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DOC-SK 14267-1

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## REGIONAL SOLID WASTE MANAGEMENT STUDY

PREPARED FOR

LOWER SAVANNAH REGIONAL COUNCIL OF GOVERNMENTS

SEPTEMBER 1, 1992

14267-1

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This study was funded through a grant provided by the United States Department of Energy (Grant #DE-FG09-92SR18267). Lower Savannah Council of Governments would like to emphasize the views and/or recommendations that appear in the “Regional Solid Waste Management Study” are those of Lower Savannah Council of Governments, Priester and Associates, and the McNair Law Firm and do not constitute an endorsement by the United States Department of Energy of the views and/or recommendations detailed in this study.

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## EXECUTIVE SUMMARY

In 1990, the Lower Savannah Council of Governments (LSCOG) began dialogue with the United States Department of Energy (DOE) regarding possibilities for cooperation and coordination of solid waste management practices among the local governments and the Savannah River Site. The Department of Energy eventually awarded a grant to the Lower Savannah Council of Governments for the development of a study, which was initiated on March 5, 1992.

In addition to other considerations involved with regional planning, two major regulatory provisions were passed during the period leading to the development of this study. First, the South Carolina Solid Waste Policy and Management Act of 1991 became effective on May 27, 1991. Secondly, the United States Environmental Protection Agency (EPA) promulgated regulations for municipal solid waste landfills pursuant to Subtitle D of the federal Resource Conservation and Recovery Act (1976). These two developments have greatly changed the nature of solid waste management in South Carolina.

Solid waste management in the future will be more costly than in the past, and there will be a great demand for technical expertise. With that in mind, lawmakers have encouraged regionalization because of economies of scale and the ability to share resources technically and monetarily. Treatment and disposal of solid waste as required in the future will require large, modern facilities with specially trained staff and specially designed handling equipment.

The study looked at nine counties plus the Savannah River Site (SRS). The counties are Aiken, Allendale, Bamberg, Barnwell, Calhoun, Orangeburg, Edgefield, McCormick, and Saluda. Within the region under study, there is a strong need for cooperation. The counties are sparsely populated for the most part, and it would be very difficult for the smaller counties to attempt to handle solid waste in a manner consistent with statutory and regulatory guidelines. Their citizens would either receive a level of service well below that of their neighboring counties, or the citizens would pay a much higher rate per person as compared to neighboring counties.

There are only three major urban areas in the region: Aiken, North Augusta, and Orangeburg. Fortunately, these three areas comprise a base of industry, academia, and government that makes the region as a whole more economically diverse and stable. Consequently, the outlying communities can hope to gain the benefits of modern recycling and management programs at a reasonable cost. While these three cities are still relatively small, they are able to join with the resources of the other areas to support a total system that is large enough to be technically

effective and highly efficient.

After careful analysis of the region's solid waste needs, this study indicates a network approach to solid waste management management to be the most viable. The network involves the following major components: 1) Rural Collection Centers, designed to provide convenience to rural citizens, while allowing some degree of participation in recycling; 2) Rural Drop-Off Centers, designed to give a greater level of education and recycling activity; 3) Inert landfills and composting centers, designed to reduce volumes going into municipal (Subtitle D) landfills and produce useable products from yard waste; 4) Transfer Stations, designed to pre-sort recyclables and compact other wastes for ultimate landfill disposal; 5) Materials Recovery Facilities, designed to separate recyclables into useable and sellable units, and 6) Subtitle D landfill for burial of all solid waste not treated through previous means.

Part of the report covers "Management Recommendations". Due to the unique aspects of regionalization, particularly with regard to statutory and regulatory requirements, the study recommends that the participating local governments form a "Joint Agency" for the purpose of managing the system. The Joint Agency would have the authority and responsibility to handle all matters with regard to solid waste management. As such, the Agency will operate totally as a body politic incorporated, with each member county appointing a representative to the Board of Directors.

The study analyzes the financial aspects of the system and offers specific action recommendations. Among the first steps to be taken includes public education, especially with regard to recycling efforts and industrial waste reduction. In all matters, it is recommended that transition be as smooth as possible from present to future activities, utilizing existing equipment and infrastructure to its highest and best use.

Regionalization provides two major benefits to the area. First, all counties and their citizens can expect a level of professionalism to be provided that otherwise would have been financially out of reach. Secondly, even with the level of professionalism, the counties will be able to enjoy a substantial financial savings when compared to the option of each county managing only its own solid wastes. When compared to any other region or option available to them, the citizens of these counties will know that they are getting a high level of service at the best possible cost.

## DESCRIPTION OF REGION

The nine counties which are considered in this study are: Management, Allendale, Barnwell, Bamberg, Calhoun, Orangeburg, Edgefield, Saluda, and McCormick. Important demographic data to be considered includes: population and projections; urban concentrations; economic base; geographic conditions; and transportation conditions. Some of the demographic information is taken from the South Carolina County Statistical Profiles, March, 1992, published by the South Carolina State Development Board. Other figures and projections come from "Forecast of Population for South Carolina's Census County Divisions through the Year 2015," originally printed in May, 1990, by the Sea Grant Consortium.

Also included in the study is the **Westinghouse Savannah River Company (WSRC)** and the **Savannah River Site (SRS)**. WSRC is the largest industry in the region, employing around 24,000 people. As is the case with the counties, WSRC has been considering the management options available to them regarding solid waste, particularly in light of new laws and regulations.

**Aiken County** is comprised of 702,000 acres and borders the state of Georgia and the Savannah River, and the counties of Edgefield, Saluda, Lexington, Orangeburg, and Barnwell. Approximately 53,000 acres in the southwest corner is occupied by the Savannah River Site (SRS). The county demographics are highly diversified, with the western half (with the exception of SRS) being urban, and eastern half being mostly rural. The western half of the county generates around 90% of the county's waste.

The 1991 population of Aiken County was 122,800, the largest in the region under study. The projected rate of growth is to exceed the pace of other counties in the region, with growth mostly in the western end. The current urban concentration is 85.5%, which is the highest in the region. The per capita income well exceeds the mean for the state and the region, and 93.7% of the employment is non-farm. Consistent with national trends, the solid waste generated per capita is also the highest in the region. Access to good transportation routes is the norm throughout the county.

**Allendale County** is coterminous with the State of Georgia and the Savannah River, and the South Carolina counties of Barnwell, Bamberg, and Hampton. The county area is approximately 264,320 acres, and land uses currently are principally agricultural and silvicultural. Only about 5% of the land is utilized for urban purposes, but 82% of the people live in urban areas. It is anticipated that the rate of growth in industrial/commercial uses will be maintained or enjoy nominal increases for the next decade

Allendale County is expected to see a population growth over the next two decades from 11,600 in 1991 to around 13,200 in the year 2015. About 50% of Allendale County's people live in the towns of Allendale and Fairfax, which are only about three miles apart. The residents of these two towns generate 75% of the county's municipal solid waste. The county enjoys a good road system.

**Barnwell County** borders the state of Georgia and the Savannah River, coterminous with Aiken, Allendale, Bamberg, and Orangeburg Counties. About 132,000 of the 354,000 acres are consumed by the Savannah River Plant. Of the remaining 222,000 acres, about 25% is cultivated, 10% is in pastureland, 60% is woodland, and 5% is utilized for urban and industrial/ commercial purposes. 54.7% of the people live in urban areas.

Barnwell County's population is 21,900, and the projected growth rate is 1.5% per year, or around 30,200 people in the year 2015. Fifty-eight percent of the people live in the towns of Barnwell, Blackville, or Williston, and these towns generate about 85% of the county's solid waste. Transportation routes are generally good around the population centers of the county.

**Bamberg County** is comprised of approximately 252,800 acres and is bordered by the counties of Allendale, Barnwell, Colleton and Orangeburg. Land uses are, for the most part are agricultural and silvicultural. The majority of the people live in or around the towns of Bamberg and Denmark.

