695	Magnetic and optical recording media
3699	Electrical equipment and supplies, nec
	TRANSPORTATION EQUIPMENT
3711	Motor vehicles and car bodies
3713	Truck and bus bodies
3714	Motor vehicle parts and accessories
3715	Truck trailers
3716	Motor homes
3721	Aircraft
3724	Aircraft engines and engine parts
3728	Aircraft parts and equipment, nec
3731	Ship building and repairing
3732	Boat building and repairing
3743	Railroad equipment
3751	Motorcycles, bicycles, and parts
3761	Guided missiles and space vehicles
3764	Space propulsion units and parts
3769	Space vehicle equipment, nec
3792	Travel trailers and campers
3795	Tanks and tank components
3799	Transportation equipment, nec
	INSTRUMENTS AND RELATED PRODUCTS
3812	Search and navigation equipment
3821	Laboratory apparatus and furniture
3822	Environmental controls
3823	Process control instruments
3824	Fluid meters and counting devices
3825	Instruments to measure electricity
3826	Analytical instruments
3827	Optical instruments and lenses
3829	Measuring and controlling devices, nec
3841	Surgical and medical instruments
3842	Surgical appliances and supplies
3843	Dental equipment and supplies
3844	X-ray apparatus and tubes
3845	Electromedical equipment
3851	Ophthalmic goods
3861	Photographic equipment and supplies
3873	Watches, clocks, watchcases, and parts
	MISCELLANEOUS MANUFACTURING INDUSTRIES
3911	Jewelry, precious metal
3914	Silverware and plated ware
3915	Jewelers' materials and lapidary work
3931	Musical instruments
3942	Dolls and stuffed toys
3944	Games, toys, and children's vehicles
3949	Sporting and athletic goods, nec
3951	Pens and mechanical pencils
3952	Lead pencils and art goods
3953	Marking devices
3955	Carbon paper and inked ribbons
3961	Costume jewelry
3965	Fasteners, buttons, needles, and pins
3991	Brooms and brushes
3993	Signs and advertising specialties
3995	Burial caskets
3996	Hard surface floor coverings, nec
3999	Manufacturing industries, nec

TRANSPORTATION AND UTILITIES

	RAILROAD TRANSPORTATION
4011	Railroads, line-haul operating
4013	Switching and terminal devices
	LOCAL AND INTERURBAN PASSENGER TRANSIT
4111	Local and suburban transit
4119	Local passenger transportation, nec
4121	Taxicabs
4131	Intercity and rural bus transportation
4141	Local bus charter service
4142	Bus charter service, except local
4151	School buses
4173	Bus terminal and service facilities
	TRUCKING AND WAREHOUSING
4212	Local trucking, without storage
4213	Trucking, except local
4214	Local trucking with storage
4215	Courier services, except by air
4221	Farm product warehousing and storage
4222	Refrigerated warehousing and storage
4225	General warehousing and storage
4226	Special warehousing and storage, nec
4231	Trucking terminal facilities
	U.S. POSTAL SERVICE
4311	U.S. Postal Service
	WATER TRANSPORTATION
4412	Deep sea foreign transportation of freight
4424	Deep sea domestic trans. of freight
4432	Freight transportation, on the Great Lakes
4449	Water transportation of freight, nec
4481	Deep sea passenger trans., except ferry
4482	Ferries
4489	Water passenger transportation, nec
4491	Marine cargo handling
4492	Towing and tugboat service
4493	Marinas
4499	Water transportation services, nec

Note: nec = not elsewhere classified.

SIC CODES
(Continued)

SIC Code	Industry

TRANSPORTATION BY AIR
4512 Air transportation, scheduled
4513 Air courier services
4522 Air transportation, nonscheduled
4581 Airports, flying fields, and services

PIPELINES, EXCEPT NATURAL GAS
4612 Crude petroleum pipelines
4613 Refined petroleum pipelines
4619 Pipelines, nec

TRANSPORTATION SERVICES
4724 Travel agencies
4725 Tour operators
4729 Passenger transportation arrangement, nec
4731 Freight transportation arrangement
4741 Rental of railroad cars
4783 Packing and crating
4785 Inspection and fixed facilities
4789 Transportation services, nec

COMMUNICATIONS
4812 Radiotelephone communications
4813 Telephone communications, except radio
4822 Telegraph and other communications
4832 Radio broadcasting stations
4833 Television broadcasting stations
4841 Cable and other pay TV services
4899 Communication services, nec

ELECTRIC, GAS, AND SANITARY SERVICES
4911 Electric services
4922 Natural gas transmission
4923 Gas transmission and distribution
4924 Natural gas distribution
4925 Gas production and/or distribution
4931 Electric and other services combined
4932 Gas and other services combined
4939 Combination utilities, nec
4941 Water supply
4952 Sewerage systems
4953 Refuse systems
4959 Sanitary services, nec
4961 Steam and air conditioning supply
4971 Irrigation systems

WHOLESALE TRADE

WHOLESALE TRADE, DURABLE GOODS
5012 Automobiles and other motor vehicles
5013 Motor vehicle supplies and new parts
5014 Tires and tubes
5015 Motor vehicle parts, used
5021 Furniture
5023 Home furnishings
5031 Lumber, plywood, and millwork
5032 Brick, stone, and related materials
5033 Roofing, siding, and insulation
5039 Construction materials, nec
5043 Photographic equipment and supplies
5044 Office equipment
5045 Computers, peripherals, and software
5046 Commercial equipment, nec
5047 Medicinal and hospital equipment
5048 Ophthalmic goods
5049 Professional equipment, nec
5051 Metals service centers and offices
5052 Coal and other minerals and ores
5063 Electrical apparatus and equipment
5064 Electrical appliances, TV and radios
5065 Electronic parts and equipment
5072 Hardware
5074 Plumbing and hydronic heating supplies
5075 Warm air heating and air conditioning
5078 Refrigeration equipment and supplies
5082 Construction and mining machinery
5083 Farm and garden machinery
5084 Industrial machinery and equipment
5085 Industrial supplies
5087 Service establishment equipment
5088 Transportation equipment and supplies
5091 Sporting and recreational goods
5092 Toys and hobby goods and supplies
5093 Scrap and waste materials
5094 Jewelry and precious stones
5099 Durable goods, nec

WHOLESALE TRADE, NONDURABLE GOODS
5111 Printing and writing paper
5112 Stationery and office supplies
5113 Industrial and personal service paper
5122 Drugs, proprietaries, and sundries
5131 Piece goods and notions
5136 Men's and boys' clothing
5137 Women's and children's clothing
5139 Footwear
5141 Groceries, general line
5142 Packaged frozen foods
5143 Dairy products, except dried or canned
5144 Poultry and poultry products
5145 Confectionery
5146 Fish and seafoods
5147 Meats and meat products
5148 Fresh fruits and vegetables
5149 Groceries and related products, nec
5153 Grain and field beans
5154 Livestock
5159 Farm-product raw materials, nec
5162 Plastics materials and basic shapes
5169 Chemicals and allied products, nec
5171 Petroleum bulk stations and terminals
5172 Petroleum products, nec
5181 Beer and ale
5182 Wines and distilled beverages
5191 Farm supplies
5192 Books, periodicals, and newspapers
5193 Flowers and florists' supplies
5194 Tobacco and tobacco products
5198 Paints, varnishes, and supplies
5199 Nondurable goods, nec

RETAIL TRADE

BUILDING MATERIALS AND GARDEN SUPPLIES
5211 Lumber and other building materials
5231 Paint, glass, and wallpaper stores
5251 Hardware stores
5261 Retail nurseries and gardens
5271 Mobile home dealers

GENERAL MERCHANDISE STORES
5311 Department stores
5331 Variety stores
5399 Miscellaneous general merchandise stores

FOOD STORES
5411 Grocery stores
5421 Meat and fish markets
5431 Fruit and vegetable markets
5441 Candy, nut, and confectionery stores
5451 Dairy products stores
5461 Retail bakers
5499 Miscellaneous food stores

AUTOMOTIVE DEALERS AND SERVICE STATIONS
5511 New and used car dealers
5521 Used car dealers
5531 Auto and home supply stores
5541 Gasoline service stations
5551 Boat dealers
5561 Recreational vehicle dealers
5571 Motorcycle dealers
5599 Automotive dealers, nec

APPAREL AND ACCESSORY STORES
5611 Men's and boys' clothing stores
5621 Women's clothing stores
5632 Women's accessory and specialty stores
5641 Children's and infants' wear stores
5651 Family clothing stores
5661 Shoe stores
5699 Miscellaneous apparel and accessory stores

FURNITURE AND HOME FURNISHINGS STORES
5712 Furniture stores
5713 Floor covering stores
5714 Drapery and upholstery stores
5719 Miscellaneous home furnishings stores
5722 Household appliance stores
5731 Radio, TV, and electronic stores
5734 Computer and software stores
5735 Record and prerecorded tape stores
5736 Musical instruments stores

EATING AND DRINKING PLACES
5812 Eating places
5813 Drinking places

MISCELLANEOUS RETAIL
5912 Drugstores and proprietary stores
5921 Liquor stores
5932 Used merchandise stores
5941 Sporting goods and bicycle shops
5942 Book stores
5943 Stationery stores
5944 Jewelry stores
5945 Hobby, toy, and game shops
5946 Camera and photographic supply stores
5947 Gift, novelty, and souvenir shops
5948 Luggage and leather goods stores
5949 Sewing, needlework, and piece goods
5961 Catalog and mail order houses
5962 Merchandising machine operators
5963 Direct selling organizations
5983 Fuel oil dealers
5989 Fuel dealers, nec
5984 Liquefied petroleum gas dealers
5992 Florists
5993 Cigar stores and stands
5994 News dealers and newsstands
5995 Optical goods stores
5999 Miscellaneous retail stores, nec

FINANCE, INSURANCE & REAL ESTATE

DEPOSITORY INSTITUTIONS
6011 Federal Reserve banks
6019 Central reserve depository, nec
6021 National commercial banks
6022 State commercial banks
6029 Commercial banks, nec
6035 Federal savings institutions
6036 Savings institutions, except federal
6061 Federal credit unions
6062 State credit unions
6081 Foreign banks and branches and agencies
6082 Foreign trade and international banks
6091 Nondeposit trust facilities
6099 Functions related to deposit banking

NONDEPOSITORY INSTITUTIONS
6111 Federal and federally-sponsored credit
6141 Personal credit institutions
6153 Short-term business credit
6159 Miscellaneous business credit institutions
6162 Mortgage bankers and correspondents
6163 Loan brokers

Note: nec = not elsewhere classified.

SIC CODES
(Continued)

SIC Code	Industry
SECURITY AND COMMODITY BROKERS	
6211	Security brokers and dealers
6221	Commodity contracts brokers, dealers
6231	Security and commodity exchanges
6282	Investment advice
6289	Security and commodity services, nec
INSURANCE CARRIERS	
6311	Life insurance
6321	Accident and health insurance
6324	Hospital and medical service plans
6331	Fire, marine, and casualty insurance
6351	Surety insurance
6361	Title insurance
6371	Pension, health, and welfare funds
6399	Insurance carriers, nec
INSURANCE AGENTS, BROKERS, AND SERVICE	
6411	Insurance agents, brokers, and service
REAL ESTATE	
6512	Nonresidential building operators
6513	Apartment building operators
6514	Dwelling operators, except apartments
6515	Mobile home site operators
6517	Railroad property lessors
6519	Real property lessors, nec
6531	Real estate agents and managers
6541	Title abstract offices
6552	Subdividers and developers, nec
6553	Cemetery subdividers and developers
HOLDING AND OTHER INVESTMENT OFFICES	
6712	Bank holding companies
6719	Holding companies, nec
6722	Management investment, open-end
6726	Investment offices, nec
6732	Educational, religious, etc. trusts
6733	Trusts, nec
6792	Oil royalty traders
6794	Patent owners and lessors
6798	Real estate investment trusts
6799	Investors, nec

SERVICES

SIC Code	Industry
HOTELS AND OTHER LODGING PLACES	
7011	Hotels and motels
7021	Rooming and boarding houses
7032	Sporting and recreational camps
7033	Trailer parks and campsites
7041	Membership-basis organization hotels
PERSONAL SERVICES	
7211	Power laundries, family and commercial
7212	Garment pressing and cleaners' agents
7213	Linen supply
7215	Coin-operated laundries and cleaning
7216	Dry cleaning plants, except rug
7217	Carpet and upholstery cleaning
7218	Industrial launderers
7219	Laundry and garment services, nec
7221	Photographic studios, portrait
7231	Beauty shops
7241	Barber shops
7251	Shoe repair and shoeshine shops
7261	Funeral service and crematories
7291	Tax return preparation services
7299	Miscellaneous personal services, nec
BUSINESS SERVICES	
7311	Advertising agencies
7312	Outdoor advertising services
7313	Radio, TV, publisher representatives
7319	Advertising, nec
7322	Adjustment and collection services
7323	Credit reporting services
7331	Direct mail advertising services
7334	Photocopying and duplicating services
7335	Commercial photography
7336	Commercial art and graphic design
7338	Secretarial and court reporting
7342	Disinfecting and pest control services
7349	Building maintenance services, nec
7352	Medical equipment rental
7353	Heavy construction equipment rental
7359	Equipment rental and leasing, nec
7361	Employment agencies
7363	Help supply services
7371	Computer programming services
7372	Prepackaged software
7373	Computer integrated systems design
7374	Data processing services
7375	Information retrieval services
7376	Computer facilities management
7377	Computer rental and leasing
7378	Computer maintenance and repair
7379	Computer related services, nec
7381	Detective and armored car services
7382	Security systems services
7383	News syndicates
7384	Photofinishing laboratories
7389	Business services, nec
AUTOMOTIVE REPAIR, SERVICES, AND PARKING	
7513	Truck rental and leasing, no drivers
7514	Passenger car rental
7515	Passenger car leasing
7519	Utility trailer rental
7521	Automobile parking
7532	Top and body repair and paint shops
7533	Auto exhaust system repair shops
7534	Tire retreading and repair shops
7536	Automotive glass replacement shops
7537	Automotive transmission repair shops
7538	General automotive repair shops
7539	Automotive repair shops, nec
7542	Car washes
7549	Automotive services, nec
MISCELLANEOUS REPAIR SERVICES	
7622	Radio and television repair
7623	Refrigeration service and repair
7629	Electrical repair shops, nec
7631	Watch, clock, and jewelry repair
7641	Reupholstery and furniture repair
7692	Welding repair
7694	Armature rewinding shops
7699	Repair services, nec
MOTION PICTURES	
7812	Motion picture and video production
7819	Services allied to motion pictures
7822	Motion picture and tape distribution
7829	Motion picture distribution services
7832	Motion picture theaters except drive-in
7833	Drive-in motion picture theaters
7841	Video tape rental
AMUSEMENT AND RECREATION SERVICES	
7911	Dance studios, schools, and halls
7922	Theatrical producers and services
7929	Entertainers and entertainment groups
7933	Bowling centers
7941	Sports clubs, managers, and promoters
7948	Racing, including track operation
7991	Physical fitness facilities
7992	Public golf courses
7993	Coin-operated amusement devices
7996	Amusement parks
7997	Membership sports and recreation clubs
7999	Amusement and recreation, nec
HEALTH SERVICES	
8011	Offices and clinics of medical doctors
8021	Offices and clinics of dentists
8031	Offices of osteopathic physicians
8041	Offices and clinics of chiropractors
8042	Offices and clinics of optometrists
8043	Office and clinics of podiatrists
8049	Offices of health practitioners, nec
8051	Skilled nurse care facilities
8052	Intermediate care facilities
8059	Nursing and personal care, nec
8062	General medical and surgical hospitals
8063	Psychiatric hospitals
8069	Specialty hospitals, except psychiatric
8071	Medical laboratories
8072	Dental laboratories
8082	Home health care services
8092	Kidney dialysis centers
8093	Specialty outpatient clinics, nec
8099	Health and allied services, nec
LEGAL SERVICES	
8111	Legal services
EDUCATIONAL SERVICES	
8211	Elementary and secondary schools
8221	Colleges and universities
8222	Junior colleges
8231	Libraries
8243	Data processing schools
8244	Business and secretarial schools
8249	Vocational schools, nec
8299	Schools and educational services, nec
SOCIAL SERVICES	
8322	Individual and family services
8331	Job training and related services
8351	Child day care services
8361	Residential care
8399	Social services, nec
MUSEUMS, BOTANICAL, ZOOLOGICAL GARDENS	
8412	Museums and art galleries
8422	Botanical and zoological gardens
MEMBERSHIP ORGANIZATIONS	
8611	Business associations
8621	Professional organizations
8631	Labor organizations
8641	Civic and social associations
8651	Political organizations
8661	Religious organizations
8699	Membership organizations, nec
ENGINEERING AND MANAGEMENT SERVICES	
8711	Engineering services
8712	Architectural services
8713	Surveying services
8721	Accounting, auditing, and bookkeeping
8731	Commercial physical research
8732	Commercial nonphysical research
8733	Noncommercial research organizations
8734	Testing laboratories
8741	Management services
8742	Management consulting services
8743	Public relations services
8744	Facilities support services
8748	Business consulting, nec
PRIVATE HOUSEHOLDS	
8811	Private households
SERVICES, NEC	
8999	Services, nec

Note: nec = not elsewhere classified

SIC CODES
(Continued)

SIC Code	Industry

PUBLIC ADMINISTRATION

EXECUTIVE, LEGISLATIVE, AND GENERAL
- 9111 Executive offices
- 9121 Legislative bodies
- 9131 Executive and legislative combined
- 9199 General government, nec

JUSTICE, PUBLIC ORDER, AND SAFETY
- 9211 Courts
- 9221 Police protection
- 9222 Legal counsel and prosecution
- 9223 Correctional institutions
- 9224 Fire protection
- 9229 Public order and safety, nec

FINANCE, TAXATION, AND MONETARY POLICY
- 9311 Finance, taxation, and monetary policy

ADMINISTRATION OF HUMAN RESOURCES
- 9411 Administration of educational programs
- 9431 Administration of public health programs
- 9441 Administration of social and manpower programs
- 9451 Administration of veterans' affairs

ENVIRONMENTAL QUALITY, AND HOUSING
- 9511 Air, water, and solid waste management
- 9512 Land, mineral, wildlife conservation
- 9531 Housing programs
- 9532 Urban and community development

ADMINISTRATION OF ECONOMIC PROGRAMS
- 9611 Admin. of general economic programs
- 9621 Regulation, admin. of transportation
- 9631 Regulation, administration of utilities
- 9641 Regulation of agricultural marketing
- 9651 Regulation of misc. commercial sectors
- 9661 Space research and technology

NATIONAL SECURITY AND INTERNATIONAL AFFAIRS
- 9711 National security
- 9721 International affairs

NONCLASSIFIABLE ESTABLISHMENTS

- 9999 Nonclassifiable establishment

Section 2.

Specific Waste Reduction Measures By Local Governments

This section presents approaches for developing local government solid waste reduction programs. Specific information on educating business and industry on the benefits of implementing waste reduction programs is followed by a discussion of cost-avoidance issues.

Section 2. Specific Waste Reduction Measures by Local Governments

A. Educating Business and Industry

To effectively educate business and industry about source waste reduction and recycling, local governments must consider both the messages they want to convey and the means by which to convey them. This section explores some information agencies may want to share with local business and industry and different forums for getting the information across.

The Messages

Although business and industry may not enjoy hearing about another round of government rules that affects their lives and possibly their profits, they should understand the framework and the reasons behind the push to recycle and reduce waste. The message can include explanations of the following Federal and State regulations governing solid waste:

Federal & State Regulations

- **Subtitle D landfill regulations, including requirements for liners, leachate collection, gas control, more stringent siting and closure procedures, post-closure care, financial assurance, etc.**
- **NC Solid Waste Management Act (GS 130A-309), including the waste reduction goals, the hierarchy of waste management techniques, bans on materials, reporting and planning requirements, etc.**
- **Any other laws and regulations that are appropriate to explain including legislation currently under consideration by Congress and the State legislature.**

The Problems With Disposal

For business and industry to understand the reasons behind the regulations in place and why disposal costs are going up, they may need to learn more about the problems associated with disposal:

- **The generation of leachate in landfills and its threat to groundwater.**
- **The generation of explosive gases in landfills as waste decomposes.**
- **The time waste takes to decompose in landfills and the need for long-term monitoring.**
- **The time and effort involved in siting new landfills.**
- **Long-term liability by local governments and industries.**

The Local Situation

[Many local businesses and industries may not understand or may not have received information about the local solid waste management situation. Information to share would include:

- **The remaining life on the current landfill, plans for the next disposal facility, and the basic timetable for disposal issues.**
- **The transfer of waste out of the county through a contract with a private landfill.**
- **The operation of local transfer stations and any restrictions that may apply.**
- **The current fee structure and future fees. Also, current expenditures on solid waste, how they have changed, and how they can be expected to change in the future.**
- **Current local solid waste policies including local ordinances, programs, disposal bans, and plans for future policies and programs.**
- **The local waste stream and contributions by local commercial and industrial waste.**

Cost Concerns

In connection with these, local governments should address the issue of cost head on with business and industry. In addition to waste management facilities and other government program costs, discussions should concern specific costs associated with commercial and industrial waste such as those for waste container purchase and rental and hauling, disposal, and in-house waste handling.

Although a local government may not know the specific cost breakdown for each company, it is important to help business and industry see clearly the cost components (see also the discussion of cost avoidance below).

Benefits of Waste Reduction and Recycling

Although business and industry may be most concerned about cost issues and the bottom line, it is also important to share with them the benefits of source reduction and recycling to society and the environment. Business and industry leaders are also citizens, and most of them have an interest in protecting the environment and helping their community. The advantages of source reduction and recycling can be emphasized:

- **Saves Energy. Most recycled materials require less energy in the manufacturing process than virgin products; for example, recycled aluminum cans require 90 percent less energy to produce than virgin bauxite ore to produce new aluminum cans.**

- **Protects Natural Resources. With waste reduction/recycling, trees are saved, less ore is mined, and less oil is used. In addition, good commodities get a chance at a second economic life through recycling.**
- **Prevents Air and Water Pollution. Many manufacturing processes involving recycled materials produce less air and wastewater emissions than virgin materials.**
- **Creates Jobs As more infrastructure and businesses develop to handle, process, and reuse recycled materials, the economy is bolstered.**

The Importance of Buying Recycled

Part of the "Big Picture" that local government can share with business and industry is that if no one buys recycled-content products, recycling will fail. The loop must be completed for true recycling to occur. Business and industry should be encouraged to do their part by considering the following:

- **Setting company goals for buying recycled-content products such as paper and other office supplies.**
- **Working with suppliers and vendors to obtain products with recycled content. Companies can exercise enormous consumer power especially if they are willing to shop around for recycled-content.**
- **Working with other local businesses in cooperative purchasing of recycled-content products.**
- **Joining the National Recycling Coalition's (NRC's) Business Alliance and Buy-Recycled Campaign. The Alliance, which involves major U.S. corporations such as Sears and IBM, has made $2.7 billion in purchases to date of recycled-content products. It seeks to add 5,000 new businesses to the Alliance over the next two years. The NRC Alliance contact is Phil Bailey, (202) 625-6406. Section 5 contains more information on recycled product procurement.**

Local governments need to determine the information they wish to share and the information business and industry needs. Although there may be time and space constraints, the important point is to help business and industry understand the background and context under which local solid waste programs now operate. (See Section 4. Exploring Options).