Bamberg County's per capita income is the lowest in the region, and 1991 population of 16,900 was 6.7% less than for 1980. Projections call for the population to hold steady or decline slightly. Transportation routes are generally good, but collection systems for the rural areas could prove costly. Bamberg county is presently sending its burnable MSW out of the county to a private landfill.

**Calhoun County** is comprised of 243,500 acres. Land uses are primarily agricultural and silvicultural. The county shares borders with Orangeburg, Lexington, Richland, Sumter, and Clarendon, although there are no good transportation routes to the latter two due to water separation of Lake Marion.

The population of Calhoun is 12,880. The only incorporated towns in the county are St. Matthews and Cameron, with a combined population of about 3,000. The economy has shifted in recent years from an agricultural to industrial base. Manufacturing is by far the leading employer in the county. Calhoun County is located between "Santee-Cooper Country" and the capital city of Columbia, and the services industry has experienced the largest percent of growth since 1980. Population growth is expected to continue at a pace of about .5% per year, with possible losses in the eastern part of the county offset by gains in the western part, near Lexington County and metropolitan Columbia.

**Orangeburg County** is comprised of 720,500 acres bordered by the counties of Bamberg, Barnwell, Aiken, Lexington, Calhoun, Clarendon, Berkeley, and Dorchester County. It has the largest geographical area in the region, with the two most distant points in the county being around 70 miles apart. Land uses currently are primarily agricultural and silvicultural; however, land uses around the city of Orangeburg (about 5% of the total area) vary significantly from the rest of the county, with a good concentration of manufacturing companies.

The 1991 population of Orangeburg County was 85,700, with about half of the people living within ten miles of the city of Orangeburg. The county's economy is diversified, similar to that of South Carolina as a whole. The fastest growing economic sector is services, which may be due to an expanding tourist industry in the eastern end of the county. Economic trends are expected to continue, with services anticipating the greatest amount of growth. The eastern part of the county and the city of Orangeburg are expected to see the heaviest population growth. Good transportation routes serve the entire county.

In 1980, Edgefield, Saluda, and McCormick counties elected to fund and operate a regional landfill, located in the northern portion of Edgefield County along U.S. Highway 378. The three counties hired a full-time Solid Waste Coordinator in 1992. The tri-county region is not a member of the Lower Savannah Council of Governments, but was approved by the Grantor for consideration under this regional solid waste study.

**McCormick County** is comprised of 252,000 acres. About 75% of the county is in Sumter National forest. The county is bordered on the west by the state of Georgia and Lake Strom Thurmond, and elsewhere by Abbeville, Greenwood, and Edgefield counties.

McCormick has a population of 8,868, and is generally considered as having no urban centers. Forty-two percent (42%) of McCormick's labor force is employed by the government, 31% is in manufacturing, and 10.5% is in services, possibly related to recreation. These three industries usually contribute toward a

larger than average waste load, but averages for the tri-county landfill do not indicate that this trend exists here; much of the employment force works out of the county. Transportation routes tend to feed into South Carolina, with only two bridges crossing into Georgia. McCormick's per capita income is low, and the population trend is declining.

**Edgefield County** is comprised of 315,000 acres. About 25% of the county is in Sumter National Forest. The county is bordered by the counties of Aiken, Saluda, McCormick, and Greenwood, and the state of Georgia and the Savannah River.

Edgefield County has a population of 18,375 with 29% of the people living in urban areas. 44.8% of the labor force is employed by manufacturing facilities. Population centers are well-served by transportation routes. Projections call for almost 2% per year population growth.

**Saluda County** encompasses approximately 295,000 acres. Land uses are primarily agricultural and silvicultural. The county is bordered by the counties of Edgefield, Greenwood, Newberry, Lexington, and Aiken.

Saluda County has a population of 16,520, and growth is projected to be steady at about 1% per year. Twenty percent (20%) of the people live in the county seat of Saluda, and 44% of the labor force is employed by the manufacturing sector. The county has one of the best transportation systems in the region.

The **Savannah River Site** (SRS) is comprised of approximately 198,344 acres. The site is owned by the United States Department of Energy, and it is used to produce nuclear materials for defense, primarily tritium. Westinghouse Savannah River Company (WSRC) manages the plant for the Department of Energy and employs approximately 24,000 people, most of whom live within one of the counties studied in this report. Two-thirds of the SRS is in Barnwell County, and one-third is in Aiken County. The entire site is bordered on the southwest side by the Savannah River and the state of Georgia.

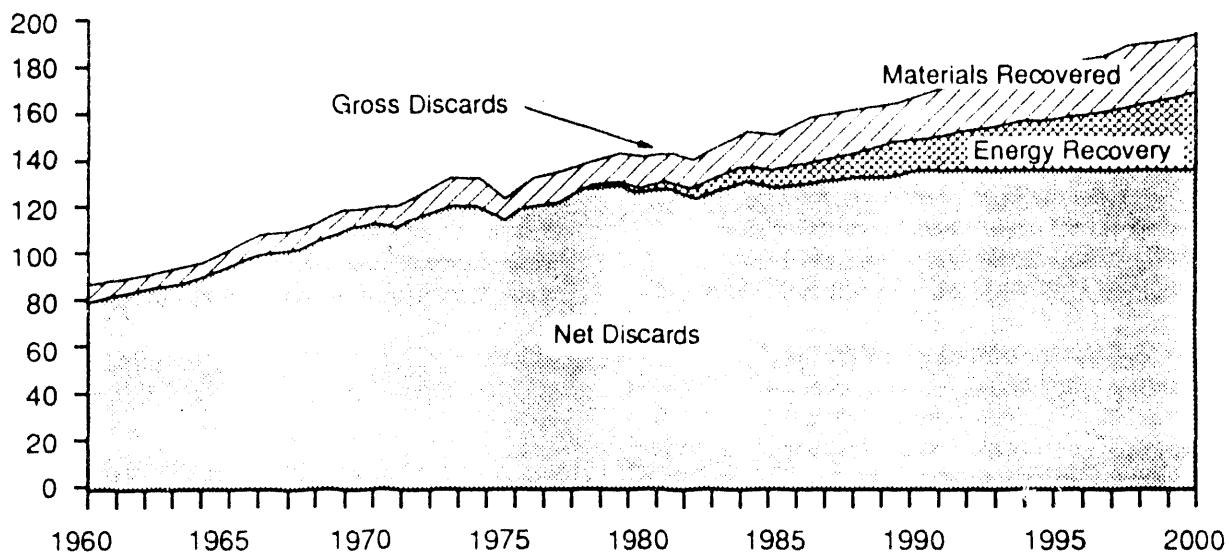
SRS has thirteen industrial centers within the site boundaries, each of which generates non-hazardous waste amounts associated with business activities. One of the major concerns associated with offsite disposal of non-hazardous waste for SRS is security. The site has restrictions for public access, and any agreements made with the surrounding counties would necessitate close security by the Department of Energy. Most of the non-hazardous solid waste stream originating from SRS would be pretreated to ensure compliance with current government orders. Waste transported to SRS for disposal would be subject to standard inspections. For purposes of this study, SRS waste will be called

municipal solid waste (MSW) so it may be categorically included with compatible wastes from elsewhere in the region.

The Savannah River Site, as an industrial complex, provides unusually positive aspects to this study. Because of their resources, infrastructure, and active waste management programs and practices, SRS could assist in providing a substantial base of operations for the region. This study was funded by the United States Department of Energy as a public service in order for SRS and the nine county region to cooperatively manage MSW in the most cost effective and environmentally safe manner. For the purposes of this study, SRS is considered as an entity similar to each of the nine counties.

Several other large industrial sites also make a positive impact on the study because of their ability to bring consistent and manageable wastestreams into the overall system. Whereas most counties have very diverse generation units, large industrial centers have shown an ability to organize and manage their MSW streams much the way other management initiatives are handled. Because of new costs associated with the management of MSW, many industrial generators will find it advantageous to recycle, re-use, or otherwise reduce their MSW.

### **Gross Discards into the Municipal Waste Stream, 1960 - 2000**



(Source: Franklin Associates, 1988)

## STATUTORY AND REGULATORY PROVISIONS

Two significant events occurred in 1991 which substantially changed, and will continue to change, how nonhazardous solid waste is managed in South Carolina. The first event was passage of a comprehensive state law on solid waste management, the South Carolina Solid Waste Policy and Management Act of 1991 (the Act). This statute was signed into law by Governor Campbell on May 27, 1991. The second major event was promulgation by the United States Environmental Protection Agency (EPA) of stringent new regulations setting minimum environmental standards for municipal solid waste landfills.\* These regulations, which were published in the Federal Register on October 9, 1991, are referred to as the "Subtitle D regulations" because they were promulgated pursuant to the statutory authority set forth in Subtitle D of the Resource Conservation and Recovery Act (RCRA). This statute is the major federal law governing solid and hazardous waste. Subtitle D is the portion of that statute devoted to nonhazardous solid waste.

This study was conceived prior to these events and was not funded in response to either of them. Their occurrence, however, clearly heightened the need for this study, making its preparation very timely in assisting with compliance with the Act and Subtitle D regulations. It is thus imperative to understand the provisions of the Act and the federal regulations and their implications for this study.

### 1. Subtitle D Regulations

It should first be noted that these regulations were published in draft form in 1988. Thus, while passage of the State Act preceded promulgation of the final subtitle D regulations, the impetus for enacting a new state law was in part an effort to respond to anticipated federal requirements.

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\* The term "municipal solid waste landfill" (MSWLF) is a defined term in the Act and in the federal regulations. As defined in the Act, which is consistent with EPA's definition, a MSWLF means "any sanitary landfill or landfill unit, publicly or privately owned, that receives household waste. The landfill may also receive other types of solid waste, such as commercial waste, nonhazardous sludge, and industrial solid waste." S.C. Code Ann. § 44-96-40(28) (emphasis added). Thus, a MSWLF does not necessarily mean a landfill owned by a municipality. The key factor is whether it accepts household waste. This term is important because certain requirements of the Act may apply to municipal solid waste facilities, but not to other types of solid waste facilities such as industrial facilities.

The Subtitle D regulations establish minimum nationwide standards for all municipal solid waste landfills. These standards cover the location, design, operation, closure, post-closure, and cleanup of new and existing MSWLFs.

The effective date of most provisions of the Subtitle D regulations is two years after the date of publication in the Federal Register, which is October 9, 1993. Certain provisions have a later effective date. The financial assurance requirements, for example, do not take effect until 30 months after publication or April 9, 1994. More importantly, the groundwater monitoring and corrective action requirements are phased in over a period of 3 to 5 years after the date of publication.

The regulations apply to all new or existing MSWLFs and all lateral expansions of MSWLFs that receive waste on or after the effective date of the regulations, October 9, 1993. The regulations include all MSWLFs that receive sewage sludge or municipal waste combustion ash. If a MSWLF ceases to receive waste after the date of publication but before October 9, 1993, it need only comply with the final cover requirements. There may, however, be other requirements that apply as a matter of state law. The new regulations do not apply to MSWLFs that ceased to accept waste by October 9, 1991.

The regulations establish management standards in the following six major categories: location restrictions, operating requirements, design standards, groundwater monitoring and corrective action, closure and post-closure care, and financial assurance criteria. The landfill design standards are particularly important, not only because they will provide substantial improvements in environmental protection, but also because the liners, leachate collection and control systems, etc., that will be required are very costly to construct. The groundwater monitoring and corrective action regulations, also very expensive to implement, require all new and existing MSWLFs to install monitoring wells to detect groundwater contamination. If a monitoring well detects contamination, the owner or operator of the landfill must clean it up to meet acceptable environmental protection standards.

The Subtitle D regulations continue to recognize solid waste management as primarily a state and local function. Consequently, EPA will rely on states to implement the new federal standards by incorporating these standards into their state solid waste programs. States must apply for EPA approval of their programs. State regulations must at least be consistent with Subtitle D regulations, but they may be more stringent than federal requirements. If a state does not apply for approval or EPA determines that the program is inadequate, EPA has the authority to implement and enforce the regulations within that state directly.

In fact, Subtitle D requirements will take effect on October 9, 1993, without any further action on EPA's part, in any state without an approved program or for which program approval is pending.

Equally as important, under RCRA, a private citizen may sue a local government to strictly enforce Subtitle D requirements or the state counterpart. Such enforcement may include the imposition of substantial civil penalties under RCRA.

## **2. South Carolina Solid Waste Policy and Management Act of 1991**

The Act is divided into two major articles. Article 1 is the policy and planning section of the law. It also addresses management of certain specific waste streams, such as waste tires, used oil, and lead-acid batteries. Article 2 of the Act is the regulatory component of the law, establishing, among other things, stricter new minimum standards for solid waste landfills and incinerators. The Act also contains several separate provisions which are not a part of Article 1 or 2, most significantly increased penalties for littering.

### **a. Article 1**

In order to promote proper solid waste management, the Act establishes several statewide policies which are of significance to this study. First, the Act states a policy of the reduction of waste at the source of generation and recycling and reuse of materials prior to either incineration or landfilling. Thus, while the Act recognizes that properly designed and operated landfills will always be necessary, it calls on local governments to not simply rely on landfills but to establish comprehensive waste management systems involving recycling and reduction efforts.

Another significant state policy is support for regionalization. The Act does not mandate that counties join together to form regions, but its provisions make unmistakably clear that regionalization is the preference of the General Assembly. Recognizing the significant economies of scale and other benefits that would result from joint efforts, the legislature attempted to guide local governments in that direction by specifically establishing regionalization as a state policy and directing DHEC to make every effort to encourage that approach.

To help implement these policies, the Act establishes a statewide goal to reduce the amount of solid waste being received at municipal solid waste landfills and incinerators by 30% within 6 years of enactment. This reduction goal will be measured based on the FY 1993 solid waste generation level, calculated by weight. Counties or regions may, however, get credit for existing programs

for one of the two previous years. The Act also establishes a recycling goal of 25% of the total solid waste in this State within 6 years after enactment.

To accomplish these goals, the Act requires DHEC to submit a solid waste management plan to the Governor and to the General Assembly 18 months after enactment. This plan will essentially serve as a "blueprint" for solid waste management activities in this State for the next 20 years. The State Plan must include, among other things, inventories of the types of solid waste currently being received at solid waste disposal facilities in the State, estimates of types of solid waste which will be disposed of in the State for the next 20 years, a description of means by which the State will achieve its solid waste reduction and recycling goals, and a description of the public education programs to be developed. As required by the Act, a statewide Solid Waste Advisory Council has been established to advise DHEC on the preparation and implementation of the State Plan. This Council will also approve grant awards to local governments. The members of the Advisory Council include representatives from manufacturing interests, the retail industry, the general public, the Governor's Office, DHEC, and counties of varying populations.

After submitting the plan to the Governor and to the General Assembly, DHEC will issue an annual report or "report card" on efforts to manage solid waste during the previous year. This report will include any revisions that are necessary in the State Plan and a description and evaluation of the progress made by local governments in implementing their own solid waste management plans.

Within 15 months after submission of the State Plan to the Governor and General Assembly, counties or regions, which must include the participation of municipalities therein, must submit local solid waste management plans to DHEC. The local plans must provide for public participation and must be consistent with the State Plan. The local plans must also provide for implementation of a recycling program within the county or region and an education program for local citizens. Since the demographics vary from county to county, however, flexibility is allowed within the county or regional plans. The type of recycling program (curbside, drop-off centers, etc.) is not specified, nor is the selection of materials to be recycled (glass, plastics, paper, etc.). Local Advisory Councils must be established to advise counties and regions on the preparation and implementation of the local plans.