C/I Waste Handled By Private Haulers

In many communities, private waste haulers "control" a large portion of the C/I waste stream through disposal contracts with local businesses and industries. Even in this situation, local government can reach out to these companies and encourage them to reduce and recycle their waste. In many cases, the companies will respond to the messages of cost savings, protection of the environment, and the importance of meeting state and local waste reduction goals. They only need some assistance in assessing their situation and in getting a waste reduction program started.

In addition, local governments can work with the private haulers to urge them to offer recycling services to their customers. Technical assistance such as with handling and marketing materials, may encourage private haulers to get involved. Local governments also can use the power of local ordinances and enforcement to drive recycling activities by private haulers.

B. Cost Avoidance

In discussions with business and industry, a local government may find that the only message they hear is the effect of source reduction and recycling on the bottom line. In that case, local government needs to address these cost concerns by emphasizing the whole waste management picture in relation to business costs. With some exceptions, many businesses and industries may not totally understand two critical aspects of waste:

- **The company's current total solid waste management costs, and**
- **The potential for cost avoidance through the implementation of source reduction and recycling.**

Local government can lead business and industry to recycling options by walking them through both these aspects. In the case of cost avoidance, local government's message to business and industry will be particularly effective in conjunction with information on current and future disposal costs and fees.

One tool for helping business and industry see the total waste cost picture is a waste cost "balance sheet." Below is an outline of such a balance sheet which identifies most waste costs a business or industry experiences, including the addition of a recycling program.

Waste Cost Balance Sheet

Itemized Costs

A.	**Waste fixed asset cost (e.g., dumpsters, roll-offs)**
B.	**+ In-house waste handling costs**
C.	**+ Hauling costs**
D.	**+ Disposal costs**
E.	**Total Waste Costs**
F.	**+ Recycling fixed assets costs (e.g., balers, bins)**
G.	**+ Recycling operational costs (material handling)**
H.	**+ Recycling hauling costs**
I.	**Total Waste + Recycling Cost**
J.	**- Avoided waste fixed asset cost**
K.	**- Avoided waste hauling costs**
L.	**- Avoided in-house waste operations cost**
M.	**- Avoided disposal costs**
N.	**- Value of tax incentives for resource recovery**
O.	**- Recycling revenues**
P.	**Total cost of waste program including recycling**

If "Bottom Line" P is less than Line E, recycling is a profit winner.

Some items in this balance sheet may require additional fact-gathering before it can be completed. For example, a company may not know its in-house waste handling costs and need to examine and quantify the number of employees, the t spent, and containers and equipment used to handle wastes.

A local government can help business and industry complete a balance sheet. Particularly, the local government can provi critical information on actual and anticipated disposal costs, breaks for the installation of recycling equipment, and on pos revenues a business can expect from the sale of its recylables.

An Important Tool: Resource Recovery Tax Breaks

As noted on the balance sheet, businesses and industries that resource recovery equipment are eligible for property and

corporate income tax credits. These credits can be a persuasive part of a program to convince companies to recycle. For more information on how the tax credits work, refer to North Carolina Special Tax Provisions for Recycling and Resource Recovery at the end of this section.

Companies may respond more quickly to appeals to the bottom line through peer examples. Case studies in Section 5 demonstrate the potential of recycling and waste reduction. In addition, below is a theoretical example also illustrating the principles of cost avoidance.

Maximizing Inputs/Minimizing Waste

One aspect of cost that local governments can communicate to companies is the concept of maximizing inputs to make outputs. A company purchases inputs to be able to make products or provide services. If some of those inputs end up as waste, the companies have paid for things they can not use: they have not got their money's worth for the purchase. Added to this bleak scenario is the likelihood that they will have to pay a disposal cost on the waste input. Companies who are smart consumers will demand that their suppliers help them reduce waste, which includes providing quality products as well as minimal packaging - which, in turn, can either be reused or recycled. These steps may substantially reduce a company's unnecessary purchases and improve its bottom line.

The Adventures of Company Z

A Simple Example of Cost Avoidance

Company Z manufactures widgets for sale nationwide. Many of its raw materials come packaged in corrugated cardboard boxes. In fact, cardboard represents half the company's waste. Company Z rents a 30-yd^3 roll-off container from a private waste hauler for $50 a month. The hauler takes full loads from the company to the landfill once a week and charges $70 per haul. Company Z is charged a tipping fee of $20 per ton at the landfill; each of its loads weighs about 4 tons.

Current Waste Costs for Company Z

Total annual waste stream: 52 weeks x 4 tons/wk. = 208 tons	
Total annual tipping fees: 208 tons x $20/ton	**$4,160**
Total annual container rent: 12 months x $50/month	600
Total Annual hauling costs: 52 weeks x $70/haul	3,640
Total Annual (external) Waste Handling Costs	8,400
(Total annual costs if tipping fee is $40/ton =	**$12,560)**

After examining its waste stream and current waste costs, Company Z decides to buy a baler to recycle its cardboard. The Company works with the local recycling coordinator to help institute the program and to find a market for the cardboard. Company Z realizes that recycling entails some costs, but it sees recycling as a way to avoid even bigger costs in the long run.

Annual "Cost" of Recycling for Company Z

Annualized cost of purchase and installation of baler: ($7,500 divided by 5 years; baler lasts 12 years)	**$1,500**
Cost of baling wire per year for cardboard baler:	**210**
Annual cost of electricity and maintenance of baler:	400
Added personnel operating costs of using baler: (Two hours/wk at $8/hr)	830
Avoided hauling fees (No. of hauls cut in half)	(1820)
Avoided tipping fees (at $20/ton)	(2,080)
Revenue from sale of cardboard ($l0/ton)	(1,040)
Total cost (savings) from recycling:	($2,000)

In addition, Company Z has saved 200 yd^3 of space in the landfill, thereby helping the county stave off the day when it must find a new landfill. The recycling of 104 tons of paper has also saved about 1,750 trees, saved water, has helped prevent air and water pollution, and has saved 426,000 kWh of energy.

Buoyed by its success, Company Z re-examines its waste stream and discovers other items to recycle such as office paper, metal hands, film plastic, aluminum cans, and pallets. Company Z once more contacts the local recycling coordinator for assistance in finding markets for these items.

The Rhode Island Lesson

In 1991, as required by law, 122 companies with over 250 employees each reported to the State of Rhode Island on their solid waste management practices. At least two thirds of the group reported that they either saved money or experienced no additional costs by instituting a recycling program; over half reported that recycling helped their bottom line.

Even when recycling efforts cost the business, those costs were modest. For instance, the range of net savings reported ($1,400 to $108,000) was much greater than the range of costs ($200 to $5,175). Because many of the costs were associated with start-up, companies can expect more savings in ensuing years.

C. Waste Reduction Assistance

Local governments can utilize several means for sharing information with business and industry.

Specific measures that North Carolina local governments have undertaken to help businesses and industries reduce waste include:

- **Workshops/Seminars**
- **Waste Assessments**
- **Material Restriction Ordinances**
- **Local Waste Exchange Programs**
- **Information Resources**
- **Awards Programs**
- **Financial Incentives**
- **Buy-Back Programs**
- **Task Forces**
- **Recycling Education Programs**
- **On-Site Assistance**
- **Surveys/Questionnaires**
- **Source Reduction Programs**
- **A Designated Commercial Recycling Coordinator**

A matrix at the end of this section depicts activities in which 26 selected North Carolina local governments are engaged. For help with designing waste reduction programs targeted at business and industry, contact the communities listed to learn about the services they offer.

Workshops/Seminars

Workshops are productive forums for providing information and exploring solutions to local commercial/industrial (C/I) waste problems. Business and industry can receive concentrated presentations on substantive topics and can network with local officials and each other on solid waste issues. Workshops can be conducted in collaboration with other civic groups such as the Chamber of Commerce, Industrial Development Boards, the Cooperative Extension Service, and the Office of Waste Reduction. Workshops may, however, fail to reach important members of the business community if they are unable to attend. To maximize attendance, workshops should take up only a half day or less.

Several counties and municipalities have sponsored commercial/industrial waste reduction workshops or seminars. These meetings, usually half-day sessions, are designed to help businesses and industries understand the importance of reducing their waste streams. Topics typically covered include:

- **State solid waste management laws;**
- **County/municipal waste reduction measures;**
- **Establishing source reduction, reuse, and recycling programs;**
- **Handling specific materials such as pallets;**
- **Resources available to assist in waste reduction;**
- **Examples of waste reduction efforts by local businesses and industries; and**
- **Opportunities to build a local support network for recycling techniques, markets, and waste solutions.**

Invited seminar speakers often include state and local solid waste management personnel, representatives from businesses with successful waste reduction programs, local waste handlers, and the director of the Southeast Waste Exchange.

Additional information may be obtained from the local governments listed in the matrix that have held workshops and seminars. A sample agenda from Gaston County is in the appendix.

Waste Assessments

To help businesses reduce their waste, local government solid waste managers need to know the materials in their waste stream. The best procedure for identifying the amount and types of wastes generated is to perform a waste assessment, a systematic observation of the types of waste generated and disposed. Several local governments are either performing waste assessments or offering waste assessments training as a service to business and industry.

New Hanover County

Recognizing that almost 70 percent of the solid waste generated in New Hanover County comes from business and industry, the New Hanover County Department of Environmental Management (NHC-DEM) began offering services to help those sectors reduce their waste and launched its waste assessment service in November 1992 to businesses and industries that requested them.

NHC-DEM staff perform a careful evaluation of the waste produced and the operations associated with the generation of the waste. During the assessment, the questions asked concern possibilities for recycling/reusing waste and changes/modifications to avoid generating certain wastes. (See Section III. Conducting A Solid Waste Assessment.) The staff also points out the potential ravings that can be realized through source reduction, reduced tipping fees, and revenues gained from the sale of recyclables.

For additional information, contact Tim Cole, New Hanover County, Department of Environmental Management, Waste Reduction Program, 3002 US Hwy 421 North, Wilmington, N.C. 28401, (910) 341-4373.

Material Restriction Ordinances

landfills. Many of the surcharges/bans are imposed on corrugated cardboard, which primarily affect the business/industry/ institutional sectors. Some ordinances affect a range of recyclables or waste specific to the community. It is important to set up education, monitoring, and enforcement programs to increase the effectiveness of this method. A possible side effect of bans/surcharges is an increase in illegal dumping. Approaches to

managing solid waste by the Town of Blowing Rock and Davidson County are described below.

Town of Blowing Rock

In 1990, the Town of Blowing Rock adopted an ordinance requiring all businesses to separate recyclables from solid waste into containers to be serviced by the Town. The decision was based on the estimate that 20 to 30 percent of the town's total waste stream was generated by the commercial sector and that more than 50 percent of that waste was recyclable. Businesses are required to separate glass, paper, metal, and plastics for recycling, and these materials are collected by the Town. Since the penalty for failure to participate is that garbage collection services will be suspended, it is not surprising that this program has resulted in 100 percent participation by businesses.

Questions about this program may be directed to Chris May, Town Manager, Town of Blowing Rock, Post Office Box 47, Blowing Rock, N.C. 28605, (704) 295-5220.

Davidson County

Because of the large number of furniture manufacturing companies in Davidson County, the County proposed during the 1992-93 budget process to acquire a wood shredder. Before a wood waste reduction program could be implemented, Todco, a local hauling and landscape supply company, announced its plans to collect, process, and market wood and yard waste. Thus, an agreement was made between the Davidson County Board of Commissioners and Todco whereby the county would ban all wood waste from the landfill and Todco would accept this waste for recycling. Todco would charge less for the wood waste than the county's disposal fee.

The agreement became effective December 15,1992, at which time all wood and yard waste was banned from the Davidson County Landfill and Todco began accepting all wood and yard waste. (Todco is conveniently located next to the entrance to the landfill.)

Todco utilizes a chipper to process wood waste into mulch or boiler-fuel material and composts the yard waste. An added incentive for the waste diversion is that Todco's tipping fee is $6.30 per ton less than the county's tipping fee, or a savings of almost 30 percent.

For more information about this unique solution to wood waste disposal, contact Bob McIntyre or Jean Alexander at the Davidson County Integrated Solid Waste Management Department, Route 1, Box 678, Lexington, N.C . 27292, (704) 242-2284.

Local Waste Exchange Programs

Some local governments are establishing formal or informal waste exchange programs for business and industry. The local government acts as a "go-between," linking generators of potentially reusable or recyclable wastes with those who can use them as raw feedstock or recycle them.

Pitt County

Pitt County has developed a form to use in linking business and industry in a waste exchange program. The four categories addressed on the form provide businesses the opportunity to list information about waste:

- **Major waste products that are not presently being recycled or reused;**
- **Possible overstocks, seconds, or waste products that a public service agency could distribute, schools could use in class rooms, or another business could use;**
- **Raw materials used in the manufacturing process that another business may generate as a waste product; and**
- **Materials needed or used that another business may generate as a waste product.**

Pitt County has been successful in helping a local apparel manufacturer reroute textile waste previously sent to the local landfill to the Salvation Army, which uses it to stuff mattresses for shelters for the homeless. In another waste exchange example, waste from a local diaper manufacturing process is used by another company as feedstock for making plastic fence posts.

For more information about Pitt County's waste exchange program, contact Joy Hudson, Pitt County Solid Waste Department, 1717 West Fifth Street, Greenville, N.C. 27834, (919) 830-6354.

Scrap Material Exchanges

A scrap material exchange takes industrial scraps or printer overuns and supplies them to educators and others in need of inexpensive resources for the creative arts. This type of exchange is popular with school teachers because they can receive low-cost materials to supplement school supplies. Materials are reused instead of being added to the landfill.

Durham

The Scrap Exchange in Durham is a non-profit organization founded in 1991. The Exchange collects scrap material from industry such as textile discards, vinyl records, foam cut-outs, and

ribbon and resells them for the creative arts. The materials are sold by the grocery bag or as individual items and can be used in workshops, at birthday parties, and for other events. For more information, contact Chris Rosenthal, The Scrap Exchange, (919) 286-2559.

Information Resources

Direct Mail

Direct mail is an effective way to reach all the business and industrial community with important information and is especially appropriate for announcements of programs, policies, and awards and for soliciting ideas and information. However, direct mail can be expensive, is less personal and effective than workshops and task forces, and offers only passive opportunities for networking. Examples of the kinds of items that can be sent through direct mail are surveys, brochures/ pamphlets, newsletters, fact sheets, directories, and vendor and market lists. Topics addressed may include a description of the waste problem and the importance of waste reduction, saving money through waste reduction, conducting a waste audit, and setting up an in-house source reduction/recycling program. The latter should include information on locating markets and promoting the program.

Mecklenburg County and Winston-Salem

Among the several North Carolina communities that have generated a variety of materials are Mecklenburg County, which has developed an array of printed materials to encourage waste reduction, and Winston-Salem, which produced a booklet, "Guide to Business Recycling," with funding assistance from a local industry and a television station. (See Local Government Contact List for contact information.)

News Releases

News releases are also effective for making announcements, requesting solicitations, and sharing general information with the business community. News releases can be either general through local newspapers, radio, and television or targeted through local Chamber of Commerce publications. In some instances, the agency may be able to reserve regular column space in the local paper or a regular time slot on local radio. As with direct mail, news releases are fairly impersonal and may not promote networking.

Awards Programs

An awards program that recognizes waste reduction efforts acts as a strong incentive to encourage businesses and industries. Several local governments in North Carolina have recently implemented programs to encourage business recycling and reduction and to recognize those businesses that have made strides towards

becoming "waste light." The North Carolina Recycling Association (NCRA) has developed a brochure titled "Waste Reduction Awards Program - Put a Wrap on It" that lists easy steps for establising a commercial waste reduction awards program and lists communities that have begun their own programs.

Chatham County

The Chatham County Recycling Program sponsors a Business Recycling Partnership Award to acknowledge those firms that have made significant strides in reducing their waste. The County has developed a form on which businesses indicate the materials they are recycling, materials they are reusing, source reduction measures they have taken, and their recycled product procurement efforts. The awards brochure lists the benefits of earning a Business Recycling Partnership Award:

- **The company receives a window seal and a certificate which recognizes the business for its waste reduction efforts,**
- **The company name will be listed biannually in the Chatham News and Record as a Business Recycling Partner,**
- **One business will be distinguished as the Outstanding Recycling Partner before the County Board of Commissioners each year, and**
- **The company's name will be engraved on a special plaque that hangs in the main county office building.**

Questions about this program should be directed to Matthew Young, Chatham County Recycling Department, Post Office Box 87, Pittsboro, N.C. 27312, (919) 542-8255.

Financial Incentives

Financial incentives can effectively motivate businesses to reduce waste. Duplin County has developed a multi-faceted financial incentive program for its businesses and industries.

Duplin County

-First, the County does not charge a tipping fee at the landfill for recyclable materials; a $26.85 per-ton savings for recyclables encourages companies to separate their loads.

- Second, businesses and industries in rural areas of Duplin County may receive free pick-up of mixed paper including cardboard. The County provides each company a bright blue dumpster for mixed paper storage and twice-a-week pickup.

- **Finally, the County offers reduced tipping fees for pallets, wood waste, and other rubble at the landfill to encourage separation of these materials.**

Questions about Duplin County's financial incentives should be directed to Teresa Quinn, Recycling Coordinator, Duplin County Landfill, Post Office Box 476, Kenansville, N.C. 28349, (910) 289-3091.

Buy-Back Programs

Another financial incentive to recycle is a commercial buy-back program wherein the local government assists companies by providing a local market for recyclables. Franklin County developed such a program to encourage businesses and industries to recycle. This rural county has no local infrastructure for recycling, nor is there a private materials recovery facility or paper dealer. However, the County developed a plan to reduce the amount of old corrugated cardboard (OCC) going to the landfill by establishing a buy-back program.

Franklin County

The County solid waste staff identified the sources of OCC. They approached large OCC generators and convinced them to bale and ship their own OCC to market.

Small and medium-sized generators were targeted separately because of the expense to purchase a baler or to collect OCC loose and transport it to the nearest paper dealer in Raleigh.

After adding up their assets - a baler at the landfill, a market for OCC, and businesses that already were responsible for bringing waste to the landfill - the County staff developed the following incentive approach: if the smaller businesses would separate out the OCC from their trash and bring it to the landfill, the County would pay them 80 percent of the market price for the it. Thus, in 1992, the County paid $10.80 per ton for the business cardboard and received $13 per ton for it. Furthermore, businesses avoided paying the landfill tipping fee of $18 per ton. The only costs to the County are 2 hours of labor per ton to bale the OCC and the electricity to operate the baler. The program has cut 50 percent of the waste stream of these businesses.

For more information, contact John Faulkner, Solid Waste Director, Franklin County Solid Waste Department, Post Office Box 529, Louisburg, N.C. 27549, (919) 496-5002.

Task Forces

Task Forces can be critical for mobilizing local business and industry to adopt and work toward a community's waste reduction

	goals. By involving business and industry directly in addressing solid waste issues, local government may raise the credibility of its C/I program. On the other hand, task forces require sustained effort by members and also may fail to reach important audiences.
	A joint public/private task force to address business recycling can be an effective waste reduction tool. Some the activities task force members can perform include developing waste reduction plans to meet local and state goals, generating educational materials, holding seminars and workshops, and implementing promotion/awareness campaigns.
Wake County	**In 1992, the Wake County Solid Waste Advisory Committee (SWAC) appointed a Private and Public Waste Reduction Task Force to recommend strategies to reduce commercial waste. The Task Force comprised private and public sector representatives and was divided into subgroups of large business, small business, industries, institutions, property management and multi-family housing operations, restaurants, and local and state government. Each subgroup researched and reported on current waste reduction activities, options for reduction, and government's role as relevant to its sector. The reports were assembled into a manual which Wake County utilizes to address commercial and industrial waste management.**
	For more information about Wake County's solid waste task force, contact Lynda Fuller, County of Wake, Community Development Services, Solid Waste Division, Post Office Box 550, Raleigh, N.C. 27602, (919) 856-5597.
Recycling Collection Programs	**Local governments can provide direct recycling assistance to business and industry by collecting their recyclables. The agency usually provides a container(s) and/or collection service at either no charge or a reduced rate. This type of service is convenient for companies, and it will achieve a high participation rate and materials diversion rate. However, this service can be expensive and labor-intensive for local governments.**
City of Greensboro	**The City of Greensboro began a recycling collection program for the business community. The annual recycling collection for Greensboro businesses allows them to recycle nine items: mixed office paper, aluminum cans, cardboard, PVC plastic, magazines, PET plastic, white ledger, chipboard, and newsprint.**

To collect data for the program, the City mailed a questionnaire to 2,200 commercial accounts to gauge their interest in source reduction and recycling. These accounts include apartments, townhouses, and condominiums in addition to the commercial businesses which the City serves. No service is provided to wholesalers, manufacturers, processors or distributors. The 800 responses indicated a strong interest in participating in waste reduction activities. City solid waste management staff visited each business responder and discussed its participation in the recycling collection program. In addition, a brochure was distributed to all commercial customers.

For more information, contact Jerry Bulla, City of Greensboro, Solid Waste Management, Post Office Box 3136, Greensboro, N.C. 27402, (910) 373-2787.

On-Site Assistance

Site visits are the most "hands-on" way to provide information to business and industry, to gather information on their activities, and to directly assist them in their recycling and waste reduction programs. Site visits show that local government is actively concerned with the impact of waste costs on business and is willing to address those impacts personally and individually. On the other hand, site visits and the follow-up work can be time consuming and are probably best limited at first to larger generators of waste. Also, some businesses and industries may be reluctant to host site visits; the decision is often best left up to them.

Several communities are offering on-site solid waste management assistance to businesses and industries. This service usually involves several components: a waste assessment (see NHC-DEM, above), identification of the major recyclable components of the waste stream, determining ways to divert these materials, calculating the costs and benefits of increased recycling, helping to set up a waste reduction program, and/or educating employees. For more information, contact communities listed on the matrix as providing this service. (See also Section 3. Conducting a Solid Waste Assessment)

Surveys/ Questionnaires

To effectively help businesses and industries reduce their waste, some local governments have developed survey instruments to obtain a better understanding of the types and amount of wastes produced by specific companies. Surveys that are carefully constructed provide detailed information that is useful for program

	planning. However, telephone surveys can be time-consuming, and mail surveys may not yield a high response rate.
Gaston County	**Gaston County sent a form to local industries asking for the following information: current average monthly generation of landfilled waste and recycled materials (including seasonal variations); types of recyclable materials generated, the percentage of recyclables in the total waste stream, and the percentage recycled; and potentially recyclable materials currently landfilled. In addition, industries were requested to indicate the amount of waste recycled back into the manufacturing process, if they plan to begin or expand a recycling program, current or planned reduction of waste generated, and if they plan to expand or change their production such that the quantity or type of waste generated will change. The survey will be used to set up a waste exchange program. Sandra Campbell, Gaston County Recycling Coordinator ((704) 866-3081), can provide more information about this program.**
Mecklenburg County	**Mecklenburg County conducted a 10-minute telephone survey of 100 randomly selected lounges, restaurants, and retail grocers to identify their solid waste management practices and needs in order to promote recycling. These businesses were asked to estimate the amount of different types of recyclable materials generated weekly; identify recycled materials, collection methods, storage, and transportation to markets; and the type of assistance needed to help the company manage its solid waste. Businesses were also asked to prioritize the specific benefits associated with recycling. Contact Bill Warren, Recycling Division Manager, ((704) 336-3846), to discuss this survey.**
	Copies of these survey instruments are provided in the manual.
Source Reduction Program	**Recognizing that source reduction is the top priority in solid waste management, some communities are establishing separate source reduction programs targeted to businesses and industries. Mecklenburg County has hired a source reduction coordinator to develop programs for the residential, commercial, and industrial sectors; and the City of Greensboro obtained federal funding to conduct a source reduction pilot program. A description of Greensboro's project follows.**
City of Greensboro	**The City of Greensboro conducted a pilot source reduction program aimed at 1,000 residents and voluntary participants from**

	the business community. The second phase of the research was targeted to the business community. A partnership with the Chamber of Commerce was established to identify businesses willing to participate in the research. The Chamber membership roster of 2,200 members defind the targeted business group. The City's objective was to determine the most effective method government could use to educate the business sector and to determine the effectiveness of the education tools and activities employed during the study.
	During the summer of 1991, the City surveyed 2,200 businesses on their waste management practices. A program was structured around respondents who indicated willingness to participate. Monthly seminars or workshops were held that covered various source reduction topics. A workbook was developed that can be used by businesses to establish a waste reduction program. In addition, monthly articles were published in the Chamber newsletter on topics such as overpackaging, "junk mail," and bulk purchasing.
	The City measured the effectiveness of the education program by resurveying the group to determine awareness and knowledge changes, action taken over the last year, and support for continued workshops/format. The City intends to continue its source reduction education efforts.
	Questions about Greensboro's source reduction program may be directed to Jerry Bulla or Elizabeth Treadway, City of Greensboro, Solid Waste Management, Post Office Box 3136, Greensboro, N.C. 27402, (910) 373-2035.
Commercial Recycling Coordinator	**Recognizing that the commercial/industrial sectors can produce up to two-thirds of the waste and a single individual cannot coordinate residential, commercial and industrial solid waste recycling, some local governments have chosen to hire a separate recycling coordinator to work witht businesses and industries. In 1991, Orange County hired a Commercial Recycling Specialist (CRS) to take over and expand the commercial recycling program.**
Orange County	**The CRS oversees commercial collection of old corrugated cardboard (OCC), glass, aluminum and steel cans. In addition to monitoring 100 dumpsters for cardboard recycling and 30 sites for glass collection, the CRS coordinates a small generator OCC program in which a rear-loader packer truck collects OCC from**

	small businesses, fraternities, and sororities. Orange County has seen a significant increase in recycling since the commercial recycling coordinator was hired. **Questions may be directed to Paul Dunn, Commercial Recycling Specialist, Orange Regional Recycling Program, Public Works Department, Town of Chapel Dill, 306 North Columbia Street, Chapel Hill, N.C. 27514, (919) 968-2796.**

Examples of Waste Reduction Assistance Targeted at Business and Industry

	Waste Reduction Workshops /Seminars	Waste Audits	Material Bans at Landvills	Local Waste Exhcnage Program	Printed Information	Awards Programs	Financial Incentives	Buy-Back Program	Task Force	Recycling Collection Program	On-Site Assistance	Survey/ Question-naire	Source Reduction Program	Commerical Recycling Coordina-tor	Other
Alamance County	X		X		X						X				X
Blowing Rock, Town of	x	x	x		x	x	x		x	x	x		x		x
Buncombe County	x	x	x								x	x			
Burke County	x	x	x	x	x	x		x			x		x		
Catawba County			x												
Chatham County		x	x		x	x						x			
Davidson County	x	x	x												
Davie County	x	x	x	x	x					x	x	x	x		x
Duplin County		x					x			x					
Durham, City of	x	x			x					x	x		x	x	
Franklin County	x					x					x				
Gaston County	x	x	x		x							x			
Greensboro, City of	x				x					x	x	x			
Haywood County			x												
High Point, City of					x						x				
Kernersville, City of	x				x					x			x		
Mecklenburg County			x		x	x			x	x			x	x	
New Hanover County	x	x		x	x										
Orange County	x			x	x	x			x	x	x		x	x	
Pitt County	x		x	x	x			x			x	x			
Raleigh, City of			x												
Randolph County	x	x	x		x	x	x		x	x	x	x			x
Rowan County	x		x		x				x	x	x				
Wake County	x	x	x		x				x		x	x	x		
Wayne County	x	x	x			x	x					x			
Winston-Salem, City of	x	x			x						x	x			x

Local Government Contacts Listed in Section 2

ALAMANCE COUNTY
Mike Gamer, Recycling Director
Alamance County Health Department
209 N. Graham-Hopedale Road
Burlington, N.C. 27217
(919) 227-0101

BLOWING ROCK, TOWN OF
Chris May, Town Manager
Town of Blowing Rock
Post Office Box 47
Blowing Rock, N.C. 28605
(704) 295-5228

BUNCOMBE COUNTY
Bob Hunter, Solid Waste Director
Buncombe County Engineering Services
Buncombe County Courthouse
Asheville, N.C. 28801
(704) 255-6055

BURKE COUNTY
Tom Rhodes, Recycling Coordinator
Solid Waste Management
Post Office Box 219
Morganton, N.C. 28655
(704) 433-9500

CATAWBA COUNTY
Dick Wyatt, County Engineer
Catawba County
Post Office Box 389
Newton, N.C. 28658
(704) 465-8263

CHATHAM COUNTY
Matt Young, Recycling Coordinator
Chatham County
Post Office Box 87
Pittsboro, N.C. 27312
(919) 542-8255

DAVIDSON COUNTY
Robert McIntyre, Director
Davidson County
Solid Waste Dept.
Route 1, Box 678
Lexington, N.C. 27292
(704) 242-2284

DAVIE COUNTY
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North Carolina Special Tax Provisions for Recycling and Resource Recovery

Provisions of the Tax

If a business purchases or constructs facilities or equipment used exclusively for recycling or resource recovery, it may be entitled to special treatment for real and personal property tax, corporate state income tax, and/or franchise tax on domestic and foreign corporations.

Part-Time Use and Space Provisions

Facilities and equipment used part of the time for recycling or resource recovery do not qualify: prorating of time is not allowed. Division of space is allowed; however, a small space within a larger building can qualify if it is used all the time for recycling. Incidental and supportive facilities and equipment such as bathrooms and office areas do not qualify. The specific tax provisions for each of the three types of tax are explained below.

Real and Personal Property Tax

Real or personal property that is used or, if under construction, is to be used exclusively for recycling or resource recovery is prohibited from being listed, appraised, assessed, or taxed by state or local government after an approved certification.

Corporate State Income Tax

An income tax is levied on corporations operating in North Carolina on the portion of net income allocable to the state.

At the option of the corporation, a deduction for the cost of constructing facilities or purchasing equipment for resource recovery or recycling can be amortized over a period of 60 months, in lieu of any depreciation allowance, when computing taxable income for corporate income tax. This option, in effect, allows the corporation to replace the normal depreciation schedule of 15 to 30 years with an accelerated deduction for amortization of costs.

Franchise Tax on Domestic and Foreign Corporations

A franchise tax is a tax on corporations for the privilege of engaging in business. The North Carolina franchise tax is levied on the largest of three alternate tax bases:

1. **The total amount of issued and outstanding capital stock, surplus, and undivided profits apportionable to the state;**
2. **Of the appraised value of property in the state subject to local taxation plus the assessed value of intangible property subject to taxation;**
3. **The book value of real and tangible personal property in the state less any debt outstanding which was created to acquire or improve real property.**

The cost of equipment and facilities used exclusively in resource recovery or recycling can be deducted from either capital stock, surplus, or undivided profits when computing corporate

franchise tax or from real and tangible personal property, net of depreciation, if the equipment and facilities are certified as excluded from the county property valuation.

Applications of North Carolina Recycling and Resource Recovery Tax Laws

- **A paper recovery business owns large containers where paper is placed for recycling. The business operates a truck that picks up the paper and delivers it to its facility where a baler, a forklift truck, other large containers, and a second truck are used to prepare and ship the paper to paper mills for recycling.**

  All the containers, the forklift truck, the other two trucks, and the baler qualify for special tax treatment. The operations area of the facility also qualifies. The bathroom and office areas of the facility do not qualify.

- **A retail store designates an area in its building for baling paper and cardboard for recycling. A forklift is used to transport the paper and cardboard to a loading dock.**

  The area of the store used for the baling, if used for no other purpose, would qualify for special tax treatment. The baler, if used for no other purpose, would also qualify. The loading dock and the forklift, if used also for other purposes, would not qualify.

- **A paper mill produces new newspaper from old newspaper. It shreds the old newspaper, makes a pulp, rolls and dries the pulp, and cuts sheets.**

  The area of the mill where shredding and pulping take place plus the equipment used for these two processes would qualify for special tax treatment. If virgin materials are being used in the other process, it would not qualify.

For information about special tax treatment for recycling/resource recovery operations:

- **Contact the county tax assessor's office.**
- **The Solid Waste Section (SWS) of the N.C. Department of Environment, Health, and Natural Resources is responsible for certifying operations for this special tax treatment.**
- **SWS Eastern Area Supervisor: Terry Dover, 225 Green Street, Suite 601, Fayetteville, NC 28301, (919) 486-1191**
- **SWS Western Area Supervisor: Julian Foscue,8025 North Point Blvd., Winston-Salem, N.C. 27106, (919) 896-7007**

Source: Triangle J Council of Governments, P.O. Box 12276, RTP, N.C. 27709

Section 3.

Conducting a Solid Waste Assessment

Section 3 presents step-by-step instructions on conducting a solid waste assessment in a large business or industry to identify wastes that can be eliminated, reduced, reused, or recycled; the volume generated; and the sources of waste generation within the facility.

Section 3. Conducting a Solid Waste Assessment at a Large Business or Industry: Guidance for the Waste Assessor

Objectives of a Solid Waste Assessment

A solid waste reduction assessment is designed to assist a company in developing sound, economically viable solid waste management options. The assessment will help identify the wastes that can be eliminated, reduced, reused, or recycled; the volume generated; and the sources of waste generation within the facility. The information collected during an assessment will also provide insight into the causes of the waste generation.

With a good understanding of the reasons wastes are generated, the waste assessor and company personnel can creatively seek source reduction and reuse solutions. Of the solid waste management options available to a company, those involving source reduction and reuse often require an indepth understanding of the industrial processes performed. Knowledge of the operating procedures that generate waste is especially important when the assessor is examining process-specific waste streams such as cotton waste from the textile industry or plaster molds and scrap chinaware from the ceramic industry.

The following information will provide the solid waste assessor with background for performing a solid waste reduction survey at any industrial or large business facility. Note that the waste assessor does not have to be an expert on the operations of every industry; rather, the assessor acts as a catalyst to stimulate the awareness of key personnel about waste generation activities, associated costs, environmental impacts, and waste reduction options.

Setting Up a Waste Assessment Visit

The initial contact at a company should be made with the environmental manager or plant manager. The assessor should explain that a brief meeting will be held and a walk-through of the facility undertaken to help identify solid waste reduction options. The entire waste assessment may take up to a day or more at large manufacturing facility or as little as one hour at a small business.

Request Meeting With Key Personnel

Businesses set up various staff positions to be responsible for solid waste management. At large facilities, this position may be dedicated to an environmental coordinator who is responsible for solid waste management along with other environmental compliance, permitting, and reporting duties associated with issues such as wastewater discharges, air emissions, groundwater/ underground storage tanks, and hazardous waste management. In

smaller companies, an employee in the maintenance department may be in charge of the company's solid waste management.

Generally, commitment by corporate executives is essential to successful waste reduction programs. A waste assessor should make every effort to meet with key management personnel such as the plant manager, the production manager, the maintenance supervisor, the purchasing agent, and any others with duties related to solid waste generation and management.

In a facility where a waste reduction team has been established, the meeting should also include the team leader and other team representatives. (The team approach to problem solving is often employed in companies that have a total quality management program.) Although the assessor may not spend a great deal of time with management personnel, the opportunity can be used to discuss the local solid waste management situation and local efforts to assist the commercial and industrial sectors with waste reduction.

Select Time Frame for Visit

The waste assessment should be conducted during normal plant/office hours so that the processes generating the waste may be observed in operation. In certain industries such as food processing, a large quantity of solid waste is generated during the second or third shifts when clean-up operations are performed. The waste assessor needs to check this point with the facility and schedule the visit accordingly. Seasonal variation needs to be noted.

Confirm Visit/ Request Background Information

The waste assessor will want to confirm the time, purpose, and duration of the visit by letter, and this letter is a good occasion to request that background information be prepared for the visit. The following is the kind of information the assessor will request:

- **Monthly solid waste management costs.**
- **Monthly average hauling fees.**
- **Monthly average tons disposed.**
- **Monthly container rental fees.**
- **Brief description of the facility's operations including process flow charts.**
- **Any solid waste stream analysis information previously collected.**
- **Other information that would be helpful.**

Time during the visit will be saved if the information is gathered in advance. Company managers are often surprised when they first examine all the costs associated with solid waste management at the facility. In many cases, waste management is viewed as an ancillary activity of the production process, that is, as fixed overhead cost. The collection and review of this information can be a first step to managing the generation of waste as an integral component of the production process.

The On-Site Visit

Meet With Plant Personnel

At the facility, the waste assessor should, as mentioned above, meet with the key personnel involved with solid waste management including upper management. In most cases, it is more productive to sit down and get general background information on waste management and general operations before walking through what may be a noisy and complex facility.

Discuss Local Solid Waste Management Plans

During the meeting, the assessor should determine the awareness level of company personnel with respect to solid waste management and provide current information about the needs for addressing waste reduction and recycling at the facility. Also during the meeting, the assessor can provide the following information about the local solid waste management plan:

- **Projections of future solid waste "tipping" fees.**
- **Explanations for increased solid waste disposal costs such as the effects of RCRA subtitle D regulation on local disposal costs, old landfill closure costs, new facility siting, construction and operation costs, and cost of the local recycling program.**
- **Any current or proposed restrictions on recyclables and the reasons these restriction have become necessary.**
- **Information on other waste reduction assistance provided or proposed by local government such as workshops, waste exchanges, buy-back programs, and commercial collection centers. (See "Messages and Means" in Section 2.)**

In areas where local recycling and waste reduction initiatives have only recently commenced, many facilities are uninformed about the local solid waste management situation and will welcome information the assessor can provide. Company personnel will be more likely to participate in local waste reduction efforts if they have a clear understanding of costs associated with a local government's disposal and recycling efforts.

Review the Company's Current Waste Reduction Efforts

The assessor needs to ask if the facility has a (solid) waste reduction policy statement, and, if a waste reduction program is in place, how well it is functioning. If there is yet no program, the assessor should ask about plans to initiate one since a waste reduction program may be required under other environmental regulations. For example, large quantity hazardous waste generators are required to have programs to reduce the volume and/or toxicity of the hazardous waste they generate. Large facilities may have comprehensive waste reduction plans that address pollutants and wastes in air emissions releases, wastewater discharges, and stormwater contamination as well as in solid wastes.

In facilities where programs addressing solid waste reduction are established, the assessor may want to ask the following kinds of questions to become informed about waste reduction techniques that work well.

- **The motivating factors for the program.**
- **Whether there is a team approach to the program.**
- **The range and depth of employee training, i.e., how the employees are educated about the waste reduction program.**
- **Whether waste reduction suggestions are solicited from employees and suggestions rewarded.**
- **The forms of communication used, i.e., newsletters, posters, charts, paycheck inserts, company picnics.**
- **Any numeric waste reduction goals established for the facility.**
- **Other ways management is supporting the waste reduction initiatives.**
- **Up-coming initiatives to reduce waste.**

If a company has made progress in reducing solid waste, the assessor needs to ask for specifics about the program; personnel will always appreciate the interest and compliments on their efforts.

If a company does not have a waste reduction program in place, the assessor needs to determine the facility-wide programs already existing such as "quality circles," "cost-cutting teams," or employee suggestion programs. A waste reduction program can often piggy-back on existing programs or utilize existing lines of communications and current educational activities.

Collecting Other Background Data

The waste reduction assessor cannot be an expert on every business or industry visited, and a company's staff will be aware of this. A waste assessor does not need to an expert on all the operations to be able to provide waste reduction tips and helpful information. At a minimum, the assessor can ask the kinds of questions about waste generation and waste management that will stimulate company personnel to a greater awareness of their solid waste generation.

Current Operations

Plant personnel should briefly explain the company's operations to the assessor. The information and process flow diagrams the company has compiled in response to the confirmation letter can be helpful in providing a clear understanding of operations. The following topics should be addressed as the information is reviewed.

- **Current solid waste management practices.**
- **Monthly waste generation rates.**
- **Information about any previous solid waste surveys.**
- **Monthly costs of solid waste management including container rental, total tipping costs, hauling fees, and other time and labor costs.**
- **The material and quantities currently being recycled, reused, or reduced.**
- **Other records available to determine specific waste generation such as scrap reports or purchasing records.**

The assessor needs to ask the reasons why large waste streams are not being reduced, reused, or recycled. Some typical answers to this question are listed below, and the assessor should be able to address these barriers to waste reduction.

- **Reuse or recycling markets are unavailable or unstable.**
- **A waste stream is contaminated or not being separated.**
- **A recycler will not pay for the waste material; therefore, the company chooses to dispose of it.**
- **No internal waste reduction program exists.**
- **The company lacks awareness or understanding about the waste and its generation.**
- **Waste reduction is uneconomical because of special handling or processing requirements.**
- **A specific waste stream is too insignificant to be concerned with.**

Waste Transfers to Other Media

Throughout the data collection, the assessor should note if solid wastes are being transferred to other media. For example, food waste washed down the drain may add to wastewater quality problems. By keeping solid wastes separated, a facility has more opportunity for waste reduction.

The Plant Walk-Through

After information is exchanged in the initial meeting, a walk-through of the facility is in order.

Route of the Walk-Through

Usually, the best route for the walk-through is to follow the flow of material through the production operation. Thus, the tour will start at the "receiving area" and continue step-by-step with the flow of raw materials until final product packing and shipping.

Observations During the Walk-Through

During the walk-through, the assessor should not only be looking at the specific sources of solid waste generation but also for opportunities for waste elimination, reduction, reuse, and recycling potential. The assessor should ask many questions about why wastes are generated and why they are not being reduced.

Typical areas and management strategies on which to focus questions and note during a walk-through of a typical manufacturing facility include the following.

Receiving and Material Inventory Areas

- **Material handling and storage that minimizes material damages or spoilage, e.g., storage in low traffic areas and in proper temperature, humidity, and light conditions.**
- **High-use material purchased in bulk returnable containers such as totes to minimize container waste.**
- **Low-use materials purchased according to needs to minimize spoilage, e.g., not stockpiled.**
- **Use of a first-in /first-out material inventory system.**
- **New material screening programs which review MSDS (Material Safety Data Sheets) for potentially hazardous or toxic materials.**
- **Reusable, recyclable, or the necessity for packaging for in-coming goods** (see Product **Packing, Storage, and Shipping below).**
- **Return of damaged incoming materials.**
- **Return of storage containers, racks, or packaging to supplier or sister facilities.**

	• **Preference to suppliers who provide minimum packaging, recyclable packaging, or raw materials with a recycled content.** • **Recycling of banding, plastic films, paper, polystyrene peanuts, etc.** • **Reuse of in-coming pallets in the facility or utilized for shipping.**
Production Areas	• **Generation of wastes because of malfunctioning equipment.** • **Generation of waste from a large number of start-ups and shut-downs or from frequent change-overs to different style products.** • **The extent and quality of waste management in the production area.** • **Use of reusable "in-process" handling systems such as permanent racking and transfer containers.** • **Disposition of "off-spec" materials; i.e., are they reworked or listed in a waste exchange.** • **For an established reuse or recycling program for process waste, the participation of all personnel on all shifts.** • **Use of dry clean-up practices such as sweeping or vacuuming rather than hosing down to collect solid waste for reuse or recycling.**
Material Collection and Storage	• **Clear labeling of dedicated reuse/recycle collection containers to avoid accidental contamination.** • **Separated collection of homogenous waste.** • **Program monitors ensure full participation by employees.** • **Reuse/recycle containers more accessible than disposal containers.** • **Adequate storage capacity for reuse/recycle containers.** • **Separation of hazardous or special waste from non-hazardous solid waste.**
Product Packing, Storage, and Shipping	• **Product packaging requirements and likelihood of changes in these requirements to reduce packaging or to use recyclable packaging.** • **Minimization of inventory.**

	• Use of used pallets or returnable packaging systems.
Waste Disposal Areas	• Reasons for and frequency of any recyclables in the dumpster or compactor. • Contamination of recyclable materials. • Monitoring of disposal areas for recyclables and personnel in charge of such monitoring.
Cafeteria/Break Rooms	• Use of reusable table ware, utensils, and cups. • Availability of recycling containers. • Procedures for handling of food waste.
Office Areas	• Programs in place to reduce office waste. • Collection of all recyclables. • Purchase of recycled-content supplies. • Degree of participation of the office employees.
Ancillary Operations	• Waste generation and waste management practices in other ancillary operations should be observed and discussed. • Laboratory waste such as glassware and chemicals waste. • Production maintenance areas such as scrap metal, packaging, and chemical containers. • Vehicle and equipment maintenance area and the management of used oil, oil containers, oil filters, spent antifreeze, and antifreeze containers. • Housekeeping storage area. • Quality control/quality assurance areas. • Ash generated from wood of coal fired boilers. • Dust from air handling operation, e.g., wood dust from furniture sawing and sanding operations. • Sludges from wastewater treatment, paint spray booths, and other water-based operations.
Other Outside Storage Areas	• Materials such as wood pallets, crates, scrap metal or other process waste are accumulating outside because a recycler has not been located.

Other Observations

- **The assessors should make particular note of clear signs of a waste reduction program in the facility such as waste reduction progress charts in break rooms, posters, slogans, suggestion award programs, and newsletters.**
- **A general impression of the facility, e.g., orderly housekeeping.**

Talking With Plant Employees

The assessor should speak to a variety of plant employees. Often, waste reduction programs are malfunctioning because of simple problems that are not being addressed such as a lack of storage containers for recyclables. The assessor also should try to get the perspective of employees in the production area and their waste reduction awareness level. Often, the waste handlers will give the most accurate assessments of waste management practices. Employees should be asked for their ideas to further reduce and recycle wastes. The most innovative suggestions to reduce waste come from employees. If the waste assessor reiterates the same ideas from employees in the factory, management may give the ideas a closer look.

Preliminary Assessment of Recyclables

Throughout the preliminary meeting and walk-through, the assessor should identify wastes that can be eliminated at the source or recyclable materials for which there are known markets. The facility personnel should be able to provide estimates for generation of general waste such as corrugated cardboard, pallets, and other packaging waste such as plastic film wrap, and polystyrene peanuts. Generation rates for other process-specific wastes such as defective or "off-spec" products can be obtained from scrap generation information or by estimates by plant personnel.