The local Advisory Council must consist of members of the governing body of the county, municipalities, and industry therein. The Act provides, however, that the governing body of a county has the ultimate responsibility and authority to provide for the operation of solid waste management facilities within the incorporated and unincorporated areas of the county.

The Act places a strong emphasis on recycling by requiring all counties and regions to implement some type of recycling program. Recycling is impractical and economically infeasible if there is no market for the separated or recycled materials. To address this problem, the Act creates a Recycling Development Market Council within the State Development Board to assist local governments in identifying and developing markets for recycled goods. The Council is a 14-member body which has been appointed by the Governor and includes representation from a number of businesses and industries with an interest in recycling.

The Act further establishes an Office of Solid Waste Reduction and Recycling within DHEC to manage the Solid Waste Trust Fund and the Solid Waste Grant Program. This non-regulatory office has been created and is now carrying out its statutory functions. The Solid Waste Management Trust Fund will consist of funds generated by fees, any funds appropriated by the General Assembly, and funds from other sources, such as federal oil overcharge money. The Trust Fund is also authorized to accept donations from private sources. Such funds will be used to fund research, public education programs, and grants to local governments to carry out their responsibilities under the Act.

The new fees imposed by the Act as of November 1, 1991, consist primarily of additional charges on the sale of specific items. These items include new tires (\$2.00 per tire, with \$1.50 going to the counties), lead-acid batteries (\$2.00 per battery), "white goods" (\$2.00 per appliance) and motor oil (8¢ a gallon).

The grant program will be established utilizing the funds within the Solid Waste Management Trust Fund. Six years after enactment, 25% of the grant program funds must be used to reward counties or regions which meet the reduction and recycling goals. The other funds shall be awarded to counties that have submitted county plans and that have made application for such grants.

Article 1 also addresses several "specific" waste streams. "Specific" wastes are defined in the Act as solid waste which "requires separate management provisions." They include plastics, used oil, waste tires, yard trash, compost, and white goods. There are separate sections in Article 1 addressing each of these waste streams and an additional section on newsprint. The requirements of these sections vary depending on the particular waste stream being addressed. They generally, however, impose fees on the waste stream, establish permitting and/or registration programs for entities handling that type of waste, prohibit that waste stream from being disposed of at a municipal solid waste landfill after a certain period of time (see timeline in this section), and establish penalties for violating the requirements for managing these waste streams.

**b. Article 2**

As indicated above, Article 2 is the regulatory component of the Act. It provides for the permitting and regulation of all types of solid waste management facilities. Most significant from a local government standpoint is the fact that the Act establishes stringent new minimum requirements for new and existing municipal solid waste landfills. These requirements are consistent with EPA's Subtitle D regulations, and will require new and expanded municipal solid waste landfills to have, among other things, some form of liner, as well as leachate collection and removal systems. New and existing landfills will be required to have, among other things, closure and postclosure care plans, groundwater monitoring systems, and corrective action programs. The Act also establishes minimum requirements for disposal of ash from municipal solid waste incinerators, essentially requiring the ash to be disposed of in lined landfills.

Other significant aspects of Article 2 include establishment of a training program and certification requirement for operators of solid waste management facilities. The Act also creates a "facility issues negotiation process" whereby local citizens can appoint a citizens' committee to negotiate with a permit applicant, public or private, for a municipal solid waste disposal facility on issues such as hours of operation, property values, traffic routing, etc.



**3. Timeline of Major Events Under State Law and EPA Subtitle D Regulations**

(Underlining denotes affirmative duties of local governments.)

**UPON ENACTMENT (May 1991)**

- "Interim" Requirements for New Municipal Solid Waste Landfills
- "Interim" Requirements for Expansions of Existing Municipal Solid Waste Landfills
- "Moratorium" on New or Expanded Municipal Solid Waste Incinerators

**NINETY DAYS AFTER ENACTMENT**  
**(August 1991)**

- State Recycling Market Development Council (has been appointed and is currently meeting)
- Office of Solid Waste Reduction and Recycling ("OSWR&R") (has been established)

**OCTOBER 9, 1991 (Federal)**

- Subtitle D regulations published in Federal Register (all municipal solid waste landfills in operation after this date must comply with the final cover requirements of Subtitle D)

**NOVEMBER 1, 1991**

- Imposition of Fees on Specific Waste Streams (oil, tires, lead-acid batteries, and white goods)

**SIX MONTHS AFTER**

- State Solid Waste Advisory

**ENACTMENT**  
**(November 1991)**

Council (has been appointed and and is currently meeting)

- "Special" Waste Analysis Plans (to be submitted by MSWLF owner/operator to DHEC)

**ONE YEAR AFTER ENACTMENT** •  
**(May 1992)**

**Local Solid Waste Advisory Councils**

- Full Cost Disclosure Regulations (pending before the General Assembly)
- Grant Program Regulations (pending before the General Assembly)
- Landfill Ban on Used Oil
- Waste Tire Regulations (pending before the General Assembly)
- Landfill Ban on Lead-Acid Batteries
- Yard Trash and Composting Regulations (pending before the General Assembly)

**FIFTEEN MONTHS AFTER**  
**ENACTMENT**  
**(August 1992)**

- Report of Recycling Market Development Council (interim report submitted on time)

**EIGHTEEN MONTHS AFTER**  
**ENACTMENT**  
**(November 1992)**

- State Plan (will be submitted on time)
- DHEC Notification by Counties (of intent to form region or "go-it-alone")
- Installation of Scales at Landfills
- Landfill Ban on Whole Waste Tires (date may change depending when DHEC promulgates regulations)

- Restrictions on Disposal of Waste Tires
- DHEC Regulations on Numerous Issues  
(landfill regulations have been released in draft form soon)
- DHEC Study on Regionalization

**TWO YEARS AFTER ENACTMENT**  
**(May 1993)**

- Full Cost Disclosure  
Implementation
- Waste Tire Accumulation Sites
- Certified Operators for Solid Waste Management Facilities
- Landfill Ban on Yard Trash (the Act was amended this past session to change this date from August 1992 to May 1993)

**OCTOBER 9, 1993 (Federal)**

- EPA Subtitle D regulations go into effect (all municipal solid waste landfills in operation after this date must fully comply with all Subtitle D requirements)

**THIRTY-THREE MONTHS AFTER ENACTMENT (February 1994)**

- Local Solid Waste Management Plans

**THREE YEARS AFTER ENACTMENT**  
**(May 1994)**

- Landfill Ban on White Goods

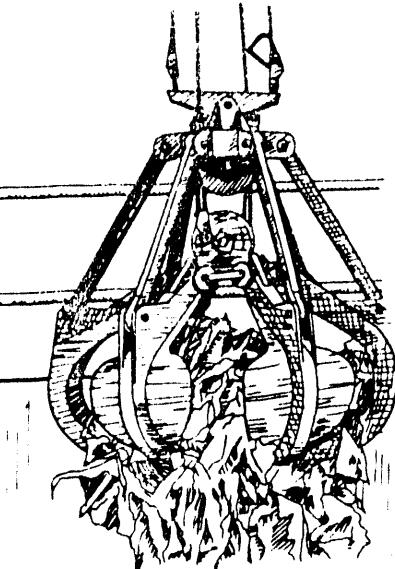
**THIRTY-NINE MONTHS AFTER ENACTMENT (August 1994)**

- DHEC Review of Local Plans Completed
- Implementation of Local Plans/Recycling Programs

FIFTY-ONE MONTHS AFTER  
ENACTMENT (August 1995)

Completion of Implementation of  
Local Plans

SIX YEARS AFTER ENACTMENT  
(May 1997)



## **WASTESTREAM AND DEMOGRAPHIC ASSESSMENT**

The first task in this phase of the work is a waste assessment and characterization and general inventory of waste handling and processing capabilities in the region. This assessment has been developed through direct, structured interviews with county administrators, public works and solid waste managers, industrial representatives, private sector waste dealers, and civic leaders.