A Dumpster Inspection

Every assessment should include a dumpster inspection to estimate the percentages in the waste stream. Approximate generation rates by volume or weight of recyclables can be determined by looking in the dumpster. This preliminary identification will provide guidance to the company about the materials that should be targeted for recycling.

Information on performing a more detailed assessment of recyclables can be left with the facility. Other more detailed solid waste surveys, such as those below, can be performed by the facility's staff.

Types of Generation Studies

- **Separate in-house collection studies for specific time periods.**

- **Estimates of material percentage during dumping of waste at the disposal facility.**
- **A "material balance" to determine the waste types and quantities associated with all in-coming goods.**

Visit Wrap-up

The assessor should have a brief wrap-up with key personnel at the Facility. The wrap-up should include praise for the waste reduction activities currently conducted. It should also include suggestions for improving a current waste reduction program or motivations For beginning a program.

Any additional assistance such as market research, contacts, or other waste reduction information that can be provided should be outlined with plant personnel.

The wrap-up is also a good opportunity to gauge a company's impression of the local government's solid waste reduction initiatives. Any suggestions about the local program should be noted.

The assessor may want to ask for a commitment from the company to voluntarily establish a waste reduction policy statement' an action plan, and solid waste reduction goals for the facility.

The assessor can also get an impression of a company's willingness or seek the company's commitment to participate in other local government programs such as waste exchanges, waste expositions, consolidated collection programs to increase a material pool, and sponsorship of activities such as a luncheon or focus group meeting with area businesses.

The Follow-Up

The assessor should follow up the visit with a letter containing information on recycling markets, waste exchanges, and waste reduction actions if that information was not available during the time of the visit. The company should be requested to keep the assessor updated on waste reduction activities or newly discovered recycling markets. The follow-up letter is also a good opportunity to inform the company of upcoming assistance that may help the company's waste reduction efforts.

Review of Section 3

Elements of a Waste Reduction Program for Business and Industry

1. **Corporate Commitment**
2. **Team Selection**
3. **Background Information and Process Flow Diagram**
4. **Plant Survey**
5. **Material Balance**
6. **Evaluation of Reduction Alternatives**
   - **Source Reduction**
   - **Reuse**
   - **Recycling**
   - **Markets**
7. **Implementation**
   - **Program**
   - **Training**

Section 4.

Exploring Options for Reducing Commercial/Industrial Solid Waste

In Section 4, source reduction, reuse, and recycling strategies that local governments may encourage C/I sectors to undertake are discussed. Also included are assistance techniques for local government including information on marketing recyclables, scenarios of commodity-specific waste reduction assistance, and waste management techniques business and industry can adopt.

Section 4. Exploring Options for Reducing Commerical/Industrial Solid Waste

This section addresses the various ways that local governments can encourage businesses, industries, and institutions to reduce and recycle waste. Part A, adapted from the North Carolina Recycling and Solid Waste Management Plan, discusses source reduction, reuse, and recycling approaches that local governments may Encourage these sectors to undertake.

A. Source Reduction, Reuse, and Recycling Strategies

The importance of source reduction cannot be overemphasized. A significant amount of waste can be eliminated just by reducing waste at the source. Source reduction techniques are implemented in an attempt to minimize the environmental and financial impacts of wastes generated by increasing efficiency, substituting materials, or changing processes so that fewer wastes are produced. Companies can be convinced that source reduction is the most direct method of cutting disposal costs: by purchasing only the materials needed and producing less waste, there is less to get rid of.

Source Reduction

Local governments may suggest two possible source reduction approaches to local manufacturers and retailers:

1. **Reduce the amount of waste they create in the production of goods and services and,**
2. **Reduce the amount of waste the consumer will discard from the product.**

For the first approach, manufacturers and retailers can use a number of methods to reduce waste generation including:

- **Improved inventory control to ensure the correct amount is purchased.**
- **Process modifications to reduce scrap and rejections that end up in the dumpster.**
- **Material substitution to eliminate waste products or increase recyclability.**
- **Improved operational and maintenance procedures.**
- **Segregation of waste to maximize on-site reuse.**

For the second approach, designers, engineers, and marketers can address the following issues before products are developed so that goods are produced in a more environmentally responsible manner and consumer discards from the product are reduced.

- **Product packaging reduced to as little material possible that requires disposal; for example, eliminating the cardboard package around a deodorant container.**
- **Product or packaging design changes that allow for reuse and later recycling; for example, for cookies packaged in a tin with a lid, the tin can be reused and then recycled.**
- **The potential environmental impacts of the product.**

In response to these issues, some manufacturers are designing thinner and/or more efficient packaging materials, concentrated products, and larger sizes or refillable containers. If local industries are encouraged to address these kinds of issues, standards for product durability, reusability, recyclability, and degradability will be factored into product designs. The cost of design modification is calculable and can be measured against the present cost of excess packaging and product disposal, a cost passed off to the consumer twice: once as purchaser of the product and once as taxpayer or user of disposal services.

Many companies are amenable to considering a source reduction program; however, they may not be aware of how to set up and implement the program. To help local businesses set up in-house waste minimization programs, local government can offer the following guidelines:

Guidelines for Implementing a Source Reduction Program

Source Reduction Program Guidelines

1. **Obtain the support and commitment of the management.**
2. **Form a team to develop and implement the source reduction program.**
3. **Conduct a waste assessment (see Section 3. Conducting a Solid Waste Assessment).**
4. **Set waste reduction goals and define objectives.**
5. **Organize materials and a waste tracking system.**
6. **Identify potential waste minimization options for selected materials.**
7. **Determine the technical and economic feasibility of the identified options.**
8. **Implement waste reduction techniques.**
9. **Establish a monitoring and evaluation program to determine if goals are being met.**

Increasingly, business trade organizations are taking initiatives to help their members reduce their waste. Some of these initiatives focus on educating the business community about relevant environmental issues and regulations. Others seek to create a forum for members to share methods to reduce waste and save money. One example of such a forum is an Environmental Affairs Committee organized by a local chamber of commerce to update businesses on environmental legislation, regulations, and other matters. The Committee sponsored several seminars each year on issues such as waste reduction and publicized the events through the chamber's newsletter.

Local governments can also encourage waste minimization by requiring waste generators or manufacturers to develop source reduction plans. Such a plan or ordinance will prompt companies to think about methods to reduce the amount of waste they generate. Businesses can develop their own methods of source reduction using guidelines provided by the community on ways to increase the effectiveness of waste minimization methods. Periodic reports can be submitted to local officials describing each company's progress in meeting their source reduction goals.

Source Reduction Ordinances

A local government should consider the following in drafting a source reduction ordinance.

- **How the ordinance will affect both new and existing businesses.**
- **Will all companies or only the major waste generators be required to submit waste minimization plans.**
- **What mechanism w-ill be used to ensure that businesses file these plans.**
- **Who is the person/staff that will review and approve the plans.**
- **Will penalties be imposed should a company fail to submit a plan or meet its source reduction goals.**

To date, the effectiveness of solid waste source reduction ordinances has not been quantified. However, they are another tool local governments can use to reduce waste generated by the commercial and industrial sectors.

Reuse

Reuse is the use of goods several times over in the same form and for the original or similar purpose. Many items that are sent to the landfill for disposal are still useable. Techniques for reusing discarded or unwanted items require an investment of efforts for

such tasks as reconditioning items to a more useful state, repairing or rebuilding goods, remanufacturing, and finding markets for reusable goods.

An example of a formal reuse program is the Southeast Waste Exchange (SEWE) operated by the Urban Institute of the University of North Carolina at Charlotte. SEWE is a non-profit, non-regulatory program that provides information, markets, research, and education for businesses and industries in their efforts to develop safe and economical waste management plans and recycling programs. Over the past 15 years, SEWE has been successful in locating markets for materials and helping companies save thousands of dollars in disposal and raw material costs. For more information, contact Maxie May, Director, Southeast Waste Exchange, Urban Institute, Department of Civil Engineering, UNC-Charlotte, Charlotte, N.C. 28223, (704) 547-4289.

Reuse Guidelines

Local governments can encourage businesses and industries to reuse items on two fronts:

First, they can convince buyers to purchase reusable packaging, boxes or containers, reconditioned auto parts and appliances, and other reusable items such as reusable razors rather than disposables.

Second, governments can encourage product reuse by targeting certain items at their point of entry into the waste stream and establishing special programs to divert those materials from the landfill.

Recycling

In the absence of regulatory requirements, the recycling of commercial/industrial solid waste is driven by economics, convenience, community perceptions, and knowledge of recycling opportunities. Factors limiting recycling activities by these sectors include:

Little or no economic incentive (disposal costs are low relative to other options).

Lack of local processors for some materials; and lack of awareness of the benefits, opportunities, and procedures of recycling.

Role of Local Government

The role of local governments in increasing commercial and industrial recycling may include:

- Providing technical information and assistance on recycling methods and opportunities.

- Serving as a catalyst for expansion of the existing collection, processing, and marketing infrastructure.

Changing waste collection and disposal fees to reflect the costs

providing incentives for recycling.

Promoting coordination between the public and private sectors

industrial generators in the planning process.

Participating in providing separate collection services either

Target Large Generators

North Carolina communities should target their technical

high-quality recyclable materials. In communities with a

may be generated by relatively few sources. Technical assistance or

significant impact on reducing the quantity of waste now being

this activity a priority, starting with distribution of marketing

Other criteria for selecting targets for recycling efforts, in addition

demonstrated management commitment for implementing

The community could also work with businesses and trade

how they, in turn, can assist the smaller quantity generators within

Local Government Assistance

Businesses may need support in their recycling efforts. Local

following:

Encouraging support for and establishing a corporate policy.

Setting up an in-house recycling program.

Identifying and managing recyclable materials in the waste stream.

-

The following sections provide more detail on ways to help businesses and industries market their recyclables.

B. Marketing C/I Recyclables: Assistance Techniques for Local Governments

Business and industry often require assistance in marketing their recyclables. Local governments can assist on a number of different levels.

Important Aspects of Marketing

Local government can help business and industry understand various aspects of marketing recyclable materials.

Material Conditions

- **Market requirements concerning material processing, e.g., baling, compacting, shredding, and granulating; can the material be delivered or picked up loose and "as is."**
- **Minimum weight and volume requirements.**
- **Market quality specifications: condition(s) that constitute rejectable materials or rejectable loads and whether the material can be stored outside.**

Containers and Processing

- **Will the market provide containers for collection, storage, and transportation of materials.**
- **Will the market provide processing equipment.**
- **Will there be a charge or rental fee for the containers or the processing equipment.**
- **Will the market accept material in containers provided by haulers, shipping companies, or the local government.**

Transportation and scheduling

- **Pick-up and delivery of the material: must it be delivered, is pick-up/delivery the generator's option, or does the market work through certain haulers.**
- **Will materials be weighed and measured at the market or at the point of generation. By what means and at what times will copies of weight slips be available.**
- **Is there a price differential between delivered and picked-up loads; i.e., can generators earn a bonus for delivering recyclables.**
- **Handling of rejected loads: are there fees or penalties; are the rejectables returned or disposed of by the market.**

Prices and Payment

- **If the market picks up the recyclable materials, will there be a predictable schedule or is pick-up on an "on-call" basis; what lead time is required.**
- **Will the market pay for the material, and are prices variable on the basis of quantity, quality, and/or delivery.**
- **Does the market require a contract; if so, what is the length of the contract.**
- **How is payment established and is interest paid on late payments.**

Market References

- **Is the market well established and will the market provide references from its customers.**
- **Do the references verify the market's adherence to contract, prompt payment, reliable pick-up, fairness on quality issues, and accurate weighing.**

Source:** ***How to Implement a Plastics Recycling Program **by the Council for Solid Waste Solutions.**

Roles for Local Governments in Assisting Business and Industry

In addition to providing basic information about various aspects of marketing, local governments can adopt the following roles in marketing C/I wastes:

- **Act as Passive Broker**
  Provide contact lists, directories, and other resource information to generators to help them connect with markets.
- **Act as Active Broker**
  Search for markets and make initial contacts on behalf of generators. Send or bring samples to potential markets. Follow through on contacts; help establish contracts or other arrangements between generator and market.
- **Arrange Exchanges**
  Put local businesses in touch with each other about waste products that may be used in the local economy.
- **Arrange Market Cooperatives**
  Help establish cooperative efforts among businesses that may not have enough material to market on their own. Help arrange common collection and hauling systems or contracts such as shared routes and shared drop-off.

- **Act as Market Outlet**
  Include recyclables from business and industry in local government processing and market shipping systems. Direct haul business and industry recyclables to market (a service that may be a normal part of government-sponsored collection programs)

C. Scenarios of Commodity Specific Waste Reduction Assistance

The following scenarios illustrate various roles local government can assume in marketing certain wastes.

PALLETS SCENARIO 1

A wholesaler generates a tractor trailer load of waste pallets every 3 weeks.

Roles for Local Government

If a generator has enough volume of material, it can usually connect directly with a market rather than utilize the local government as the handler. The generator may not need to be part of a larger marketing cooperative, nor will the local government have to act as the market outlet, Local government may find the following roles more effective.

- **Passive broker**
  Provide list of pallet recyclers in the region.
- **Active broker**
  Call local pallet recyclers to assess demand; describe waste pallets; arrange contact with generator.
- **Arrange Exchange**
  Put generator in touch with other local businesses that buy pallets for shipping and other uses.

PALLETS SCENARIO 2

Each of a number of companies in the industrial park and nearby area generate a small volume of pallets every month, e.g., an average of 50 per company.

Roles for Local Government

Small volume generators will have difficulty gaining access to a market directly with their pallets; that is, the market will be less willing to spot a trailer on-site unless the market is close and can haul directly to it. If not, some of the appropriate roles for local government in this case would be:

- **Arrange Co-ops**
  Convene the small generators as a group to gauge the interest in marketing together. Propose either a pick-up route between them, or propose that one business act as the drop-off point.
- **Act as Market Outlet**
  Provide drop-off point for small generator pallets and make arrangements with pallet markets for pick-up.
- **Arrange Exchange**
  Establish a pallet exchange at which good pallets can be reused until they become damaged.
  Establish connections between small generators and users of pallets in the community.

CARDBOARD (OCC) SCENARIO 1

A manufacturer generates over 2 tons a week of OCC.

Roles for Local Government

As in the scenario above, this large generator of OCC can probably connect directly with a market such as a paper broker or end-user. (The end-user obviously is the preferred priority.) Local government may find the following roles most effective in this scenario.

- **Passive broker**
  Provide list of paper brokers and end-users of OCC in the general area.
- **Active Broker**
  Make contact with paper brokers and end-users on behalf of the manufacturer and link up the best market possibilities with the company. Provide advice to the manufacturer on balers, compactors, and other equipment that may be needed to access the market.

OCC SCENARIO 2

Each of a large number of retailers in various shopping centers generate less than 1 ton monthly of OCC but collectively generate close to 30 tons every month.

Roles for Local Government

Again, as in Pallet Scenario 2, these small-volume generators will have difficulty accessing a market directly unless the market is close by. Local government in this case may have to be more creative and provide more direct services or programs.

- **Passive Broker**
  Supply retailers with a list of companies that may provide collection services for OCC.
- **Active Broker**
  Help establish contracts between OCC haulers and retailers. Provide advice to retailers on handling and storage of OCC.
- **Arrange Co-ops**
  Explore the sharing of OCC collection containers and/or pick-up routes between retailers under cooperative contracts between groups of retailers and OCC haulers. Propose that one business act as the drop-off point (the anchor) in a collection program.
- **Market Outlet**
  Provide government-sponsored drop-off centers and/or collection routes. Consider establishing a buy-back center for OCC.

FOOD WASTE SCENARIO

supermarkets, restaurants, and institutional cafeterias in the community collectively generate 50 tons of food waste per month.

Local Government Role

- **Waste Reduction**
  First, arrange for a food bank or shelter to collect the unspoiled food.

  Next, there are two other major possible ways of dealing with food waste: convert it to animal feed or compost it. Few large-scale converters of food-waste-to-animal-feed exist; it is more likely that local livestock and, in particular, hog farmers may be able to take some food wastes for their operation. Local government can act as a passive or active broker in exploring these outlets.

Local government may instead want to act as a market outlet by establishing a food collection and composting program. Such a composting program may fit well with plans for other compostables such as yard waste, industrial wood by-products, mixed paper, tobacco wastes, or cotton and other textile wastes.

OFFICE PAPER SCENARIO

A number of businesses in a downtown office area overall generate 25 tons a month of high-grade paper.

- **Waste Reduction**
  Provide businesses with a sample recycled paper procurement policy statement. The policy statement should include endorsement of double-sided documents, scrap paper for memos, electronic mail/messages, document routing instead of a copy for each person, and a ban on unnecessary printing and photocopying.

Local Government Role

As in Pallet Scenario 2 and Cardboard Scenario 2 above, local government in this instance may need to exercise a more active and interventionist role to encourage the recycling of these high grade papers.

Passive Broker
Supply retailers with a list of companies that may provide collection or drop-off services for high grade papers.

Active Broker
Help establish contracts between high grade paper collectors, or, if the businesses are willing to market directly, provide information and make contacts with nearby paper brokers on behalf of the businesses. Provide advice to businesses on how to set up an office paper program and provide lists of retailers of in-house office paper systems.

Arrange Co-ops
Explore sharing of high-grade collection routes under cooperative contracts among groups of businesses and high grade haulers. Propose that one business act as the drop-off point (the anchor) in a collection program.

Market Outlet
Provide government-sponsored drop-off centers and/or collection routes. Consider establishing a buy-back center for high grades.

Conclusion

Many of the same principles of marketing assistance illustrated in these examples could also apply to other CA materials such as film plastics, banding, and process wastes. The general rules for these services include:

1. **If a company generates a large volume of a certain type of recyclable, it may be able to directly access a market. Local government can assist the company by connecting it with appropriate brokers or end-users. Note that companies may be able to achieve large volumes through long-term storage.**
2. **If a company generates only a small volume of a certain recyclable, local government may need to arrange for a higher level of assistance by providing drop-off sites, arranging collection routes, and offering buy-backs or other programs.**

D. Waste Management Techniques Business and Industry can Adopt

The following information is designed to present material-specific waste management options for businesses and industries in the C/I sectors. Included are tips on reduction, reuse, and recycling options that a business or industry may employ. Recycling coordinators can share these waste management techniques with businesses and encourage companies to adopt them as standard procedures.

Please feel free to duplicate and distribute the information in Section 4. D. for businesses and industries in your community.

1. Material-Specific Waste Reduction Techniques for Business

Packaging (General)

A recent poll by *Packaging* magazine stated that the top 100 largest industrial users of packaging materials and containers spent $2.1 billion more to package their products in 1992 than 1991. Most of these companies believe that annual expenditures on packaging will continue to grow throughout the 1990's.

Simultaneously, many companies are taking impressive steps to reduce and recycle packaging. Below are some examples that business and industry may want to consider.

Guidelines For Waste Reduction Through Packaging

The first step in assessing waste reduction possibilities is to develop a checklist of all packaging materials and procedures utilized in a manufacturing process. A variety of checklists has been developed and generally elaborate on the following questions:

- **Are all the packaging materials or elements currently used actually needed. If so, can they be reduced in size or can they be replaced by less bulky materials.**
- **Are the packaging materials reusable. If so, is there a system in place to collect the packaging for reuse.**

- **Are the constituents recyclable and/or made partially from recycled materials. If not, can they be.**
- **Is there a collection and recycling system in place for the packaging. If not, how can one be implemented or facilitated, i.e., labeling of plastics, receiving recyclables.**

A company needs to work with its consumers, employees, and area recycling coordinators to analyze this assessment. After the initial assessment, a company should set up guidelines for future package development to help prioritize the goals for reducing packaging waste.

Preferred Packaging Practices

The Coalition of Northeastern Governors (CONEG) Source Reduction Task Force has published a set of guidelines for preferred packaging practices.

No Packaging

- **The need for any packaging should be evaluated in the research and development stages and prior to introduction on the market.**

Minimal Packaging

- **Alternative methods of product and packaging design should be pursued to minimize the packaging material required.**

Consumable Packaging

- **Manufacturers should consider consumable packaging that is eliminated in the process of using the product.**

Returnable Packaging

- **Manufacturers should consider returnable packaging that is returned to a business or industry for reuse and redistribution.**

Refillable/Reusable Packaging

- **Manufacturers should consider refillable/reusable packaging that is refilled by a customer or consumer from bulk or larger size containers. The packaging or container may be so large and bulky that refills by smaller, lower-volume packaging are allowed.**

Recyclable Packaging/Recycled Material in Packaging

A package is considered recyclable if there is an economically viable and widely available collection, processing, and marketing system for the material. Recyclability of a package is maximized when it is made of a homogeneous material or of materials that do not need to be further separated prior to recycling. Labels, closures, and seals should be made of like or similar material to the primary package.

Recycled content should include the greatest amount of post-consumer material possible. The use of in-plant or mill scrap alone is not sufficient to be considered recycled-content packaging.

Guidelines For Waste Reduction Through Purchasing

To reduce the quantities of packaging waste generated through receiving goods for manufacturing purposes, companies should review their packaging requirements. Areas of focus should address the following:

Bulk Ordering

- **Specifying recyclable or returnable packaging and material containing recycled products.**
- **Investigating alternative uses for waste vendor packaging in the manufacturing process.**
- **Terminating useless packaging from the vendor.**
- **Requiring packaging that may be utilized at another facility.**

Companies can greatly reduce their waste disposal costs by investigating these and other requirements through their vendors (see "Maximizing Inputs/Minimizing Wastes, Section 2).

Examples of Innovative Packaging Ideas

Many companies have successfully implemented source reduction programs for packaging. These programs have not only reduced the waste stream but, in many cases, have yielded a profit and increased productivity, as in the following examples.

Packaging Elimination/Size Reduction

- **By combining a desktop workstation, monitor, system unit, keyboard, mouse, and software in a single set of polystyrene cushions, IBM eliminated over 8 million square feet of corrugated cardboard and saved $736,000.**
- **Proctor & Gamble reduced 3.4 million lbs/year of paperboard by removing the carton from Secret and Sure deodorants.**
- **By eliminating the plastic covering for Craftsman screwdrivers and pliers, Sears reduced 78 tons of plastic a year.**
- **By reducing the thickness of the plastic bag in its cereal boxes by 12 percent, General MiIls saved 500,000 lbs/year of plastic.**

Material Substitution

- **By switching its packaging materials from corrugated cases to reusable polyurethane cushions, Steelcase, a leading maker of office furniture, was able to eliminate 2.4 million lbs/year of solid waste. The uncartoned chairs increase truck space by 58 percent and material cost savings are estimated at about 20 percent. Also 5,000 square feet of warehouse space has been freed up.**
- **Several caulk and sealant makers have reduced packaging by 86 percent by designing refillable caulking guns that replace cardboard cartridges with chub packages like those in which**

sausages are packaged. Guns for use with chubs are sold by Albian Engineering Company in Philadelphia (Paul Bueter, 215 535-3476).

- In response to environmental concerns, flexible stand-up pouches are becoming the packaging of choice over rigid plastic containers. These pouches use 70 percent less plastic than their rigid counterparts and are more easily recyclable.

Packaging Structure Redesign

- IBM modified four corrugated packaging designs by replacing the former top-load carton with a new end-load design; the modification eliminated over 2000 square feet of cardboard and saved $121,000.
- The Oak Tree Packaging Corporation redesigned its folding carton reducing paperboard usage by 40 percent. Oak Tree customers can realize about a 15 percent reduction in carton expenditures.

Initiating/Utilizing Recycling and/or Reuse Markets

- Free Flow Packaging Corporation manufactures loose fill from l00-percent recycled polystyrene without CFC's.
- Crown Crafts, Inc., of North Carolina persuaded its supplier to use white or clear strapping because it is more marketable than black waste strapping.
- Resource America has introduced a system to provide customers of electronics companies with "return kits" for left-over packages. The kits include a prepaid mailing label and easy-to-understand instructions for returning the packaging material to an authorized collection point.

Selected Packaging Contacts

Many on the following list of packaging organizations provide newsletters and up-todate information on waste reduction in the packaging industry.

Packaging and Recycling Organizations

- Institute of Packaging Professionals
  11800 Sunrise Valley Drive
  Reston International Center
  Reston, Virginia 22091
  (703) 620-9380

- Council on Packaging in the Environment (COPE)
  Edward J. Stanza, Executive Director
  275 K Street, N. W., Suite 400
  Washington, D.C. 20005
  (202) 331-0099

- **Flexible Packaging Association**
  Glenn Braswell, President
  1090 Vermont Ave., N. W., Suite 500
  Washington, D.C. 20005
  (202) 842-3880

Office Waste

Some of the most easily recyclable materials for any company are generated in office settings. The benefits of establishing an office waste reduction program for a facility can be significant and include savings in materials used and in disposal costs.

The design of an office waste recycling program depends on several factors:

- **Types of waste paper and other materials generated.**
- **The willingness of employees to participate.**
- **The size and location of the office.**
- **The availability of markets.**
- **The amount of storage space and accessibility of pickup locations.**

Types of Office Waste Paper/Materials

As much as 70 percent of the waste generated by offices may be computer and white bond papers that can be easily recycled and have high value. Some of the other paper grades to consider recycling are colored ledger paper, filestock from discarded files, mixed paper grades, corrugated cardboard, and newspaper. In addition, other recyclables include aluminum cans, glass, and plastic bottles.

Offices generally arrange for a recycling service to collect and process the recyclables for a fee. However, the sale of the recyclables and avoided disposal costs will help offset any added costs.

Setting Up an Office Recycling Program

The following are necessary steps for setting up a successful office recycling program:

1. **Seek support from top management.**
2. **Determine in-house resources needed.**
3. **Designate a program coordinator.**
4. **Determine the types and amounts of paper and other materials generated by the office that can be recycled.**
5. **Locate buyers or collectors of the materials.**

6. Create and set up a collection and storage process.

7. Develop an employee education program.

8. Recruit program monitors.

9. Publicize results.

Initiatives for creating less waste, reusing materials, and buying recycled products can be devised during the planning stage. For example, employees can use reusable coffee cups instead of disposable items, and the amount of disposable items used in the company cafeteria/cantina can be minimized.

Employee participation is a major difference between an office paper recycling program and a process waste recycling program. Whereas recycling process waste typically involves a small number of workers, a successful office paper recycling program requires the participation of the majority of employees. Thus, staff education and promotion will be a critical feature of the recycling program. Studies of office recycling programs show that a convenient' well publicized program can average 90 percent employee participation rates.

Encouraging Employees To Recycle

Employee participation can be encouraged by the following "motivators":

- Donating recycling profits to employee programs or socials such as an annual Christmas party.
- Publicizing the progress of the program.
- Rewarding individual employees or departments for "contaminant-free" recyclables.
- Providing quick responses to employee questions and problems.
- Creating contests to maintain interest in the program.

Markets for Office Paper

With demand for recycled content in paper increasing, the market demand for recyclable office waste paper is expected to be relatively strong in the coming decade. At least two end users, both tissue mills, are currently operating in North Carolina. A plant near the North Carolina line in Franklin, Virginia, will be operational by 1995 and is expected to consume 400 tons per day. This use is equivalent to as much as two thirds of North Carolina's total available supply.

Trends in the markets for office paper include the rise of independent de-inking plants, which will supply de-inked pulp to mills, and the increased demand for an "office pack," which is a mixed load of different colors and grades of office paper.

Recyclers should check with collectors, brokers, and dealers about what they will accept.

Pallets

Strategies to Optimize Pallet Management

Used pallets can present a serious disposal problem both in expense and handling. However, a company can take a number of steps to better manage used pallets.

Surveying the Situation

- **First, the current use of pallets should be examined to determine why they become a waste.**
- **The sixes, the types, the number of pallets being purchased/hauled off, and their use requirements should be noted.**
- **Then, the costs that the company incurs by purchasing, handling, and disposing of the pallets should be noted.**

After this information is gathered, the following options can be considered for reducing the number of pallets that the company must manage.

-Having suppliers take back their pallets.
-Having customers return pallets to the company.
-Using a no-pallet material handling system such as slipsheets or durable racks.
-Changing pallet size or quality specifications to promote reuse and recycling.

Following are pallet management strategies to be considered.

Standardizing Pallet sizes

To reduce the number of pallets that the company is handling, standardizing the size of incoming and outgoing pallets should be considered. Vendors can perhaps supply incoming materials on pallets that the company can use to ship out its final products. A change in pallet size may require some modifications to racking, storage facilities, or product orientation, but the savings may be well worth it. In addition to handling and disposal costs for each pallet not reused, companies can pay up to $8.50 or more for each new full-sized pallet'

Recycling markets are generally better for a standard-size pallets such as a 48 by 40-inch "four-way." A company that uses a

standard-size pallet also eliminates the need to sort pallets prior to recycling.

Exchanging Pallets

One way to handle excess pallets is to set up an exchange between businesses. The Pitt County Solid Waste Department initiated this type of exchange by locating businesses with used pallets and those that needed pallets. They notified the companies about the possibility of a pallet partnership, and the resulting agreements to exchange pallets kept used pallets out of the solid waste stream and reduced costs for new materials. Exchanges work especially well when participating businesses do not require top quality pallets.

Intra-county exchange programs can be expanded into larger regional waste exchanges to increase the material pool. Contact Joy Hudson or John Weaver of the Pitt County Solid Waste Department (919/ 830-6354) for more information on this type of intra-county waste exchange program.

Another good exchange possibility is that the company and a sister facility can exchange pallets.

Repairing Pallets

Some businesses that repair pallets in-house enjoy savings up to about $3 to $4 per pallet repaired. Thus, companies that use pallets regularly may find it economical to purchase high quality, rebuildable pallets instead of cheaper models.

A number of private pallet recyclers rebuild pallets. Contacts for this service include current suppliers and agencies.

Recycling Infrastructure

The infrastructure for recycling pallets is growing. A recent study by the Department of Wood Science and Forst Products at Virginia Teach University documents that the pallet industry recovered over 65 million pallets in 1992 and cites a survey indicating strong future demand for waste pallets.

The Office of Waste Reduction maintains a list of pallet recyclers across the state. Many of these companies provide pick-up service and may charge a fee to cover transportation costs. Such fees are generally well below the cost of disposing of pallets as waste.

For a copy of the latest list of pallet recyclers in North Carolina, call the Office of Waste Reduction at (919) 571-4100 or l-800-763-0136.

Vocational rehabilitation associations may also have trained handicapped individuals to recycle pallets. Persons interested in

initiating or promoting a vocational workshop program or who have questions about the operations can contact Tony Jolly with Wilkes County Vocational Workshops at (919/838-3812).

Donating Pallets

Industries can give wood pallets away to facilities that chip pallets for use as fuel, mulch, compost, or animal bedding if the pallets are not treated or contaminated with hazardous or toxic residuals.

Currently, several county solid waste management facilities and some private facilities have the capability to grind and process pallets to remove nails and fasteners. Companies with a small numbers of pallets can give clean scrap pallets to employees for firewood, and during the winter, to the public to fuel wood stoves. A newspaper classified ad can generate considerable demand.

Corrugated Cardboard (OCC)

Recycling corrugated cardboard (OCC) can be economically viable for business and industry, especially because it tends to make up a large portion of the waste stream. In general, recycling markets for OCC are well established, and OCC can be easily targeted in any recycling program such as landfill bans and other disposal restrictions. Below are some options for managing waste OCC and general guidelines for baling it on-site.

OCC can be collected and marketed loose or baled. A company can choose either to have it picked up or to deliver it to a local recycler. OCC recyclers will often cooperate in setting up program logistics.

Determining the Amount of Recyclable OCC Generated

Many companies are surprised to find out how much OCC they generate. The chart below gives estimated weights of loose OCC in different sized containers for 100-percent-full and SO-percent-full conditions. Boxes are assumed to be flattened.

Container size (yards)	100% full (pounds)	50% full (pounds)
40	6,000	3,000
30	4,500	2,250
20	3,000	l,500
8	1,200	600
6	900	450

To Bale or Not to Bale

Baling OCC can improve its marketability. The fast step in making a determination about whether to bale is to contact the local OCC recycler for acceptable bale sizes and purchase prices.

If the OCC is selling at $0.50 per 100 pounds ($10/ton) in a loose form, this same OCC may sell for $20/ton in a baled form. Savings can also be achieved by avoided hauling costs. The following information are some rough guidelines:

Determining Baler Size

Determining baler size is application-specific and is based on storage space constraints, OCC collection and handling methods, and buyer specifications. If an estimated 40 minutes are needed to load and strap a bale from a vertical baler (300- to 1,000-pound bales) and all the OCC is at the baler location, one employee will be needed to load the baler and one or two to strap the bale. Unless the facility is generating very high volumes of OCC (greater than 25 tons/month), a vertical baler should have sufficient capacity.

Baler Cost and Bale Volumes

The following information concerning bale volumes may be of interest. Costs are average list prices in November 1993.

Vertical Balers

Bale Wt. (lbs)	Feed Opening (in.)	Bale Vol. (ft^3)	Avg. List Price($)	Motor (HP)
300	36x15	15	4,750	5
800	48x28	47.5	7,600	10
1,000	60x28	50	8,900	10
1,200	72 x 28	60	9,700	10
1,500	72 x 32	84	20,000	15

	Horizontal Balers				
	Bale Wt, (lbs)	Feed Opening (in.)	Bale Vol. (ft^3)	Avg. List Price($)	Motor (HP)
	1,200	28 x 50	52	25,000	25
	1,500	46 x 50	57	35,000	30
	2,000	45 x 60	64	45,000	40

Determining Other Costs of Baling

Labor — Since loading and tying a bale take about 40 minutes, labor costs can be determined by this time requirement. This time can be compared to the time to collect, break down boxes, and load the dumpster without recycling.

Baling Wire — Wire costs vary with bale size between $80 to $1.00 per bale.

Electrical usage — Electrical usage will vary widely, although an estimate for one 750-pound bale is $1.05.

Annual Maintenance — Annual maintenance is estimated to be 1 to 2 percent of the baler's purchased price.

Note also that other recyclable materials baled such as plastic film wrap, textile scraps, and other plastics can be baled.

Markets for OCC — The southeast has a large number of end users for OCC; North Carolina has at least five end users, one of whom is planning a major expansion. By late 1996, Weyerhauser in Plymouth is expected to be consuming 1,200 tons per day of OCC, the equivalent of the quantity currently still going to landfills and incinerators in North Carolina.

Some analysts predict that because supplies of OCC may not meet demand in the mid-1990s, prices will be driven up. Others caution that those predictions depend upon the strength of the economy. At the least, with demand for OCC expected to be stable over the coming decade, there is room for expansion of OCC collection and recycling programs.

2. Business-Specific Waste Reduction Guidance	**The following pages contain strategies for handling solid waste in an office, a restaurant/cafeteria, a retail/warehouse, an institution, a manufacturing facility, and an automotive dealer/service station. These charts are followed by a Waste Reduction Checklist and guidelines on procurement of recycled and recycled-content items.** **Local governments may wish to provide the tips, checklist, and procurement information to companies in their communities.**

Reduce, Reuse, and Recycle Options for the Workplace: The Office

Reduce	Reuse	Recycle
. Order office supplies in bulk quantities to reduce packaging.	• Repair old furniture and office equipment or donate it to charitable organizations.	• Recycle high-grade white ledger paper.
. Remove the name of your business from junk mail lists.	• Donate old magazines to hospitals or charitable organizations.	• Recycle other light-colored ledger paper.
. Print only the amount of documents you need; don't "pad the order."	• Use re-fillable, reusable toner cartridges for laser printers.	• Recycle glass and aluminum beverage containers used in the office.
. Use Electronic Mail to eliminate paper copies.	• Use an erasable memo or chalk board for messages.	• Purchase recycled copier, computer, FAX pager.
. Review documents on the computer screen before printing to eliminate reprinting.	• Collect and reuse paper printed on one side. A separate paper tray for used paper will make reusing paper easier and help eliminate paper jams.	• Purchase recycled notebook paper, envelopes, and mailing pouches.
• Circulate only one copy of a memo, letter, or publication via a routing slip.	• Convert scrap paper into memo and telephone answering pads.	• Purchase recycled paper in bulk to reduce costs.
• Make two-sided (duplex) copies when possible . Consider purchasing a FAX machine that uses non-coated and recycled FAX paper. (Standard FAX paper is not recyclable because of the thermal printing process and the chemicals that coat the paper during transmission. Also, because standard thermal FAX paper fades over time, papers are photocopied - which uses even more paper.)	• Use reusable or two-way envelopes and mailing pouches.	• Do not purchase glossy, colored, or hard-to-recycle paper items.
• Buy liquid cleaning supplies in concentrate form.		

Reduce, Reuse, and Recycle Options for the Workplace: Retail/Warehouse

Reduce	Reuse	Recycle
• Order items in bulk quantity to reduce packaging.	• Return corrugated boxes to your supplier for use, or reuse them at your business.	• Recycle cardboard that cannot be reused.
• Ask shippers not to send disposable or hard-to-recycle packing materials.	• Consider purchasing sturdy, high-quality storage and shipping containers made of plastic, wood, or metal which can be reused indefinitely.	• Send damaged wood pallets to a lumberyard that can shred them into wooden chips for mulch, or let employees take untreated wood pieces home for kindling.
• Ask that your supplies use recycled and recyclable packing materials.	• Save polystyrene "peanuts" and other packing materials and return them to your supplier for reuse or reuse them in your business or donate them to whoever can use them.	• Purchase recycled packaging materials such as shredded newspapers and cardboard to use for shipping products.
	• Create your own packing materials by shredding non-recyclable paper items.	• Shippers recommend plain, non-oiled popcorn as a packing material. A reusable plastic liner should be included to prevent odors from attracting rodents, animals, and pests.
	• Use cardboard or plastic "roll ends" (the rolls inside wound newspapers and printing paper) as packing materials. Printers or newspapers would rather donate or charge a small fee for roll ends than pay to dispose of them.	
	• Wash and reuse steel and plastic storage containers that held non-hazardous materials. Some distributors will accept back these containers on a deposit basis.	
	• Repair broken wood pallets for reuse.	
	• Enclose a note in packages to remind recipients to reuse packaging materials.	

Reduce, Reuse, and Recycle Options for the Workplace: Restaurant/Cafeteria

Reduce	Reuse	Recycle
Serve soda, bee, and other drinks from bulk dispensers instead of individual bottles.	• Provide reusable, washable plates and utensils instead of disposable paper and plastics.	• Recycle glass, plastic, aluminum, and steel containers.
Order items in bulk quantities to reduce packaging.	• Use linen and cloth napkins and tablecloths instead of disposable paper or plastic.	• Recycle corrugated cardboard that cannot be reused.
Buy liquid cleaning supplies in concentrate form.	• Have old refrigerators/appliances repaired or rebuilt unless potential energy savings warrant buying new equipment.	• Recycle unrepairable or energy-inefficient refrigerators/appliances with appliance recycling dealers.
Have the name of your company removed from junk mail lists.	• Provide discounts for patrons who bring in their own cups or mugs.	• Recycle CFC's (also known by the brand name Freon) from old appliances through a qualified collection and recycling facility.
Ask that your suppliers use recycled and recyclable packing materials.	• Provide "re-fill" vending machines that do not automatically provide disposable cups.	• Purchase recycled paper products when paper products are used.
	• Wash and reuse steel and plastic storage containers that held non-hazardous materials. Some distributors will accept back these containers on a deposit basis.	• Send cooking oils, fats, and grease to a rendering firm.
	• Return corrugated boxes to your supplier for reuse or reuse them at your own business.	

Reduce, Reuse, and Recycle Options for the Workplace: Automotive Dealer/Service Station

Reduce	Reuse	Recycle
• Order parts in bulk quantities to reduce packaging.	• Collect and rejuventate/recycle CFC's from auto air conditioning systems.	• Recycle steel and aluminum body parts with a scrap metals dealer.
• Remove the name of your business from junk mail lists.	• Replace paper hand towels with reusable cloth towels and cleaning rags.	• Recycle used motor oil by using a DEHNR-licensed waste oil hauler.
• Buy liquid cleaning supplies in concentrate form.	• Wash and reuse steel and plastic storage containers that carried non-hazardous materials. Many distributors will accept back these containers on a deposit basis.	• Recycle lead acid vehicle batteries with a DEHNR-licensed battery recycler or salvage dealer.
• Ask shippers not to send disposable or hard-to-recycle packing materials.	• Promote retreading of worn tires when possible.	• Recycle worn tires at a DEHNR-licensed tire processing facility.
• Ask that your suppliers use recycled and recyclable packing materials.		

Reduce, Reuse, and Recycle Options for the Workplace: Institution

Reduce	Reuse	Recycle
• Purchase products with minimum packaging.	• Replace paper towel dispensers with cloth towels.	• Office paper.
• Purchase liquid cleaning supplies in bulk.	• Replace disposable dinner ware with reusable.	• Mixed paper if marketable in your area.
• Purchase food in bulk.	• Use reusable dinner trays.	• Corrugated cardboard.
• Copy all documents double-sided.	• Provide employees with reusable mugs.	• Newspaper.
• Purchase a bulk milk dispenser.	• Use reusable water pitchers.	• Aluminum and bi-metal.
• If individual, disposable milk servings must be purchased, consider 8-oz. milk pouches.	• Use cloth napkins, diapers, aprons, gowns, etc.	• Plastic.
• Install low-flow shower heads and water-saving toilet devices.	• Use reusable (washable) underpads on bedding.	• Scrap metal.
• Purchase products in recyclable packaging.	• Convert scrap paper into memo pads.	• Glass bottles and jars.
• Purchase dispensers for soap, shampoo, etc.	• Use two-way envelopes.	
	• Repair furniture.	
	• Purchase items that use electricity, not batteries.	
	• Use re-chargeable batteries.	
	• Purchase reusable printer ribbons and cartridges.	

Reduce, Reuse, and Recycle Options for the Workplace: Manufacturing

Reduce	Reuse	Recycle
• Improve product design to use fewer materials.	• Maintain equipment properly to reduce wear and extend machinery life. Consider re-manufacturing worn equipment instead of replacing it.	• Include recycled materials in manufactured products whenever possible.
• Reduce production scrap by modifying production equipment and processes.	• Return corrugated boxes to your supplier for reuse, or reuse them at your company.	• When applicable, collect excess materials for in-house, post-industrial recycling.
• Order parts in bulk quantities to reduce packaging.	• Collect cores from paper, plastic, and metal rolls for return to the supplier, or reuse them as packaging materials.	• Collect metal strapping bands, shavings, and floor sweepings for a metals recycler.
• Have your company name removed from junk mail lists.	• Replace paper towels with reusable cloth towels and cleaning rags.	• Purchase recycled packaging materials such as shredded newspaper and cardboard when shipping products.
• Ask your suppliers to use recycled and recyclable packing materials.	• Purchase used instead of new gaylord boxes.	• Recycle cardboard that cannot be reused.
• Buy liquid cleaning supplies in concentrate form.	• Wash and reuse steel and plastic storage containers that carried non-hazardous materials. Many distributors will accept back these containers on a deposit basis.	• Separately collect motor oil, lubricants, and cleaning solvents for recycling.
• Purchase high-quality pallets that are easily repaired.	• Repair broken wood pallets for reuse.	• Send damaged wood pallets to a lumberyard that can shred them into wood chips for mulch, or allow employees take untreated wood pieces home for kindling.

Source: Business & Commercial Recycling: A Guide to Recycling in the Workplace. Wisconsin Department of Natural Resources. April 1992.

Waste Reduction Checklist

This checklist is not meant to be all-inclusive. These suggestions should stimulate additional ideas that may apply to a firm's specific situation. By examining the waste-producing processes, more opportunities for source reduction and recycling may be discovered.

Identify the points at which waste is generated in the production or work processes.

- **Determine quantities of each waste generated for each specific time period, i.e., hour, day, month.**
- **Identify one or more alternative ways that wastes can be reduced at each point in the process.**
- **Evaluate the raw materials used for ways to reduce their toxicity and volume of disposal. This evaluation may result in the use of different raw materials that may be easier to reuse or recycle.**
- **Reduce the materials in the waste that are likely to have a negative impact on the environment. (The U.S. EPA maintains a list of hazardous wastes; this list may be obtained by contacting the regional EPA office.)**
- **Reduce those materials that appear in the waste in large quantities.**
- **Develop a plan that specifies waste reduction objectives and sets targeted completion times for accomplishing them.**
- **Invest in durable products and equipment which can be easily repaired and/or recycled.**
- **Buy products made from recycled materials such as paper, containers, and packages.**
- **Improve quality monitoring systems to improve production efficiency. Close monitoring will result in fewer rejected products and less waste.**
- **Develop a waste reduction budget. Be sure that needed resources will be available.**
- **Establish a company-wide commitment to making waste reduction a part of doing business.**
- **Establish a waste reduction task force to implement the plan. The task force should be headed by an enthusiastic person to serve as its coordinator.**
- **Develop employee education programs on waste generation.**
- **Train employees on waste reduction techniques.**
- **Check waste exchanges for materials that may be used as raw materials in the production process.**

This section has been reproduced from the Ohio State Department of Natural Resource's *Waste Reduction Guide for Ohio's Business and Industry.*

Closing the Loop - Buying Recycled Products

If a company is reducing, reusing or recycling solid wastes, it has already made great strides to better manage solid wastes. However, until collected recyclable materials are manufactured into new products, which are then purchased and used, "recycling" has not really occurred. A company can further promote true recycling by buying products made from recycled materials. Buying products with a recycled content will increase the demand for recycled materials and help close the loop of the larger recycling picture.

Promoting Buy-Recycled

- **Establish and implement a procurement policy on recycled products and purchase recycled products.**
- **Review with the purchasing agent the recycled content and recyclability of the following items that the company may buy:**

Office paper	**Computer Paper**
Packaging	**Copier paper, stationery, and envelopes**
Cardboard	**Carpet**
Paperboard	**Tissue**
Lube & motor oil	**Hand towels**
Construction materials	**Asphalt, cement**
Plastic lumber screens	**Retread tires**
Other production feed stocks	**Reconditioned equipment**

- **Examine purchasing specifications to eliminate prohibitions or limitations on recycled products. Price preferences (5 to 10 percent) and life-cycle costing can provide incentives for using recycled products.**

Recycled or Recyclable?