Data is categorized by source: residential; commercial; construction/demolition; special; and industrial. The categorization allows for analysis of a reuse/recycling program as is necessary for compliance with the 1991 South Carolina Solid Waste Policy and Management Act. Seasonal variations in waste quantity, estimated from the available records and data, are being correlated with a database of waste generation information.

Long-term projections of the waste stream by major category are an important element in evaluating the disposal alternatives. Changes in the quantity of waste generation can be caused by local population trends, land-use policies, the rate of growth in commercial and industrial business activity, and/or the addition/deletion of special waste generators. Projections made in this study take each of these criteria into consideration. Data was collected from available sources as referenced earlier. Data from all sources was compared and, if different with regards to a specific area, research was conducted to determine the rationale for the difference. This study is not only concerned with treatment and disposal options, but also in recommendations for source reduction, which would result in reducing the volume of the waste stream. Changes in composition of the waste stream requiring ultimate disposal would result from changes in the degree and extent of pretreatment (i.e., reuse/recycling) and changes in technology and product packaging. Despite inherent uncertainties, such estimates are essential to permit evaluation of the feasibility of a joint arrangement with the surrounding jurisdictions.

Waste projections, made to the year 2015 for the applicable categories take into account current waste generation, per capita estimates of waste generation, and estimates of future waste generation. This is based on population and commercial/industrial growth as well as adjustments for reuse/recycling and changes in commercial activity to the extent supported by available data. Based on the resultant waste quantity and composition, the Lower Savannah Council of Governments will have estimates of the amount of waste available for determination of each ultimate treatment alternative.

Recycling activity in the region has been surveyed and assessed for waste characterization, product development, and final use. Geographic location and waste handling capacity of all separation facilities, processors, packagers, and transporters have been surveyed.

The major remaining solid waste generator addressed in this phase of the work is the industrial sector. Interviews with major manufacturing firms have identified several special waste generation points and options for disposal, reuse, recycling, or source reduction opportunities. In addition to manufacturing concerns, there are several large generators of paper wastes which impact options available for that category.

Annual costs of solid waste management in the affected counties has been estimated. A standard uniform cost analysis methodology has been developed for use, adapted from academic models and vendor-supplied information. As much as possible, cost information was gathered from actual users of waste disposal and treatment equipment. Often, however, the information is vendor-supplied.

With regard to financial considerations, it is often assumed that the waste stream can be converted into a revenue producer which could possibly offset expenses. Because of market trauma caused by the enormous changes in waste handling, however, it will probably take years to develop recovery systems that can realize financial gains from the waste stream. While it is theoretically feasible to do so, markets at this time are lagging behind technology.

### WASTE LOADS BY COUNTIES

<u>County</u>	<u>Total Tons</u>	<u>Tons/day</u>	<u>Total Pop.</u>	<u>Rate/capita/day</u>
Aiken	147,217	403.33	120,940	6.67
Allendale	8,094	22.17	11,600	3.82
Bamberg	8,478	23.22	16,902	2.74 +
Bamberg	14,493	39.71	16,902	4.69 +
Barnwell	15,525	42.53	22,500	3.78
Calhoun	10,556	28.92	12,753	4.50 *
Orangeburg	73,528	201.45	84,803	4.75
Tri-county	28,296	77.52	43,600	3.56
SRS	10,009	27.42	26,000	2.11 #

+ burnable MSW sent out of county; top line figures are based on landfill records; second line figures are based on interpolation from industrial surveys done in conjunction with this study

\* based on Clemson study, November and December, 1991,  
Dr. Richard K. White, Project Leader

# Westinghouse Savannah River Site employees; based on a 20-week Waste Characterization Study, March 18, 1991, to May 24, 1991, with a total of 98 operating days where waste was received.

Aiken County's 6.67 pounds per capita per day appears to be unusually high; however, national trends indicate a definite relationship between per capita income and MSW. Aiken County residents enjoy a relatively high per capita income. Additionally, Aiken County's industrial base contributes significantly to the Waste stream.



Based on landfill records, industrial surveys, and random table-sorts, it is estimated that the following characterization represents the region's MSW stream:

**MSW CHARACTERIZATION BY COUNTY**

<b>County</b>	<b>Commercial/ Residential</b>	<b>Industrial</b>	<b>Construction/ Demolition</b>	<b>Special</b>
Aiken				
Tons	82,442	36,804	17,666	10,305
%	56 %	25 %	12 %	7 %
Allendale				
Tons	6,127	914	648	405
%	76 %	11 %	8 %	5 %
Bamberg				
Tons	9,361	2,464	1,449	1,159
%	65 %	17 %	10 %	8 %
Barnwell				
Tons	11,489	1552	1,708	776
%	74 %	10 %	11 %	5 %
Calhoun				
Tons	4,434	2,956	2,639	528
%	42 %	28 %	25 %	5 %
Orangeburg				
Tons	50,734	12,500	3,676	5,882
%	69 %	17 %	5 %	8 %
Tri-County				
Tons	21,201	1,981	2,830	2,264
%	75 %	7 %	10 %	8 %
SRS				
Tons	1,348	7,512	17	1,132
%	13 %	75 %	.2 %	11 %

The above figures are particularly relevant when making projections as to recyclables. This study also examined the waste characterization per County Census Division (CCD). In determining projections and transportation calculations, the relevant units should be as detailed as possible.

County Census Divisions (CCDs) are a source for a number of statistical analyses, and are so used because of the readily available comparative data that can be gathered from other sources. County Census Divisions should continue to be used for comparative record-keeping purposes.

The following chart ranks the counties according to per capita income (1989 is the latest available). There is a relationship between income and MSW, but other factors are more important, as will be shown throughout this report.

#### COMPARISON OF WASTE AND INCOME

County	1989 per Capita Annual Income	Per Capita Daily Income	#/person/day Resid. Waste
Aiken	\$ 15,485	\$ 42.42	3.74
Barnwell	12,560	34.41	3.00
Calhoun	12,210	33.45	1.91
Tri-county	11,487	31.47	2.66
Orangeburg	11,355	31.11	3.27
Allendale	10,763	29.48	2.89
Bamberg	9,663	26.47	3.03

The above data indicates that using income alone as a criteria for making MSW projections is not a good practice, although generally this is a good indicator of household waste volumes. Urban concentrations, manufacturing industries, and experience (growth and demographics) must be used in conjunction to predict waste concentrations.

The following chart lists the counties in this region according to urban populations. For purposes of this study, urban areas are defined as incorporated towns or cities with populations over 1,000, plus high density population areas within five miles of an incorporated area. This definition is based on the assumption that these areas could offer community-based support for waste management programs, including some centralized collection and recycling programs. Urban population figures found in the South Carolina Statistical Profiles, as cited earlier, use incorporated populations of 2500 or better to designate "urban." If this study had used that criteria, Calhoun County would be listed as 0 % urban.

### MSW BY POPULATION DENSITY

County	Population	Urban Population (approximate)	% Urban	Residential MSW/person/ day
Aiken	122,800	105,000	85.5 %	3.74 lbs.
Orangeburg	85,700	65,000	75.8 %	3.27 lbs.
Bamberg	16,900	14,000	82.8 %	3.03 lbs.
Barnwell	21,900	12,000	54.7 %	3.00 lbs.
Allendale	11,600	9,500	81.8 %	2.89 lbs
Edgefield	18,700	6,000	32.1 %	2.66 lbs.
Saluda	16,520	6,000	36.3 %	2.66 lbs.
McCormick	8,880	3,000	33.8 %	2.66 lbs.
Calhoun	12,753	4,000	31.3 %	1.91 lbs.