Products bearing the "recycled" label are constructed at least in part with recycled materials. Products labeled "recyclable" are made of materials that are technically recyclable. The "recyclable" label does not mean that the product has recycled content. Users need to ensure that recycled-content products can also be recycled after their intended use. For would-be consumers, local recyclers can provide information about products that can be recycled.

Post-Consumer or Post-Industrial?

Products with post-consumer content are made from materials recycled after their intended end-use. Post-industrial products are

made with scrap of by-product materials generated at the manufacturing process. An example of a product with post-industrial content is paper products that are made using paper trimming or cutting wastes recycled back into the paper making process.

Buy Recycled Business Alliance - National Recycling Coalition

The National Recycling Coalition (NRC) has initiated the "Buy Recycled Business Alliance," a group of national companies working with the NRC who have committed to increasing their use of recycled-content products. The national campaign goals are to develop and expand markets for recycled materials by increasing awareness of the value, reliability, and performance of recycled-content products.

Future activities of the business alliance will include training workshops, a buy-recycled procurement manual, current use assessments, and other educational tools.

To join the national Buy Recycled Campaign or to request more information, contact Phil Bailey, Director of Market Development, National Recycling Coalition, 202/625-6406.

1993 Buy Recycled Business Steering Committee members include:

- American Airlines
- AT&T
- Bell Atlantic Co.
- The Coca-Cola Co.
- E. I. duPont Co.
- Fort Howard Corp.
- James River Corp.
- Johnson Controls
- Laidlaw, Inc.
- Menasha Corp.
- Quaker Oats
- Rubbermaid, Inc.
- Sears Roebuck and Co.
- Waste Management' Inc.
- Wisconsin Tissue Mills
- Anheuser-Busch, Inc.
- Bank of America
- Browning Ferris Industries
- Cracker Barrel Old County Store, Inc.
- Garden State Paper Co.
- Johnson & Johnson
- Kmart Corporation
- McDonald's Corp.
- Moore Business Forms, Inc.
- Rock-Tenn Co.
- Safeway, Inc.
- Wal-Mart, Inc.
- Wellman, Inc.

North Carolina's Buy-Recycled Campaign

North Carolina also initiated a state "Buy-Recycled Campaign" in 1991. A key element of the campaign was the first North Carolina Buy-Recycled Conference July 1992 which brought together nearly 300 participants including recycled products vendors as well as purchasing agents from local governments, State agencies, and

private companies. The conference was co-sponsored by the North Carolina Departments of Administration; Commerce; Environment, Health, and Natural Resources; and Transportation. Sponsors also included the North Carolina Recycling Association and the Small Business Technology Development Center.

The North Carolina Office of Waste Reduction and other State agencies including the Division of Purchasing and Contracts continue the campaign through production of various publications and sponsorship of "Buy-Recycled" sessions at State recycling and purchasing events. Presentations were made at the Carolinas Association of Governmental Purchasers Annual Spring Conference in March 1993 and 1994 in Durham and at the North Carolina Recycling Association's annual conferences in March 1993 and March 1994 in Asheville. A series of one-day regional workshops on purchasing recycled products is under development. The brochure, "Buying Recycled Products Through North Carolina State Contracts," is currently available at OWR.

Information Resources

The following resources can provide more information on purchasing recycled products.

- North Carolina Office of Waste Reduction, 919/571-4100 or l-800-763-0136
- Official Recycled Products Guide (RPG), American Recycling Markets, Inc., l-800-267-0707
- National Recycling Coalition, Buy Recycled Business Alliance, 202/625-6406
- National Office Paper Recycling Project' 202/223-3089

Case Studies Summary

Company	Industry	Application	Waste Reduction/ Annual Savings/Revenues
Allied-Signal, Inc.	Yarn Production	Waste Reduction/ Recycling	Eliminated 99 percent of waste disposed in landfill.
Amital Spinning Corp.	Yarn Production	Water/Energy Conservation; Solid Waste Reduction	$80,000 Savings.
Breadman's Restaurant	Restaurant	Source Reduction/ Waste Reuse	Construction/ Demolition waste reclaimed/reused.
Boston Gear Division	Gear Machining	Waste Reduction/ Management, Recycling	$120,000 in savings and revenues.
Campbell Soup Company	Processed Foods	Waste Reduction/ Recycling	Over $2 million in revenues and savings.
CertainTeed Corp.	Roofing Materials	Process Modification, Recycling	$50,500 savings.
Crown Crafts, Inc.	Textiles Manufacture	Recycling	$118,500 in savings and revenues.
Glen Raven Mills, Inc.	Yarn Manufacture	Recycling	Reduced landfill trips from 22 to 5 per month.
Harriet & Henderson Yarns, Inc.	Yarn Manufacture	Recycling/Reuse	$240/week revenues in all plants.
International Business Machines	Computer Manufacture	Packaging Waste Reduction	Over $2 million in savings.
Johnson & Johnson Advanced Materials	Fabricated Rubber Products	Recycling/Reuse	$365,000 savings.
JPS Elastomerics Co.	Fabricated Rubber Products	Recycling/Reuse	$55,175 savings.
Mastercraft	Textiles Weaver	Reuse/Recycling	$300,000 savings
Medlin-Davis	Dry Cleaners	Reuse	Coat hangers reused.
Miller Brewing Company	Brewery	Reuse/Recycling	Reduced landfill loads by 72 percent.
Morganite, Inc.	Electrical Components	Recovery/Reuse	$69,000 savings.
Neuville Industries	Textile Processing	Reduction/ Recycling	$15,000 savings
Northwoods Village	Residential Apartments	Recycling	Residential recycling program.
Thomson Crown Wood	Furniture Manufacture	Reduction/Recycling/ Waste Elimination	Over $200,000 in savings.
R. J. Reynolds	Cigarette Manufacture	Waste Recovery	$686,000 in revenues.
Watauga Ready Mix	Concrete Manufacture	Recovery/Reuse	$30,650 savings.
City of Winston-Salem	Municipality	Yard Waste Composting	Reduction in landfill waste.
Zuttel, Inc.	Restaurant	Recycling	$2,641 savings in disposal costs.

Section 5.

Case Studies

This section contains case studies of successful solid waste reduction projects implemented by North Carolina businesses and industries. Examples of innovative, cost-effective waste management programs rang from a computer manufacturer's packaging strategies to a restaurant's recycling/reuse program that earned the 1992 Governor's Award for Achievement in Industrial Waste Management.

Section 5. Case Studies

Allied-Signal, Inc.

Location	**Moncure, North Carolina (Chatham County)**
Industry	**Polyester Yarn Production**
Application	**Waste Reduction/Recycling**
Waste Reduction	**Eliminated 99 percent of waste disposed in landfill**
Background	**Allied-Signal, Inc., manufactures high strength polyester yarn for use in products such as automobile tires, seat and conveyor belts, cordage, and broad woven fabrics such as tarps.** **To achieve its goal to eliminate all forms of waste polyester from disposal at the county landfill, the company organized a team of employees from various departments to identify waste polyester management projects and to set goals for completing the projects.** **After identifying all the waste streams, the team members decided on several steps to be taken. The first and simplest step involved segregation of polymer sample waste from routine trash collected in the department. This waste was then added to the polymer waste that was already being recycled.**

Amital Spinning Corporation

	$80,000

Amital, continued

Waste Reduction Activities

To reuse and conserve process water, Amital collected non-contact cooling water to use in the color kitchen for the preparation of dye Liquors. The use of this warm water for preparing the dye liquors at high temperatures reduces steam requirements during dyeing. Process water is recovered, and the expended chemicals are replenished. These changes reduce water and energy consumption and costs. Other savings include a reduction in the quantity of batch chemicals and in the time required for heating by 8 to 10 minutes per cycle.

Amital also increased its profitability through a solid waste recycling and reuse program for various cardboard, metal, plastic, and acrylic fiber components. Waste products are recycled back to the same process or sold through an outside market. Disposal costs for these recyclables are, therefore, avoided. A baler was installed to facilitate program operation. The company recycled approximately 933,000 pounds of solid waste out of a total of 1.1 million pounds generated in 1992.

Waste Reduction

Amital was able to reduce the amount of wastewater generated per pound of yam dyed from 19.34 gallons in 1988 to 3.19 gallons in 1992. Wastewater volume was reduced from 320,000 gallons to an average of 112,000 gallons per day while production increased from 12 to more than 25 batches of yarn per day. Through the recycling program, the solid waste stream destined for disposal was reduced by 933,000 pounds per year, or an annual solid waste reduction of approximately 80 percent.

Annual Savings

Amital Spinning's savings in 1992 from solid waste disposal costs avoided along witb $185,000 in water use and $500,000 in energy use totaled approximately $800,000 Also, Amital is saving about $45 per batch in chemicals. The company netted approximately $100,000 through its solid waste recycling and reuse program. Amital Spinning was recognized in the 1992 Governor's Awards for Excellence in Waste Management for "Significant Achievement in Industrial Waste Management.."

Breadman's Restaurant

Location Chapel Hill, North Carolina (Orange County)

Industry Restaurant

Application Source Reduction/Waste Reuse

Contact Roy Piscitello, (919) 967-7110.

Background

Breadman's Restaurant in Chapel Hill recently moved locations into a 3,000-ft^2 renovated building. During construction of the new facility and in daily operations, the owners focused on source reduction. The Orange Regional Recycling Program assisted Breadman's in its efforts in conjunction with the Town of Chapel Hill's solid waste management plan for any new commercial or multi-family facility. The plan includes construction waste management, evaluation of the use of recycled materials in construction, and a solid waste reduction operations plan. A sample of activities the restaurant undertook is listed below.

Breadman's, continued

Source Reduction/ Waste Reuse Activities	• **Almost all the broken brick and other rubble from demolition, a total of five loads, was claimed by a passer-by for building a road on his property.** • **Large rocks from the western landscaping design were claimed by a local citizen for erosion control in a gully on his property.** • **When new equipment was delivered, used restaurant equipment was picked up by Equipment Brokerage, a used equipment supply firm.** • **Carpeting, lighting fixtures, and commodes were taken for reuse and resale by Building Supply Recycling Center.** • **All old tables and booths were refinished with a water-based coating and reused at the facility.** • **Exterior doors were removed and reused. Old brick from the interior walls of a Western Sizzlin' was used in construction of interior partitions and decorative features.** • **Fiberglass insulation above the ceiling was taken down, stored on site, and reused when the new ceiling was constructed.** • **Breakfast is no longer served with side jelly packets and extra napkins. Instead, because packets and dispensers are placed at each table, jelly and napkin use are reduced by 40 and 20 percent, respectively.**

Boston Gear Division, Imo Industries, Inc.

Location	**Louisburg, North Carolina (Franklin County)**
Industry:	**Gear Machining**
Application	**Waste Reduction/Recycling/Waste Management**
Savings/Increased Revenues:	**$120,000 per year**
Contact	**Woodrow Prouty, Factory Manager, (919) 496-2041**
Waste Reduction Activities	**The Boston Gear Team (BGT), a Division of Imo Industries, Inc., thinks of its waste as a gain, not a loss. Every effort is made to minimize the amount of waste going into the waste streams. Recycling is BGT's main thrust, and the gain in dollars comes from recyclable materials such as cast iron chips, steel shavings, and bronze and aluminum chips from the machining processes and in solids from scrap or defective component parts.** **All cardboard and recyclable paper is collected, baled and sold. BGT also recycles wood pallets.**

The other area where real savings are realized is the reduction in hauling and landfill fees. In 1991, BGT reduced the tonnage that used to be sent to the landfill by 50 percent.

Waste Management Policies

Another part of BGT's program is to make sure that all waste that cannot be sent into the waste streams such as waste oils, machining coolants, grinding swarf, and paint filters are all collected, recycled, or disposed of through various waste management companies. The cost of disposal for materials has forced BGT to filter and recycle some of its hydraulic oils and filter and reuse machining coolants.

The management of BGT's program is based on a conscientious effort by each member of the Team to recycle where possible and to dispose of waste properly. "Aside from the dollar value of the program, the real savings and gratification comes from knowing that we are doing our best to ensure a clean and safe environment for our community, neighbors and our children."

Boston Gear Division's Recycle/Reuse Savings

Material	Savings, $/yr
Recycled metals (275 gross tons)	80,000
Recycled cardboard (32.4 gross tons)	6,000
Reduction of hauling and landfill fees	23,000
Recycled paper	1,000
Filtering and reclaiming of hydraulic oils and cutting fluids	5,000
Recycling and reuse of pallets	5,000
Total	$120,000

Note: Franklin County presented Boston Gear with a "Wastebuster" award for its waste reduction efforts.

Campbell Soup Company

Location	**Maxton, North Carolina (Robeson County)**
Industry	**Processed Foods**
Application	**Waste Reduction/Recycling**
Savings/Revenues	**Over $2 million (revenues and raw material and landfill savings)**
Contact	**Nancy K. Miller, Environmental Project Engineer, Camden, New Jersey, (609) 968-4435, or Don Fleming, Maxton, North Carolina, (910) 844-5631**
Background	**The Campbell Soup Company (Campbell) facility in Maxton, North Carolina, manufactures heat processed canned soups and canned food products. The preparation of canned soups and foods involves the combination of various ingredients in pre-processed and fresh form. The principal ingredients include vegetables, meat, poultry, dairy products, flour starches, seasonings, fats, and tomato paste. Processing vegetables from raw form involves cleaning, peeling, dicing, and sizing before final washing. Other vegetables are delivered to the plant pre-processed and in bulk.** **The canned food manufacturiug process includes blending, preheating, filling, heat processing, cooling, and packaging. Container manufacturing also takes place at the Maxton plant, which produces about 33 million cases of product each year.**
Pollution Prevention Policy/Approach	**Campbell has developed a corporate-wide pollution prevention program with a strong emphasis on water conservation, waste minimization, and solid waste recycling. The program reflects EPA's solid waste management hierarchy in which source reduction and recycling are highest priority and landfilling is considered a last alternative.** **Campbell's pollution prevention program has been motivated by increasingly strict environmental regulations but has also been effective in lowering plant operation costs and improving overall plant efficiency.** **The Maxton Plant generates approximately 21,000 tons per year of solid waste and scrap material from its canned food and container manufacturing operation and currently recycles 70 percent of this material. Items presently recycled include vegetable waste, cardboard, metal drums, scrap metal, wooden pallets, and fiber drums.** • **Vegetable waste from the soup manufacturing operation is recycled as hog feed. It is transferred from a collection hopper into a hog farmer's truck, which is equipped with steam spargers to sterilize and cook the material on site.** • **Recyclable cardboard is baled and then hauled by the plant's solid waste hauler to a local paper recycling facility.** • **Wooden pallets and ingredient drums are returned to the suppliers.**

Revenues/Savings

The sale of scrap stainless steel, 55-gallon drums, and various other scrap metals to a salvage company generated about $18,000 per year in revenues. Reusing copper and tin plate scrap from the can manufacturing operation saves the plant an estimated $1.5 million in raw material costs.

Water Conservation

In addition to the Maxton Plant's solid waste reduction efforts, considerable progress has also been made in the areas of water conservation and hazardous waste management.

For several years after the Maxton plant began operations, water usage exceeded that experienced at other canned food plants, and increased plant production brought the wastewater flow rate to just within the plant's treatment system capacity. In 1986, a task force recommended ways to improve water use habits throughout the plant and eliminate the need to expand the treatment system:

- **A program of dry cleaning of floors and equipment was instituted. A common sense program of turning water off when it was not needed was enforced.**
- **Modifications to plant processes such as the installation of flow meters on water-using equipment and elimination of fluming of scraps were implemented at a cost of approximately $50,000.**
- **In 1991, the plant also began round-the clock, continuous sanitation manufacturing, which eliminated third shift cleanup and further reduced water use.**

Reduced Operating costs

Water conservation efforts have resulted in a 50 percent reduction in water use per production unit between 1985 and 1992, a period during which production at the plant has more than doubled. In addition to eliminating the need to expand the wastewater treatment system, the efforts of the task force reduced plant operating costs by $125,000 per year.

Can Enamel Waste Reduction/ Cost Savings

In 1989, the Container Department at Maxton implemented a can enamel waste reduction program which has resulted in significant cost savings and a positive environmental impact.

- **Several steps were taken to detect leaks and spills.**
- **Scrapers were installed to dry-clean enamelling equipment, which eliminated the use of solvent baths.**
- **Enamel was filtered and reused where possible**
- **Bulk delivery of enamels and thinners in returnable containers was arranged with vendors.**
- **The Container Department's efforts have resulted in a cost savings of over $200,000 since the program began.**

Campbell Soup, continued

Suggestions for a Recycling Program

A task force approach, in which a group of employees is given the responsibility of recycling one type of material, lends itself well to starting a recycling program. This approach encourages employee involvement and teamwork and makes good use of employees' time because they are concentrating on one item at a time.

It is important that the progress of a recycling task force be measured, documented, and rewarded. Posting educational materials and notices of recycling program successes on plant bulletin boards increases employee interest and participation.

Campbell Soup Company has found from experience that source reduction is vital to an effective solid waste management program. A good starting point for a recycling task force is a study of ways that raw materials packaging waste might be reduced. The Purchasing Department can help in this process by working with existing suppliers (or seeking out new ones) who will take back shipping materials, crates, cartons, and other packaging for reuse or at least package the materials in containers which are readily recyclable.

Certain Teed Corporation

Location — **Oxford, NC (Granville County)**

Industry — **Roofing Materials (SIC 2950)**

Application — **Process Modification/Recycling**

Annual Savings — **$50,500**

Contact — **George Wilkins, Engineering Manager, (919) 693-1141**

Background

Certain Teed Corporation manufactures asphalt shingles. In 1989, Certain Teed contributed approximately 37 percent of the solid waste landfilled in Granville County, or 16,000 of the 43,000 total tons. To reduce this waste stream, Certain Teed invited the Pollution Prevention Program (PPP) to assess the problem and offer pollution reduction alternatives.

Waste Reduction Activities

Certain Teed activated a recycling committee comprised of two line operators, representatives from the purchasing and accounting departments and the engineering manager. This committee was formed to identify new opportunities for recycling or potential source reduction and communicate the programs to all employees.

- **Leaflets were distributed to educate the employees on recycling efforts and the impact of waste disposal on the environment.**
- **Recycling programs for pallets, paper, corrugated cardboard, aluminum, scrap metal, and tab cutouts from asphalt roofing were implemented. Certain Teed produces an estimated 3,000 tons of tab**

	cutout waste annually. This scrap is being sold to paving companies to be mixed in asphalt for parking lots and driveways. • Some of the savings from these waste reduction activities are used to fund picnics and other activities for the employees. • The committee created a community newspaper recycling program and plans to invest in an outdoor recycling bin for all recyclable waste from the community.
Waste Reduction	Solid waste disposal has decreased at Certain Teed by 5,000 tons per year, although part of the reduction results from a decrease in production.
Annual Savings	Certain Teed estimates that the pallet recycling program will eventually save over $25,000 annually; currently, estimated savings are $10,000 annually. The paper, cardboard, and aluminum can recycling programs are saving $3,500 annually. Scrap metal recycling saves Certain Teed over $2,000 annually. The sale of tab cutouts to paving companies is creating $6,000 per year in revenues and saving Certain Teed $29,000 per year in disposal charges.
Other Activities	Most of the process scrap at Certain Teed results from off-spec material. To reduce this waste stream, Certain Teed installed a process control computer. This system cost Certain Teed $250,000 to incorporate into the process but is saving $66,000 annually. This computer, which allows operators to monitor product material constandy, permits immediate shut down of the process if the material is off-spec. Not only has this process control program resulted in reduced waste, but an increase in the quality of the product has also been achieved.

Crown Crafts, Inc.

Location	Roxboro, North Carolina (Person County)
Industry	Textiles
Application	Recycling
Savings/Revenues	$118,500
Background	Crown Crafts is a cut and sew operation that manufactures comforters, sheets, pillow cases, and other bedding products. The 1,000-employee facility has a variety of solid wastes ranging from cotton cloth to cardboard tubes and metal scrap.
Annual Savings/ Waste Reduction Activities	Through a plant-wide recycling effort, Crown Crafts has reduced the waste it sends to the landfill by 94 percent or nearly 1,616,000 pounds of solid waste for which the company would have had to pay almost $27,500 for disposal. The company made a profit of $91,000 from the sale of its recyclables.

Crow crafts, continued

Crown Craft also requires its suppliers to use white or clear strapping since there is no market for the black strapping previously used. The company also sent mailers in part of its product Line so that the consumer can send back the product packaging materials. To close the recycling loop, Crown Crafts buys supplies and packaging materials made from recycled products.

Glen Raven Mills, Inc., Glenspun Plant

Location Glen Raven, North Carolina (Alamance County)

Industry Yarn Manufacture

Application Waste Recycling

Savings Reduced landfill trips from 22 to 5 per month

Contact Don Johnson, Recycling Coordinator (910) 226-3556

Background

Glen Raven Mills, Inc., which is a privately owned textile company in existence since 1880, manufactures several different products at different locations. Yam for knitters is manufactured at the Glenspun plant.

In 1992, Alamance County set up strict rules and regulations governing the materials that could be put in the landfill. Although Glen Raven has been recycling cardboard for 8 years, early in 1992 the company decided to start recycling everything it could before the landfill ban became effective in July. Don Johnson, appointed Reclamation Coordinator for the Division, found that it was a challenge to set up the plant's comprehensive recycling program.

Recycling Program

To grind polypropylene dye springs into 5/16-inch chips, Glen Raven purchased a granulator, 1.5-cubic-yard tilt trucks, a conveyor, and a cyclone with vacuum. They also built a ramp and an inspection table. Also purchased were a filtering system for collection of dust particles produced during the grinding operation and a pallet jack to move the Gaylord boxes when they are full (about 750 pounds capacity). The chips are sent back to the supplier where they are reused to make rigid tubes or cones. Currently Glen Raven is recycling about 425,000 pounds of ground polypropylene per year.

Cardboard

Glen Raven Mills also is recycling cardboard under an arrangement with Federal Waste, who picks up its trailer at the Glen Raven plant when it is full and returns it after unloading. Currently, Glen Raven is recycling 426,000 pounds of cardboard per year.

Plastics

Glen Raven Mills is recycling three grades of plastic: stretch film; bale wrap, which is used on the cover of fiber bales received from the fiber producer; and polyethylene, which is used to keep the yarn clean. The company currently recycles 50,000 pounds of plastic per year.

Glen Raven Mills, continued

Steel	Glen Raven purchased a chopper and is recycling about 50,000 pounds per year of the steel bands that come on bales of fiber. This operation requires the strips be cut into t-inch lengths and shipped in Gaylord boxes. However, the supplier has already started using a recyclable polyester strapping material, and, by July 1993, Glen Raven should not receive steel strapping any longer.
Office Paper/ Cans/ Containers	Currently Glen Raven Mills recycles about 10,000 pounds of office paper a year and also has placed recycling containers in all the commissary areas to collect aluminum cans, steel cans, and plastic containers.
Savings	Since Glen Raven began recycling in June 1992, dumpster trips to the landfill have decreased from 22 to 5 per month, a savings of 67,000 pounds each month of materials diverted from the landfill. The recycling efforts will result in keeping about 1 million pounds of solid waste from the landfill. Mr. Johnson says that "our main objective in this program is to save the environment for the future generation. It has cost quite a sum of money and labor to do this, but we feel good about it and encourage everyone to join in this endeavor."

Harriet & Henderson Yarns, Inc.

Location	Henderson, NC (Vance County)
Industry	Manufacture Spun Cotton Yarn (SIC 2342)
Application	Recycling/Reuse
Annual Revenues	$240/week all plants by March 1993
Alternative Use	50 bales/week donated as livestock feedstuff
PPP Challenge Grant Award	$4,000
Contacts	Richard Johnson (919) 430-5121 or Bud Wortham (919) 430-5381
Background	Harriet & Henderson Yarns, Inc. (HHY), manufactures spun cotton yarn at four plants in Henderson, N.C., two plants in Clarkton, N.C., and another plant in Summerville, Ga. Part of the manufacturing process involves cleaning the raw cotton to remove bits of crushed cotton stalks and seeds, dust, and short cotton fibers. All this cleaning by-product was formerly baled and sent to the local landfill. The four Henderson plants generate 80 bales (44,000 pounds) of the cleaning by-product per week. Landfilling the material costs approximately $10.00 per bale in Vance County.
By-Product Research and Sales	HHY sought alternative ways to use or manage the material to avoid landfilling. By modifying the cleaning operations so that more of the short

fibers could be recovered, HHY is able to currently sell about 5,300 pounds per week (10 bales) to textile by-product brokers at 1.5 cents per pound. Once modifications are completed at all plants in March 1993, they expect to be able to sell 16,000 pounds per week.

Agents with the Vance County Cooperative Extension Office advised that the material has potential uses in agriculture and identified three potential uses: as a soil amendment and nutrient source for crops, as a soil stabilizer for erosion control, and as a feed source for livestock. To research and test these applications, HHY received a Challenge Grant from the Pollution Prevention Program to evaluate these potential uses. HHY matched the grant with its own funds.

The by-product can feasibly be used as a soil amendment to supplement commercial fertilizer or as a soil stabilizer to replace wheat straw and asphalt, but it must first be milled to permit even distribution for either of these applications.

By-Product Donations

The most promising of the alternative uses was as a feed source for livestock. Cotton by-products such as cottonseed, cottonseed hulls, and cottonseed meal are already widely used as livestock feed ingredients. Feeding studies by animal nutrition specialists at North Carolina State University revealed that the cleaning by-product is comparable to low-quality hay.

Hay of this quality has a value of approximately 1.5 cents per pound, but the policy at HHY is to provide the by-product to interested livestock producers at no charge. HHY currently distributes an average of twenty 680-pound bales per week, and there is a waiting list of farmers wanting to get this free feed. After further modifications, the company expects to be able to supply 50 bales per week.

The success at Harriet & Henderson has been advertised among Cooperative Extension personnel across the state, and other cotton processors have begun to evaluate the potential to use their cleaning by-product for cattle feed.

Contact Information

Cotton characteristics vary widely with geography and production and processing practices. Cotton processors who are interested in exploring livestock feeding are strongly encouraged to contact Dr. Matt Poore, Ruminant Nutrition Specialist at NCSU Animal Science Department at (919) 515-2761, ext. 2762, for guidelines for setting up a feeding program and to have the by-product analyzed to determine its nutrient value and to detect any constituents that may be harmful to livestock.

International Business Machines (IBM)

Location	**Research Triangle Park (RTP), North Carolina (Durham County)**
Industry	**Computer Manufacture**
Application	**Packaging Waste Reduction**
Savings	**Over $2 Million**
Contact	**Doug Smith, IBM Advisory Packaging Engineer, Packaging Engineering Dept 324**

Background

IBM's Packaging Engineering Department at Research Triangle Park (RTP), North Carolina is aware of and concerned about the complex environmental issues that industry faces today. The packaging engineering team is playing a key role in addressing those problems by reducing solid waste, eliminating CPC's (chlorofiuorocarbons) from foam shipping cushions, and eliminating bleached liner paper and heavy metal printing inks from shipping cartons.

IBM considers today's environmental issues its Number One priority for the 1990's and has already implemented many improvements in the areas of source reduction, recyclability, reusability, and consumer awareness and education. This case study highlights IBM Packaging Engineering Department's contributions and improvements in the environmental arena and showcases its dedication and accomplishments.

Solid Waste Recycle/Reuse

In 1990 the total amount of solid waste recycled and reused at IBM was 11,605 tons, which comprise over 88 percent of the corrugated materials collected at RTP. Packaging material (corrugated, foam and plastics, wood) comprised approximately 50 percent of that total. The largest contributors were corrugated paper products such as shipping cartons, inserts and folders (over 5,000 tons). In comparison, 65 percent of all corrugated material in IBM was recycled and about 50 percent of corrugated used in the U.S. was recycled in 1989. The 1992 target established by the Environmental Protection Agency is 25 percent.

Environmental Goals

The environmental goals in Packaging Engineering Department are as follows:

1. **To incorporate reuse/recycling and/or disposal plans into all existing and new product packaging designs and plans.**
2. **To design product packaging to minimize "disposable" solid waste through more rugged product design that requires less packaging, innovative design techniques, and prudent material selection without compromising product protection.**
3. **To educate and inform customers, coworkers, and the industry about the need for environmental awareness and policy and help dispel the many myths surrounding the packaging industry, its materials, and practices.**

4. To provide customers with easily obtainable recycling and/or disposal options for their packaging materials.
5. To use stringent environmental criteria when selecting materials for protective packaging, i.e., no CFC's, toxins, heavy metals, etc.
6. To increase the use of recycled raw material content in the manufacture of new packaging materials.

Packaging Engineering at RTP is committed to a proactive environmental policy based on the three R's hierarchy: Reduce, Reuse, Recycle.

Source Reduction

IBM's initial design energies are concentrated on source reduction; that is, utilizing the minimum amount of material in package designs without compromising product protection, optimizing designs, and eliminating all non-value added material, thereby reducing "disposable materials" input to the solid waste stream. Once design is optimized, IBM then considers and designs for reuse and/or recycling options.

The best opportunity for source reduction lies in a rugged product design. Increased product fragility requirements and earlier and more thorough mechanical analysis are the best levers for reducing product protection needs. This analysis would result in decreased package size, less material content, and lower transportation expense as well as higher product quality and reduced warranty costs. Product designers are working closely with development teams to get involved earlier and establish stringent fragility criteria for new products and subassemblies. Other opportunities he in prudent material selection and innovative package design.

1991 Savings in Source Reduction/ Design Modification

IBM is also investigating existing package designs and looking for material reduction opportunities. The following source reduction/design modification improvements were implemented in 1991:

- A package cushion material underwent material change from polyethylene strand foam to polypropylene which resulted in a 30-percent reduction in foam material and saved $900,000.
- The PS1 "Solution in a Box" was an evolutionary design strategy that provided the customer with an entire desktop workstation including monitor, system unit, keyboard, mouse, and software in a single set of polystyrene cushions. This new design eliminated separate individual element cartons (over 8,000,000 square feet of corrugated) and saved $736,000 in 1991. Further redesign reduced plastic foam content and netted an additional $147,000 in 1991 savings.
- Initial modifications of PS2 Mod 30/55 cushions, as designed by the supplier, eliminated non-essential material and incorporated a stacking/nesting feature. The reduction in material and mold cycle time resulted in a 1991 savings of $1,177,000.

- **Certain repaired units packaging was redesigned to incorporate a reusable Ethafoam (Polyethylene) design, and a reuse collection and return program was put in place between the Repair Center and the cushion supplier.**
- **Four modified corrugated carton designs replaced the former top-load carton with a new end load design. The change eliminated over 2,000 square feet of corrugated paper and netted $121,000 in savings.**

Consumer Awareness Education

In September 1992, IBM RTP Packaging Consulting Services began offering its package design, testing, and experience to outside (non-IBM) customers. Consumers wishing more information about how IBM can help with packaging problems may call 1-919-543-6625.

IBM believes that the biggest environmental asset it has is an informed and concerned consumer. It is the consumer, the end user, that needs to take the initiative and save, reuse, recycle or properly dispose of their new product package. The Packaging Department was again instrumental in promoting the use of recycling symbols and resin codes on IBM packaging materials to help inform citizens of recycling options.

Elimination of CFC's and Heavy Ink Metals

One of the five major IBM corporate packaging environmental initiatives was the total elimination of CFC's from foam shipping cushions and the processes used to manufacture the cushions. Typically used as expansion or blowing agents in the foam molding process, CFC's are commonly believed to attack and deplete the earth's protective ozone layer. In addition IBM has added strict CFC-free requirements on all foam cushion specifications and drawings.

IBM has also totally eliminated and now prohibit the use of heavy metals in printing inks (carton graphics) or plastic packaging manufacture. The heavy metals, if used, are reputed to release toxins into the environment during manufacture and/or disposal operations.

There still remains much to be done. These environmental issues and objectives will continue to be IBM's highest priority. There is much opportunity in the pursuit of these initiatives. These issues must be attacked with creativity and innovation. IBM welcomes any and all suggestions, comments, or ideas on how to better our packaging products and services.

Johnson & Johnson Advanced Materials Company

Location	**Benson, North Carolina (Johnston County)**
Industry	**Textiles**
Application	**Source Reduction/Recycling**
Savings/Revenues	$365,000
Background	**Johnson & Johnson (J&J) Advanced Materials Company manufactures non-woven textiles and fabrics for medical markets, wiping markets, and the automotive industry.**
Source Reduction Activities	**J&J is not only working to minimize its current waste streams, but it has found a way to address future wastes before they occur. The company adopted a Product/Process Development Program which requires an environmental impact assessment of all new products and processes. The product assessments or life cycle analyses examine the environmental impact and the natural resource usage associated with a product from its inception at the raw material stage to its final disposition as waste. This activity allows J&J to determine the processes that are the least detrimental to the environment.**
Waste Reduction/ Annual Savings	**Current source reduction efforts in recycling have saved nearly 1.6 million pounds of office, packaging, and production was from going to the landtill. The company's efforts saved it more than $365,000 in 1992.**

JPS Elastomerics Company, Inc.

Location	**Westfield, North Carolina (Stokes County)**
Industry	**Fabricated Rubber Products**
Application	**Waste Recycling/Reuse**
Savings	**$55,175 per year**
Challenge Grant Awarded	**$15,000**
Contact	**Joe Gregory, Plant Manager, (910) 351-3131**
Background	**JPS Elastomerics Company manufactures single-ply roofing, reservoir linings, covers, and geomembranes. Because of increasing landfill costs and regulations, JPS sought to reduce its solid waste load. After visiting the facility, the Pollution Prevention Program (PPP) recommended some possible recycling markets for JPS' waste streams. With these markets in mind, JPS applied for an Office of Waste Reduction/PPP Challenge Grant to research possible rises for these wastes.**
Six Pilot-Scale Programs	**JPS performed six pilot-scale programs to reduce the amount of cardboard and polymer sheet waste discarded. As a result, several programs were implemented:**

JPS Elastomerics, continued

- A larger baler was purchased and is used to condense the cardboard so that it can be sold to a recycler.
- The polymer sheet waste is sorted, cut to size, and press molded into walkway pads. These pads have become a profitable new product for JPS.
- Other waste polymer is being ground and recycled back into the original manufacturing process.

Waste Reduction

JPS is recycling approximately 85 tons of cardboard and 222 tons of polymer sheet waste a year.

Cost Savings

The company realized almost immediate returns on its investment. Tipping fees have been reduced by $16,400 a year, and JPS is making approximately $38,775 a year by selling the cardboard and walkway pads. Annual overall savings are about $55,175.

Mastercraft

Location Five North Carolina Locations

Industry Textiles

Application Reuse/Recycling

Savings/Revenues $300,000

Contact Wilson Jumper (704) 2864811)

Background

The Mastercraft Fabrics Division of Collins & Aikman Corporation is a jacquard weaver of home furnishings and contract fabrics with five locations in North Carolina.

Waste Reduction Activities

Through recycling and reuse, Mastercraft has been able to reduce many of the traditional solid waste streams found in the textile industry.

Examples of Mastercraft's recycling efforts include the breaking down of latex used in backing to its raw form for reuse in non-critical applications, reuse of paper yam carriers previously disposed of in the landfill, and concentrated efforts to make optimum use of raw materials by focusing on fabric yields. All yam and fabric wastes are sold for further processing into useable products.

Annual Savings

By reducing landfill wastes, Mastercraft has realized savings of approximately $300,000 at its North Carolina plants.

Medlin-Davis Cleaners

Location	**Raleigh, North Carolina (Wake County)**
Industry	**Dry Cleaning**
Application	**Reuse**
Contact	**Ray McEwen, 932 NE Maynard Road, Cary, NC, (919) 380-1080.**
Reuse Activities	**Medlin-Davis Cleaners, with 10 stores in Cary and Raleigh, has instituted a program to accept coat hangers from customers for reuse. Customers have responded well by bringing hangers in by the paper bag. To keep hangers from creating "puzzle piles," the store began providing customers with cardboard hanger caddies. The hangers are reused if in good condition, or the store owners take the hangers to a laundry they own for customers to use there.**
Environmental Assistance Contributions	**Beginning in May 1992, Medlin-Davis Cleaners donated one cent for every hanger returned to the Triangle Land Conservancy to raise money to purchase land that is geographically or botanically significant to the region. Currently the company contributes a flat amount of $200 per month to the group which is based on the time saved counting hangers.**

Miller Brewing Company

Location	**Eden, North Carolina (Rockingham County)**
Industry	**Beer Brewing**
Application	**Reuse/Recycling**
Waste Reduction	**Reduced landfill loads by 72 percent**
Background	**Miller Brewing Company made a commitment to eliminate its use of landfills by the end of the 1990s. To achieve this goal, a Secondary Resources Committee comprised of salaried and hourly employees was established. The committee attended seminars on waste reduction and recycling to become more familiar with possible options. The committee then made plans, established contacts, and developed markets for the brewery's solid waste and by-products. Using the committee's recommendations, Miller Brewing implemented several projects:**
Waste Reduction Activities	• **The purchasing department rewrote existing contracts to initiate reuse or specify a different type of container that was made of recycled or contained recyclable material.** • **Bulk containers are now being returned to vendors for reuse, and wood from crate shipments is being donated to local schools.** • **Miller Brewing has improved its method of collecting broken glass so that more of it is being recycled.**
Waste Reduction	**These projects have helped the company reduce loads to the landfill by an average of 72 percent.**

Morganite, Inc.

Location	**Dunn, North Carolina (Harnett County)**
Industry	**Manufacturers Electrical Components**
Application	**Solid Waste Recovery/Reuse**
Savings	**$69,000 per year**
Challenge Grant Award	**$5,000**
Contact	**Norb Dichmann, Environmental Engineer, (910) 892-8081**

Bachground

Morganite, Inc., a manufacturer of electric motor parts, is made up of two divisions: the Electrical Carbon Brush Division, which makes carbon brushes, and the Commutator Division, which makes commutators. In 1989, Morganite's 748,300 lbs of hazardous waste made it one of the top 25 waste generators in North Carolina.

This waste, which was produced solely from the Electrical Carbon Brush Division, consisted of lead-contaminated dust from the dust-collection system, lead-contaminated offcuts and other solid scrap pieces from brush processing, solvent waste from brush rinsing (acetone, alcohol and varsol), cyanide waste from plating silver on copper tamping powder, copper plating waste from specialty copper-plated carbon brushes, and lead-contaminated filters from the dust-collection system.

Waste Reduction Activities

In 1990, Morganite invested in an environmental engineer position to address the quantity of hazardous waste generated. The following activities were implemented between 1990 and 1993.

- **One of Morganite's first steps, and the one that resulted in the largest reduction of hazardous waste, was to separate the dust-collection system. Several different operations in the plant that produce dust particulates were jointly connected to this system. Although only 10 percent of the brush grades produced contained lead, each operating area used some quantity of lead, and all the dust collected was eventually contaminated. In 1990, Morganite designated a Cutting and Grinding Department to produce carbon brushes with no lead content. The dust from this department was connected to a separate dust-collection system that yielded non-hazardous dust waste.**
- **Because the carbon content of the hazardous dust was reduced, the waste containing lead now contained high concentrations of copper. Morganite initiated a project to test the briquetting of the high-copper dust into a marketable form. This project facilitated the briquetting of dust containing 50 percent or more of copper to be sold to a local scrap metal dealer. After several attempts to locate markets for dust with lower copper content, Morganite found a smelter that could take dust with the copper as low as 15 percent and now ships this metal-bearing dust as a saleable, recyclable by-product rather than as a hazardous waste.**

- **Morganite examined operations that generate the remaining lead-contaminated dust disposed of as a hazardous waste. The blending operations, where materials are bound together with resins and, then, ground to produce a powder, were redesigned to eliminate the high volume of powder removed by the dust-collection system. The new dust-collection system at the milling operation, where the clumped resin-powder mix is ground, was installed with a small cyclone to capture the powder for reuse before any contamination occurred. These modifications not only reduced raw material costs and hazardous waste generation, but the waste dust from the blending operation now contained enongh copper to be shipped off for reclamation.**
- **A reconfiguration of the cutting and grinding operations permitted the offcuts of the pure carbon brushes to be completely separated from lead-contaminated offcuts. Furthermore, because of the large reduction in pure carbon offcuts, the remaining offcut waste contained at least 50-percent copper. These offcuts are claimed as exempt scrap metal and shipped off site for copper reclamation.**
- **The Impregnation Department, where solvents are nsed to impregnate the resins into the brushes, initiated an employee involvement program to facilitate reductions in shipments of hazardous solvent wastes. A 50-percent reduction in the solvent waste was achieved as a direct result of employee frugality.**
- **Morganite contracted out its cyanide plating needs and, therefore, eliminated this plating waste stream. The other plating waste was generated from a copper plating operation installed to produce specialty brushes for a single customer. As a result of the new grade of brush designed by Morganite's product development team that out-performed the copper-plated brush, this plating operation was eliminated.**
- **A limited quantity of the final carbon brushes are wet ground for specialty application p&poses, and the wastewater from this operation is contaminated with small amounts of lead. In the past, the waste was drummed and disposed of as a hazardous waste. The installation of a filtration unit permits the water to be reclaimed and the dust particles removed for disposal.**

Waste Reduction

Morganite reduced its hazardous waste generation in the face of a l0-percent growth in production per year. Assuming no increase in hazardous waste generation from other sources or process changes, Morganite generated at least 718,300 fewer pounds of hazardous waste in 1993 than in 1989 as a result of the waste reduction activities. As the list below shows, the different projects account for varying percentages of the 718,000-pound waste reduction:

Morganite, continued

Waste Reduction Project	Percentage of Waste Reduction
Dust separation	48
No-lead carbon offcuts	15
High-copper offcuts	13
Powder dust recovery	5
Copper dust reclamation	10
Solvent waste reduction	3
Elimination of plating wastewater	3

The waste reduction activities at Morganite may make it possible for the company to be categorized as a small quantity generator in 1994.

Annual Savings

The waste reduction activities have resulted in disposal savings of approximately $200,000 annually. Capital investment for all the process modifications has not been compiled.

Neuville Industries, Inc.

Location Hildebran, NC (Burke County)

Industry Textile Processing (SIC 2252)

Application Solid Waste Reduction/Recycling

Annual Savings $l5,000

Contact Jack DeBev'e, Safety Director, (704) 397-5566

Background

The cotton and blended hosiery manufacturing process at Neuville Industries consists of knitting, dyeing, and boarding the hosiery products. The purchase of fabrics and chemicals used in this process, as well as fabric processing, produces large solid waste streams comprised of cardboard, plastic, and paper cones and polybags from packaging.

Waste Reduction Activities

Neuville Industries set up a recycling committee to evaluate, organize and implement solid waste reduction techniques to reduce the cost burden of solid waste disposal. The committee, which comprised the facility safety inspector and members from each of the housekeeping, accounting, knitting and seaming, and training staffs, first established a recycling program in 1990. To spark immediate awareness of the need for recycling and facilitate employee involvement, a employee suggestion program wasset up. Below is a synopsis of the programs implemented for recycling office, purchasing, and processing wastes.

- Office and Break Room Waste: A "bag it" program with Garbage Disposal Systems (GDS) to handle paper and aluninum can waste,

	and color coded waste cans to ensure good separation of different paper grades. • Purchasing Waste: Cardboard recycling program with GDS, plastic cone recycling program with GDS and selling paper cones, and reuse of most shipping pallets in-plant • Processing Waste: Donation of toe clippings to interested parties. The recycling committee is seeking other recycling programs for additional waste streams such as polybags from packaging, knitting oils, and some plastic cones that are not accepted by GDS. The program implemented an employee benefit program to funnel savings back to the employees and facilitate ongoing employee involvement The committee meets bi-annually.
Waste Reduction	Between 1990 and 1992, Neuville reduced its solid waste disposal from 266 yd^3/week to 180 yd /week.
Annual Savings	Nueville's reductions in solid waste resulted in avoided costs of $12,738 for disposal charges. Also, in 1992, $2,389 was received for recyclable materials for a total annual savings of $15,127.

Northwoods Village Apartments

Location	Cary, North Carolina (Wake County)
Application	Residential Apartment Recycling
Pounds Recycled in 1992	Newspaper: 458; Glass clear, green, and brown: 4,259; Aluminum: 271.
Contact	Susan Tolleson Bufano, Property Manager, (919) 467-4560
Background	Northwoods Village Apartments is a 6-year-old community of 228 units ranging in sire from one to three bedrooms. Residents generally fall into the 25 to 34-year-old age group.
Recycling Program	For waste disposal, Northwoods had utilized five 8-yd^3 front end loaders with three dumps a week. Seeing a possibility to reduce costs in 1989, Northwoods cut back its dumps to two a week. This effort proved to be disastrous on some occasions. Certain cans were overflowing during holidays and on the first and last weeks of the month due to move-ins and move-outs. Efforts were made to route residents to remaining empty containers, but often trash was left beside full containers. In May 1991, Northwoods management seized an opportunity to bring recycling to the community primarily for the environmental benefit With the help of Waste Industries, four recycling igloos were brought to Northwoods for newspapers, clear glass, amber/green split, and aluminum cans. The containers were placed in the rear of the property in an area which afforded ample parking.

A recycling kick-off was held for residents to celebrate the beginning of the program. Chuck Sayler of Waste Industries and Cheryl Hannah, Recycling Coordinator for the Town of Cary, attended, and several neighborhood businesses participated in the event by contributing food and gifts. Although very few residents attended the kick-off, they began using the igloos immediately. Northwoods sent out flyers, doorhangers, and used word-of mouth advertising (as well as enthusiasm by the staff) to begin the program.

Additional Recycling Activities

Following the success of the first endeavor, other recycling programs were put into place. A can for newspapers was placed by the resident mailboxes, and a receptacle was placed by the pool for aluminum cans. Employees were instructed to put all office paper and aluminum cans in the proper containers in the storage room in the office, and an in-house corrugated cardboard collection program was recently put into place..

Benefits

All these efforts have been fruitful in many respects.