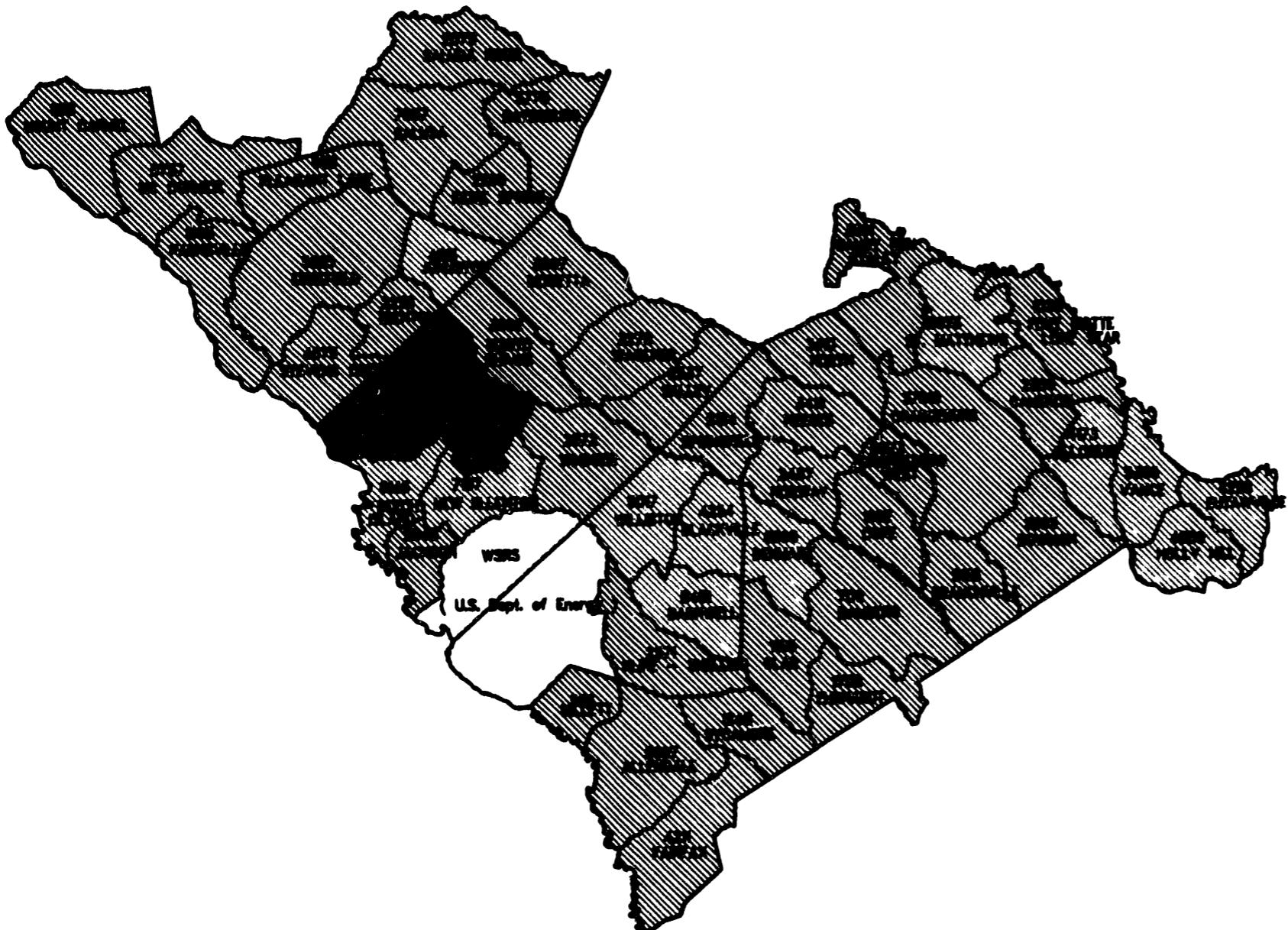
The above figures represent household waste generated in urban areas. As the chart illustrates, MSW per day is not directly related to the percentage of urban population in a given county, but is more a product of population density. As alluded to earlier, "urban" is a relative term. By many definitions, only three urban areas exist in this region: Aiken, North Augusta, and Orangeburg. It should be noted that, while Bamberg and Allendale counties show a relatively high urban concentration, they, in fact, have no densely populated areas, and they have the lowest per capita incomes in the region. The income level, coupled with low density population, would account for the fact that their MSW is low. Orangeburg, on the other hand, has a low per capita income but is more densely populated and, therefore, has a higher residential MSW generation.

The pattern that seems to emerge from the waste stream assessment in this study suggests that the following factors directly affect MSW wastestreams, in order: 1) population density; 2) industrial generation/ manufacturing base; 3) experience (i.e., patterns already established); and 4) per capita income. When making projections, these four factors are weighted in that order.

The following chart illustrates wastestream per county census division (CCD) in the region. The chart also shows projections to the year 2015 for populations and MSW. Projections are based on a the four criteria listed above.

**MSW BY COUNTY CENSUS DIVISION (CCD)**

CCD	COUNTY	1990 POPULATION	2015 POPULATION	1991 MSW TONS	2015 MSW TONS
Aiken	Aiken	45,572	60,720	70,666	92,493
Beech Island	"	6,146	9,200	4,387	6,824
Edisto-Shaws	"	3,902	4,249	2,054	2,342
Jackson	"	2,843	3,680	1,526	2,014
Monetta	"	3,097	3,984	2,053	3,232
New Ellenton	"	7,197	8,390	3,755	4,619
No. Augusta	"	44,059	61,530	59,729	74,763
Salley	"	2,537	3,034	2,011	2,071
Wagener	"	3,278	3,457	2,321	2,437
Windsor	"	2,872	2,956	1,273	1,464
Allendale	Allendale	5,697	7,401	4,488	5,161
Fairfax	"	4,211	4,819	2,486	3,549
Millett	"	566	559	422	418
Sycamore	"	1,248	1,421	698	782
Bamberg	Bamberg	7,011	7,011 *	7,095	7,095
Denmark	"	6,668	6,668 *	6,677	6,677
Ehrhardt	"	1,708	1,708 *	1,016	1,016
Olar	"	1,515	1,515 *	1,165	1,165
Barnwell	Barnwell	8,451	14,205	5,627	9,059
Blackville	"	4,254	4,891	4,679	6,085
Kline-Snelling	"	2,571	2,974	1,237	1,633
Williston	"	5,017	6,130	3,966	5,076
Cameron	Calhoun	2,356	2,188	1,477	1,477
Fort Motte/ Lone Star	"	1,030	918	554	504
St. Matthews	"	5,676	6,530	3,881	4,230
Sandy Run/ Staley	"	3,691	5,064	4,656	6,286



## SOLID WASTE STUDY

1990 POPULATION PER CCD  
Thursday October 22, 1992

### MAP FEATURES

- POP. / Sq. Mile 0
- POP. / Sq. Mile 1 - 50
- POP. / Sq. Mile 51 - 100
- POP. / Sq. Mile 101 - 200
- POP. / Sq. Mile 201 - 300
- POP. / Sq. Mile 301 - 400
- POP. / Sq. Mile 401 +