- The dumpsters are rarely ever full by dumping time. Although Northwoods has not seen a reduction in costs (ii fact, the program costs approximately $150 a month), from another standpoint Northwoods has truly benefited. Management reinforces residents for the contributions they are making, and the residents view themselves as part of an important recycling effort.
- From a marketing standpoint, prospects have fortified their decision to live at Northwoods because it is one of the few communities that has recycling on-site; they view the program as part of the apartment convenience package.
- Another important and positive note is that there have been no loads unacceptable because of contamination. The residents who recycle take great care in preparation and distribution of materials.

Northwoods Village is fortunate to have a manager and a company that are interested in this effort and will keep it running. Most apartment communities are governed by tightbudgets and spending controls, and, unless required by law, will not enact a recycling program. Another problem for apartment communities is lack of space for containers. New construction should be required to include areas for recycling areas.

In summary, recycling at Northwoods Village has been a very positive experience. It has taken very little maintenance once in place and is a benefit for the residents as well as the community. at large. Also, the marketing benefit of recycling programs cannot be over emphasized.

Thomson Crown Wood Products

Location	**Mocksville, North Carolina (Davie County)**
Industry	**Furniture Manufacture**
Application	**Waste Reduction/Recycling/Waste Elimination**
Savings	**Over $200,000 annually**
Challenge Grant Award	**$l0,000**
Contact	**Pat Cobble, (704) 634-8202**

Background

Thomson Crown Wood Products (Thomson) is a part of Thomson Consumer Electronics, an international company that makes TV's, VCR's, and a variety of other electronic products. Thomson manufactures console television cabinets and storage units for audio, producing approximately 500,000 units per year. Production of these items generates a variety of waste, both hazardous and non-hazardous.

Employee Training

In 1978, Thomson instituted a 16-week course to train all employees to recognize problems, develop solutions, and take actions to eliminate waste. The training program was based on the premise that if employees have the knowledge, they will lead the way in improving the quality of the product and protecting the environment The employees worked in teams, and from these teams have come numerous projects dealing with waste reduction, recycling, and elimination of hazardous waste.

The "Mix-Ups Team"

- **The Mix-Ups Team received a Challenge Grant of $10,000 from the Pollution Prevention Program of the Office of Waste Reduction. This money allowed Thomson to purchase new spray guns that reduced the amount of emissions exhausted in the air and the amount of material being used. Although it cost $21,000 to implement this project, in the end Thomson expects to save more than $90,000 per year.**

The "Millroom Madness Team"

- **The Millroom Madness Team implemented a process change on the Heian router that turned a square foot of medium density fiberboard, which was cut from the speaker panel, into an auxiliary shelf for the same television cabinet The shaping of the shelf is now done at the same time the cut-out is made for the speaker. Therefore, the speaker panels are stacked off the Heian onto one pallet and the auxiliary shelf onto another.**

This change eliminated scrap from the process while providing two complete parts. In 1992, this Team's project saved 34 tons of material from going to the landfill and saved Crown Wood in excess of $15,000. This was definitely a "cut-out to talk about"

The "OCC/Fine-liners Team

The OOC/Fineliners team took on the project of glue rejects on the end panel assembly line in the cabinet room. Thomson was losing an average of 21 fully assembled and finished end panel per day to the landfill. By changing a process in the glue application, parts which were glued and transported on the conveyor are now glued at each builder's station with

	an applicator bottle, Thus, no glue parts are placed on the line to be handled by several people before assembly. This process reduced rejects for glue to zero and in one year have kept over 4,000 end panels out of the landfill. The savings produced by this change are over $125,000. At Thompson Crown Wood Products, people who make a wonderful difference in improving the quality of the product and protecting the environment

R.J. Reynolds Tobacco Company

Location	Winston-Salem, North Carolina (Forsyth County)
Industry	Cigarette Manufacture
Application	Waste Recovery
Savings/Revenues	$686,000
Background	R J. Reynolds Tobacco Company (RJR) has cigarette manufacturing facilities in Winston-Salem and Forsyth County. In 1991, the company joined forces with Waste Management, Inc. (WMI) to establish one of the largest privately funded materials recovery facilities (MRF) in the southeast.
Waste Reduction Activities	RJR delivers clean waste related to the manufacture of cigarettes to the MRF where WMI further separates and sells the material. Under their agreement, RJR pays the handling fees for the waste, and the revenues are shared according to their contract Because RJR's materials provide the foundation of the enterprise, WMI is able to serve neighboring businesses and small communities whose waste streams would otherwise be uneconomical to handle. WMI has separate contractual relationships with the other parties.
Waste Reduction/ Revenues	In addition to providing a recycling outlet to businesses and neighboring communities, the MRF has helped RJR reduce its solid waste sent to the landfill by 52 percent since the 1988-1989 fiscal year. The cost savings have also been substantial. RJR received $686,000 in revenues from sales of its recyclable materials in 1992.

Watauga Ready Mix Corporation

Location	**Boone, North Carolina (Watauga County)**
Industry	**Concrete Manufacture**
Application	**Concrete Recovery and Reuse**
Savings	**$30,650 annually**
Challenge Grant Award	**$15,000**
Contact	**G. Perry Greene, Jr., Plant Manager, (704) 264-2611**

Background

Watauga Ready Mix manufactures and distributes ready mix concrete in mixing trucks. Disposal of mix left over in these trucks has historically been a problem in this industry. Although the company attempted to reuse this waste stream by giving it to employees, making soil stabilization blocks, etc., a large percentage was dumped in private local landfills. In an effort to reduce this waste stream and make use of valuable materials, Watauga studied several concrete reclaiming techniques.

Concrete Reclaiming

After a year of review, Watauga determined that Recycle System III, manufactured by J & H Systems, was the best for its operation because of its low capital cost and maintenance, small land area requirement, and the efficiency in cleaning and separating coarse and fine aggregate.

This system comprises two distinct mechanisms, a reclaiming process and settlement basin. The reclaimer is equipped with a hopper to collect wash water and concrete from the mixing trucks. This material is rinsed as it is transferred by screw conveyer up an incline. Aggregate particles, stone and sand, are separated from cement, fly ash, and very fine sand as they move up the conveyor (the other components and excess water are pumped to the settling basins). A punched stainless steel plate filters the fine aggregate into a second screw conveyor while the coarse aggregate is deposited out the top of the first conveyor. The fine aggregate continues to be rinsed as it moves up the second screw conveyor until it is deposited out the top.

The aggregate collected from this procedure is of comparable quality to purchased materials and is reused in the manufacturing of concrete. The settlement basin employs five divided compartments, the first of which receives the overflow from the reclaimer. The purpose of these divided compartments is to allow water reuse by settling materials from the water. The first few compartments are accessible by a front end loader to recover the cement/fines mixture, which is used for fill material, stabilization of gravel roads, and landfill cover. The final compartment contains several pumps to collect water for concrete mixing, truck cleaning, and aggregate cleaning. The water reused for concrete mixing produces a stronger quality concrete than does tap water.

Watauga, continued	
Waste Recovery/ Reuse	**Watauga estimates a recovery of over 5.1 million pounds per year of aggregate, and 650,000 gallons per year of water is reused for plant operations. Part of the water recovered in the basin is collected from area runoff, not just from the reclaimer.**
Annual Savings	**Reclaimed aggregate saves approximately $25,000 per year in purchasing and $7,750 per year in dumping costs. The water savings are $3,000 per year. Cost of cleaning out the basins, maintenance, and electricity are estimated at $5,100 per year, giving a total savings of $30,650 per year. With a project cost of $92,000, au estimated payback period is three years.**

City of Winston-Salem

Location	**Winston-Salem, North Carolina (Forsyth County)**
Industry	**Tobacco/Municipal Solid Waste**
Application	**Yard Waste Composting Demonstration Project**
Savings	**Reduction in Landfill Waste**
Contact	**Dan Miles, M.I.S.S. Department, (910) 727-2846**
Background	**The yard waste composting project in Winston-Salem, North Carolina, has shown that a low-cost, low-level composting technology can be utilized successfully with the inclusion of inert, industrial organic materials.** **Several years of composting leaves produced a nice mulch, although it is nitrogen deficient Most yard waste composting projects include grass clippings to obtain an effective carbon-nitrogen ratio for a good quality compost The high moisture content of the grass clippings combined with the high nitrogen content typically requires a sophisticated aeration system such as a windrow turner to prevent anaerobic decomposition of the compost, which creates odor problems.**
Substituting Tobacco Waste	**An internal effort to work with local industries at reducing landfill waste resulted in the City's demonstration project to substitute tobacco waste for grass clippings. Tobacco proved to be an excellent source of nitrogen, but, unlike grass clippings, the waste product is low in moisture content, which allowed for the use of a relatively low-level composting technology and kept processing cost to a minimum. As an added level of odor protection, coal and wood-chip boiler ash was added as a liming agent to help control pH levels.**
Equipment/ Site Selection	**The composting process utilized a windrow composting method aerated by a CAT 963 front-end track loader, an existing piece of equipment normally used by the demolition landfill division of the City's Solid Waste Management Program. Therefore, the City did not have an equipment outlay for start-up. Also, four separate sites were selected to maximize leaf collection. The City owned three of the four sites and leased the fourth. Labor was provided by the demolition landfill staff.**

Winston-Salem, continued

Data Collection	**Data were accumulated on daily temperature readings, weather conditions, and windrow turning frequencies. The windrows were turned after three consecutive days of internal temperatures exceeding 140 degrees F. Additionally, windrows were turned immediately after a major storm event to move the moisture to the inside of the windrows and provide additional void space for oxygen**
Project Costs	**Total costs for the project were $31,500 including labor, equipment maintenance and fuel, fencing, stone, and signs. Approximately 10,000 tons of leaves composted with several thousand tons of tobacco wastes and boiler ash resulted in a net cost of about $3.00 per ton.**
Landtill Reduction	**The addition of the industrial organics provided a better quality compost as evidenced in a "Waste Analysis Report" on samples of the finished product by the North Carolina Department of Agriculture. Also, a significant amount of material was diverted from the landfill to help meet reduction goals at low cost**

Zuttel,Inc.: The Harvey Mansion Restaurant and Lounge

Location	**New Bern, North Carolina (Craven County)**
Industry	**Restaurant**
Application	**Recycling Program**
Award	**Winner of the 1992 Governor's Award for Achievement in Industrial Waste Management**
Savings/Revenues	**$2,641**
Contact	**Carolyn Zuttel, Co-Owner, (919) 638-3205**
Background	**The Harvey Mansion in New Bern is a dining and restaurant lounge whose owners began an aggressive recycling program in 1991 just after Craven County initiated its county-wide recycling program. Prior to implementing the program,. the restaurant had a daily garbage pickup from an 8-yd^3 dumpster which resulted in a monthly fee of $304.**
Waste Reduction Activities	**A first step in the recycling program was to send frozen compost, vegetable peelings, seafood, and other meat scraps to a local farmer for animal food and fertilizer.** **The restaurant staff was trained on the recycling activities. Two containers were added to every station for food waste, one for compostable materials and one for dry or packaging waste. Cardboard and other recyclable materials such as glass are stored in special recycling receptacles provided by American Refuse Systems, Inc.**
Annual Savings	**The Harvey Mansion reduced trash pickups from daily to weekly and decreased the dumpster size to 4 yd^3 for a reduction in garbage collection of about 3,000 yd^3 per year. Annual disposal costs dropped from $3,646 to $1,005.**

Section 6.

Resources/Contacts

Section 6 contains useful resources and contacts local governments can call upon to assist with their commercial/industrial recycling and waste reduction programs. Included are state agencies, organizations, material groups, and publications.

Section 6. Resources/Contacts

Below are resources local governments can call upon to assist with their commercial and industrial recycling and waste reduction programs.

State Agencies

North Carolina Office of Waste Reduction

The North Carolina Office of Waste Reduction (OWR) is the lead agency responsible for carrying out the State of North Carolina's pollution prevention efforts and waste reduction goals. On April 24,1990, OWR was created when the Pollution Prevention Program of the Division of Environment Management was combined with the hazardous waste minimization and solid waste recycling programs of the Solid Waste Management Division in order to coordinate and strengthen the State's waste reduction efforts. The creation of the office brought together people who already had waste reduction responsibilities and integrated the resources and expertise of the former programs. OWR provides industry, local governments, State agencies, and citizens with non-regulatory technical assistance, education, and training on ways to eliminate, reduce or recycle wastes before they become pollutants.

A divisional level agency within the Department of Environment, Health, and Natural Resources, OWR has two sections:

Pollution Prevention Program

The Pollution Prevention Program, created in 1983, addresses waste in all media including air emissions, waterborne pollutants, toxics, hazardous waste, and industrial solid waste. This program provides industry with free, non-regulatory, and voluntary technical assistance on waste reduction. The Pollution Prevention Program will also provide training and guidance necessary for industries to conduct and implement waste reduction programs.

Solid Waste Reduction Program

The Solid Waste Reduction Program focuses on source reduction, recycling, reuse, and composting. These activities include providing local governments, state agencies, and business, and industry with assistance in meeting the State's waste reduction goal and other waste reduction provisions of Senate Bill 111 and House Bill 1109. The services of the Solid Waste Reduction Program are also directed to developing a recycling infrastructure within the State and to promoting a waste reduction ethic through behavioral change.

Office of Waste Reduction Services

Both the Pollution Prevention Program and the Solid Waste Reduction Program provide a similar range of assistance and support activities:

Information Clearinghouse

The Office has established and maintains a library of journal articles, handbooks, guidance manuals, and other publications concerning waste reduction technologies. This library, which is open to the public, contains over 3,000 publications and can be searched through an electronic database. In addition to hard copy, the clearinghouse also can access national and international computer databases and bulletin boards. Other types of information available include audiovisuals such as videos and slide tape shows and extensive equipment/vendor information.

The Office has also developed a series of publications ranging from condensed waste reduction tips and fact sheets to more in-depth technical handbooks. Over 90 publications are available to North Carolina's industries and local governments at no charge.

Technical Assistance

OWR provides industries, local governments, institutions, and businesses with technical assistance on how to develop and implement waste reduction programs. Information available includes fact sheets on technologies and approaches to waste reduction, issue papers, a recycling contact directory, and a recycling markets directory.

Also, upon request, on-site technical assistance to business, industry, or local government is provided. For industrial sites, OWR staff conducts a multimedia waste survey and prepares a detailed technical report to the industry that outlines state-of-the-art waste reduction techniques and technologies. For local governments and businesses, a range of areas can be addressed including optimizing collection and processing, location of markets for recyclables, and economic/technical evaluation of waste reduction options.

Outreach, Education and Training

Education and training for industries, local governments, trade organizations, professional organizations, citizens groups, and other government agencies is critical to the State's overall waste reduction effort. In addition to general and technical presentations, the staff also conducts in-depth training sessions, workshops, and conferences.

State Agency Support	OWR supports and coordinates on-going waste reduction activities within the Department of Environment, Health, and Natural Resources and other State agencies. Some major efforts include directing the State agency solid waste recycling program; training environmental regulatory staff on waste reduction and providing support to the environmental regulatory agencies on waste reduction planning requirements; integrating waste reduction activities into single-media regulatory programs; regulatory and policy development; and other related regulatory activities.
Grants	The Office supports two grants programs to foster waste reduction activities: The Pollution Prevention Challenge Grant program provides industries with matching funds to undertake waste reduction projects, and the Solid Waste Recycling Assistance Grant program provides matching funds to local governments for infrastructure development.+ Both programs also fund, when possible, waste reduction research and education projects specific to North Carolina.
OWR Contact	For more information, contact the Office of Waste Reduction, at 3825 Barrett Drive, Suite 300, Raleigh, NC 27609 or call (919) 571-400 or (800) 763-0136.
The North Carolina Cooperative Extension Service	The North Carolina Cooperative Extension Service provides local governments, businesses, and individuals with assistance in addressing solid waste management issues related to source reduction, reuse, recycling, composting, incineration, and landfilling. Extension agents work with county officials in planning and implementing solid waste management programs. County agents also conduct a variety of educational activities to enhance awareness and to modify waste disposal practices to increase waste reduction.
NCCES Activities	Some of the Extension's solid waste management activities include: • The Master Waste Managers training program was offered by 13 counties during 1992-1993. In this program, extension agents train volunteers who, in turn, educate the public about solid waste management issues. • Participation by Extension county agents in specialized solid waste management training. These agents conduct solid waste programs in the areas of household hazardous waste, source reduction, recycling, and composting. Available in each County Extension Center to complement the programs are educational

materials and Residential Water Quality and Waste Management notebooks.

- Numerous solid waste management research projects that include use of waste materials in animal feed and bedding; composting of yard waste, sludge, paper, animal waste, and other materials; and wooden pallet recycling.
- Backyard composting and grasscycling education programs in several dozen counties. Activities include Master Waste Composter training programs and composting demonstration sites. A variety of educational materials also is available.
- Extensive youth curriculum activities in solid waste management in several counties. A solid waste curriculum designed primarily for 5th graders called The Mystery of the Cast-Off Capers is available for use in schools; and in-school composting, waste reduction, and recycling activities have also been implemented.
- Solid waste management information exchanged with an electronic news group that reaches extension agents in 100 counties and the Cherokee Indian Reservation.

Additional services in solid waste management are available that include on-site technical assistance, training and outreach to local governments, reference notebooks, educational materials, videotapes, and slide sets.

For more information, contact Rhonda Sherman, Extension Specialist in Solid Waste Management, North Carolina State University, Department of Biological and Agricultural Engineering, Box 7625, Raleigh, N.C. 27695-7695, (919) 515-6770.

North Carolina Division of Solid Waste Management

Responsible for all solid waste regulatory and permitting issues and protection of public health through enforcement of North Carolina's solid waste management laws, the North Carolina Division of Solid Waste Management, Solid Waste Section, can be reached at (919) 733-0692.

Southeast Waste Exchange

The Southeast Waste Exchange (SEWE) is a non-profit, non-regulatory outreach program sponsored by the Urban Institute at the University of North Carolina at Charlotte. The primary area of operation for SEWE is the southeastern United States.

Established in 1978, SEWE provides information, markets, research, and education to businesses and industries who are striving to develop safe and economical waste management plans

and recycling programs. Funding for this on-going program comes from subscription/listing fees, contracts and grants, and industry contributions. The program primarily focuses on the conservation of energy, valuable resources, and landfill space by actively working to find markets for industrial by-products and surplus materials. The extensive network developed by SEWE over the years has enabled the program to be very successful in finding markets for materials, thus saving businesses and industries thousands of dollars in disposal and raw material costs.

Exchanging waste is a simple process. Generators list materials they have available and want to transfer, and potential users place listings for by-products and surplus materials they can use as a raw material. For each material, the catalog lists a waste code number, a brief description, the quantity, availability, and general geographic location. Listings can be made confidential or nonconfidential. SEWE staff matches up generators with users; however, SEWE does not get involved in negotiations.

SEWE has initiated successful transfers of the following categories of materials: Acids, Alkalis, Inorganic Chemicals, Solvents, Organic Chemicals, Oils and Waxes, Plastics and Rubber, Wood and Paper, and Metals. Other materials fall in the miscellaneous category. Below are some examples of successful exchanges.

- **A company transferred 169,060 pounds of polypropylene bag waste for earnings of $3,381. This material was processed into pellets and used in the automobile industry.**
- **A transfer of 4,140 pounds of surfactant saved another industry $1,035 on the cost of raw materials it uses in the manufacture of shampoo.**
- **Over 1,680 pounds of propylene glycol was used in the manufacture of all-purpose detergent. This transfer saved the receiving industry $302 on the cost of raw materials. The generator saved over $300 in disposal costs.**

A subscription to Waste Watcher, a bi-monthly catalog, costs $25 per year. Users of the program must be subscribers. The SEWE can list up to 10 different listings in the catalog for $50 per year. These fees help offset printing and postage costs for the catalog.

Other services provided by the SEWE include an on-line Bulletin Board Service that can be accessed internationally. The SEWE also

designs and coordinates workshops on regulations, materials recycling and reuse, and industry-specific issues.

Participation in the SEWE by industries and communities can facilitate the recycling and reuse of solid waste mandated by law in many states. The SEWE is organized to promote EPA's waste management hierarchy through source reduction, recycling, and reuse assistance.

For additional information about SEWE and assistance, contact Maxie May at (704) 547-2307.

Organizations

National Office Paper Recycling Project, U.S. Conference of Mayors, (202) 223-3089.

NRC Business Alliance and Buy Recycled Campaign, Phil Bailey, (202) 625-6406.

SWICH (Solid Waste Information Clearinghouse, a computer database), (301) 585-2898.

Material Croups

American Forest and Paper Association (formerly American Paper Institute), (800) 878-8878.

Polystyrene Plastics Council, (202) 822-6424.

Vinyl Institute, (201) 890-9299.

NAPCOR (National Association of Plastic Container Recyclers), (704) 358-8882.

Publications

How Your Business Can Cut Costs By Reducing Waste by the North Carolina Cooperative Extension Service is available to local governments. A four-page guide, the pamphlet explains the importance of waste reduction and ways to practice it, the reasons for "buying recycled," and sources for more information. Solid waste managers may want to mail or hand-deliver the guide to businesses to help educate them about the importance of waste reduction and motivate them to take action. For copies, call Rhonda Sherman, (919) 515-6770.

Paper copies of the Directory of Markets for Recyclable Materials are published periodically; the Directory is also maintained as a computerized database. Call the N.C. Office of Waste Reduction at (919) 571-4100.

Office Paper Recycling Guide, National Office Paper Recycling Project & U.S. Conference of Mayors, N.C. Office of Waste Reduction, (919) 571-4100.

Guide to Commercial and Industrial Recycling, Northeast Maryland Waste Disposal Authority, (410) 333-2721 (FAX).

Recycled Products Guide and American Recycling Markets, American Recycling Markets, (315) 471-0707.

Recycling Guide, US Postal Service. Limited copies available through N.C. Office of Waste Reduction, (919) 571-4100.

Business and Commercial Recycling: A Guide to Recycling in the Workplace, Wisconsin Department of Natural Resources, (608) 266-2111.

Business Recycling Manual, INFORM, (212) 689-4040.

PaperMatcher, American Forest and Paper Association, (800) 878-8878.

Waste Audit - The First Step to Waste Reduction, Stephanie Richardson, N.C. Pollution Prevention Program, Office of Waste Reduction, (919) 571-4100.

The Keep America Beautiful, Inc., Guide to Waste in the Workplace, (202) 323-8987.

Source Reduction Now: How To Implement a Source Reduction Program, Minnesota Office of Waste Management, (612) 649-5750.

Journals, Magazines, Newsletters

NCRA R-Word	**Recycling Today**	**Waste Age**
(919) 851-8444	**(216) 961-4130**	**(202) 861-0708**
Resource Recycling	**Recycling Times**	**Garbage**
(503) 227-1319	**(202) 861-0708**	**(718) 788-1700**
BioCycle	**Solid Waste & Power**	**Scrap (ISRI)**
(215) 967-4135	**(816) 931-1311**	**(202) 466-4050**
World Wastes	**Fibre Market News**	**MSW Management**
(615) 377-3322	**(800) 456-0707**	**(310) 576-6180**
PIMA (Paper Ind.)	**Recycled Paper News**	**Packaging**
(708) 956-0250	**(703) 750-1158**	**(708) 635-8800**
Pulp & Paper Week	**The Paper Stock Report**	
(415) 995-2424	**(216) 923-8042**	