### ACKNOWLEDGEMENTS:

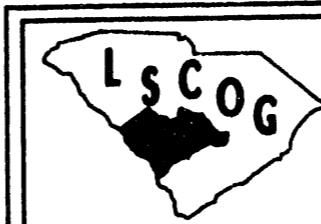
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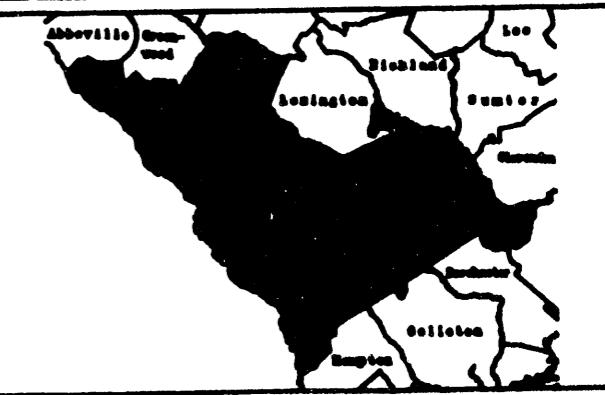
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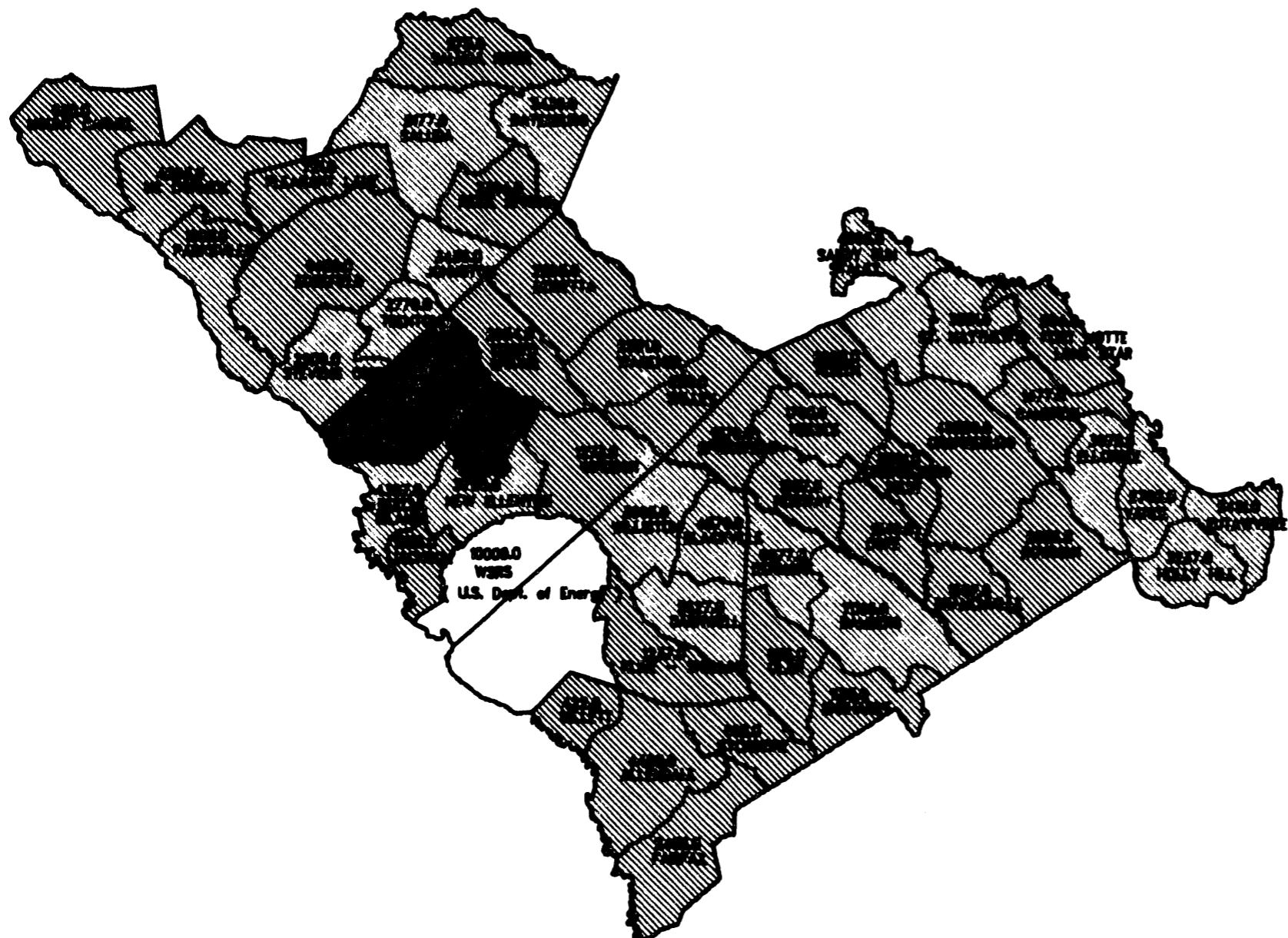
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## SOLID WASTE STUDY

1991 MSW TONS PER CCD  
Thursday October 22, 1992

### MAP FEATURES

- MSW. / Sq. Mile 0
- MSW. / Sq. Mile 1 - 30
- MSW. / Sq. Mile 31 - 100
- MSW. / Sq. Mile 101 - 300
- MSW. / Sq. Mile 301 - 500
- MSW. / Sq. Mile 501 - 700
- MSW. / Sq. Mile 701 -

### ACKNOWLEDGEMENTS:

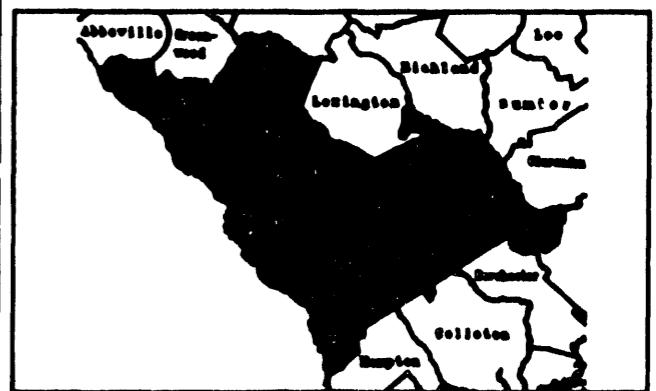
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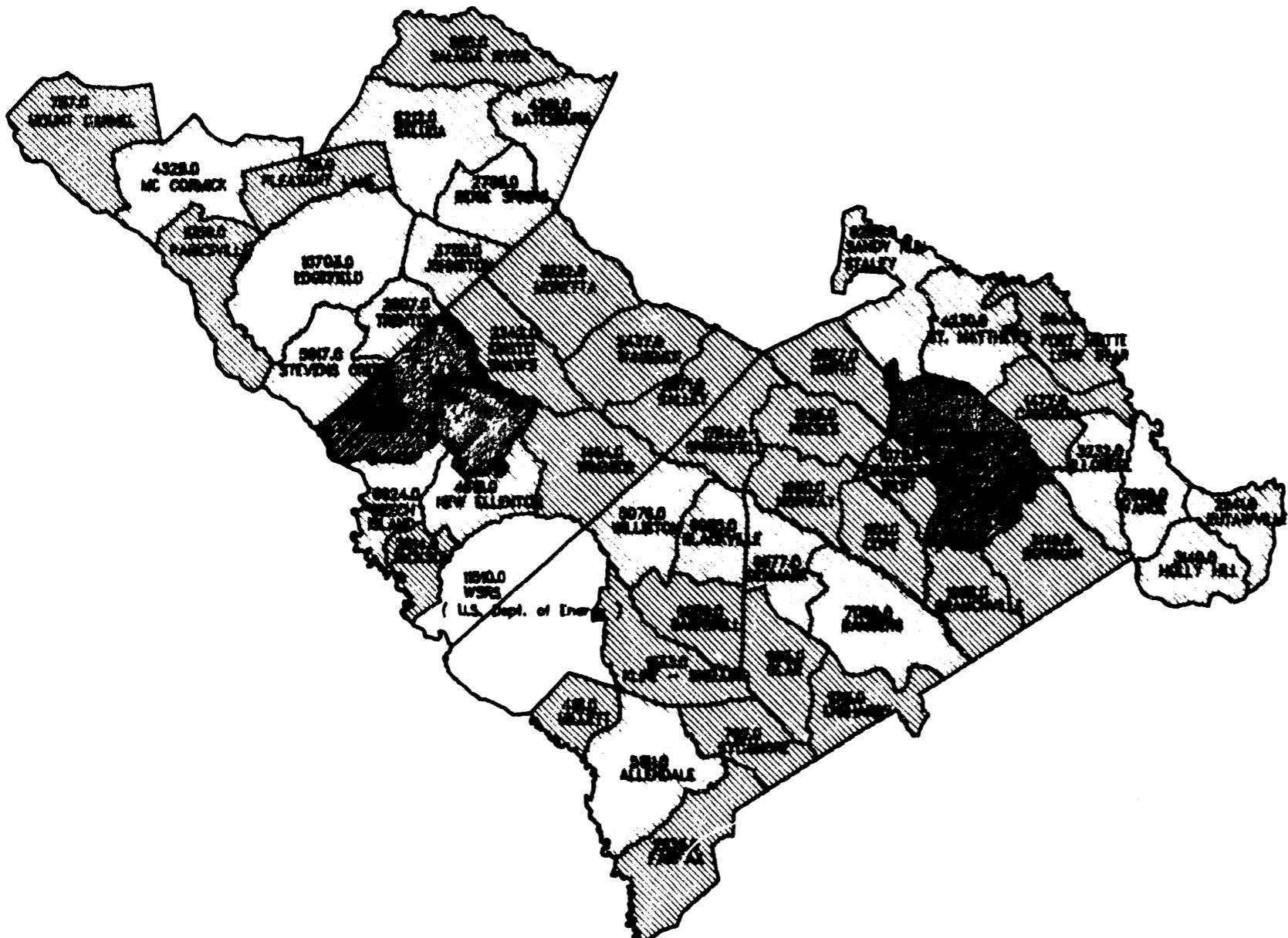
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## SOLID WASTE STUDY

2015 MSW TONS PER CCD  
Thursday October 22, 1992



### MAP FEATURES

- MSW. / Sq. Mile 0
- MSW. / Sq. Mile 1 - 30
- MSW. / Sq. Mile 31 - 100
- MSW. / Sq. Mile 101 - 300
- MSW. / Sq. Mile 301 - 500
- MSW. / Sq. Mile 501 - 700
- MSW. / Sq. Mile 701 -

### ACKNOWLEDGEMENTS:

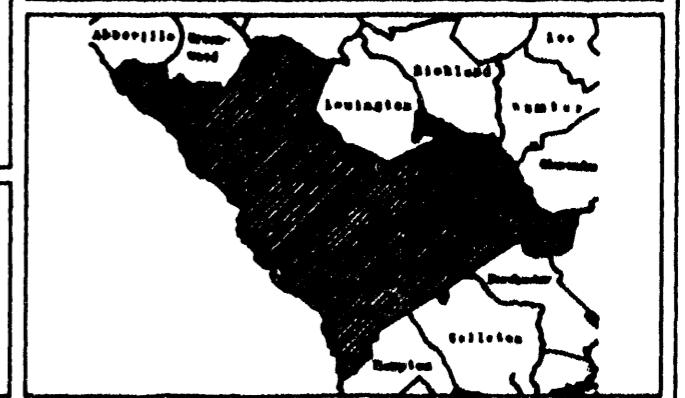
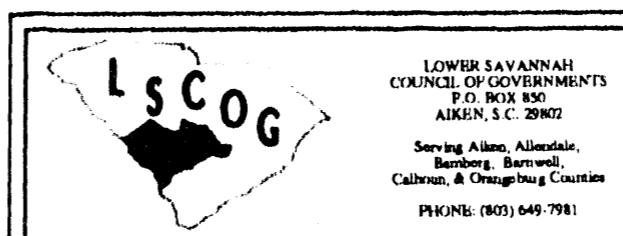
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**MSW BY CENSUS COUNTY DIVISION (cont.)**

CCD	COUNTY	1990 POPULATION	2015 POPULATION	1991 MSW TONS	2015 MSW TONS
Edgefield	Edgefield	5,925	10,360	5,127	10,703
Johnston	"	4,616	5,064	3,436	3,780
Pleasant Lane	"	959	975	721	728
Stevens Creek	"	4,579	8,431	2,900	5,017
Trenton	"	2,296	2,311	2,223	2,807
McCormick	McCormick	5,737	5,877	3,362	4,329
Mt. Carmel	"	1,168	1,437	690	787
Parksville	"	1,963	2,111	1,009	1,059
Bowman	Orangeburg	3,993	4,218	2,886	3,146
Branchville	"	2,165	2,447	1,582	1,098
Cope	"	1,962	2,100 *	1,046	1,151
Elloree	"	4,173	4,294	3,078	3,232
Eutawville	"	4,298	5,369	2,451	2,941
Holly Hill	"	4,959	5,057	3,237	3,140
Neeses	"	3,416	3,511	1,790	1,826
North	"	3,410	3,570	2,090	2,027
Norway	"	2,487	2,691	1,587	1,650
Orangeburg	"	37,819	49,920	45,880	58,268
Orangeburg West	"	8,573	10,860	8,501	10,711
Springfield	"	2,184	2,214	1,878	1,784
Vance	"	5,365	5,915	2,702	2,999
Batesburg	Saluda	3,776	4,633	2,748	4,261
Ridge Spring	"	2,995	3,526	2,384	2,789
Saluda	"	7,507	9,133	5,177	6,212
Saluda River	"	2,079	2,206	975	995
SRS				10,009	11,510
TOTAL REGIONAL MSW TONS				319,368	401,422

\* Figures for the above are derived from South Carolina Statistical Profiles, March, 1992, and/or from The Sea Grant Consortium, May, 1990. An asterisk (\*) is placed beside each CCD where the two sources differed as to projected populations, or where this study had other information which pointed to a difference in projected population (such as the announcement of SCE&G's Cope Generation Plant).

After calculating MSW for each CCD, the figures were compared to totals allocated to each county previously in this study (Page 20). The totals for each county, when calculated by combining the CCD numbers, were almost identical to totals derived from county landfill records. It is assumed, then, that the MSW numbers provided above are very close to actual amounts generated per CCD.

Based on interviews and literature from other regions with experience in innovative MSW management, people generally respond to organized programs run by institutions or professionals. Larger governmental entities and industrial centers are well equipped to organize waste reduction and recycling programs. A number of private firms have amassed experience which can be valuable. Several industries in this region have adopted resolutions with 100% recycling goals, to be implemented as early as the end of 1992.

It is difficult to project MSW because so many factors impact generation. The S.C. Solid Waste Policy and Management Act dictates that there will be a 30% reduction of landfilled MSW, by weight, by 1997. The projections that follow assume an increase in MSW generation of about 2% annually, adjusted to reflect population increases, as well.

The following projections extend through 1997. The third column represents a "best case" estimate of MSW which could be landfilled if source reduction and recycling programs are aggressively initiated; the far-right column is an estimate based on the 30% statutory goal. It is anticipated that industries will lead the way in MSW reduction, and the resulting possibilities are reflected in figures appearing in the third column of the following chart.

Throughout the 1980's, MSW grew at a rate faster than the general population growth. More densely populated areas led the way with the largest rate of MSW growth. The rate of MSW growth projected for urban areas in this study will vary significantly from projections for rural areas.

The following method is used for projections: Total tons (per county), not including industrial MSW, multiplied by percentage of population living in that CCD; plus actual numbers from industrial contributors in that CCD; multiplied by population growth rate; multiplied by a factor for population density; multiplied by a factor for income levels.

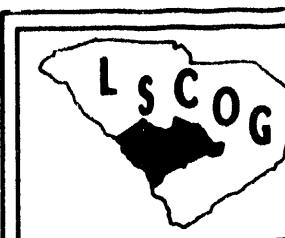
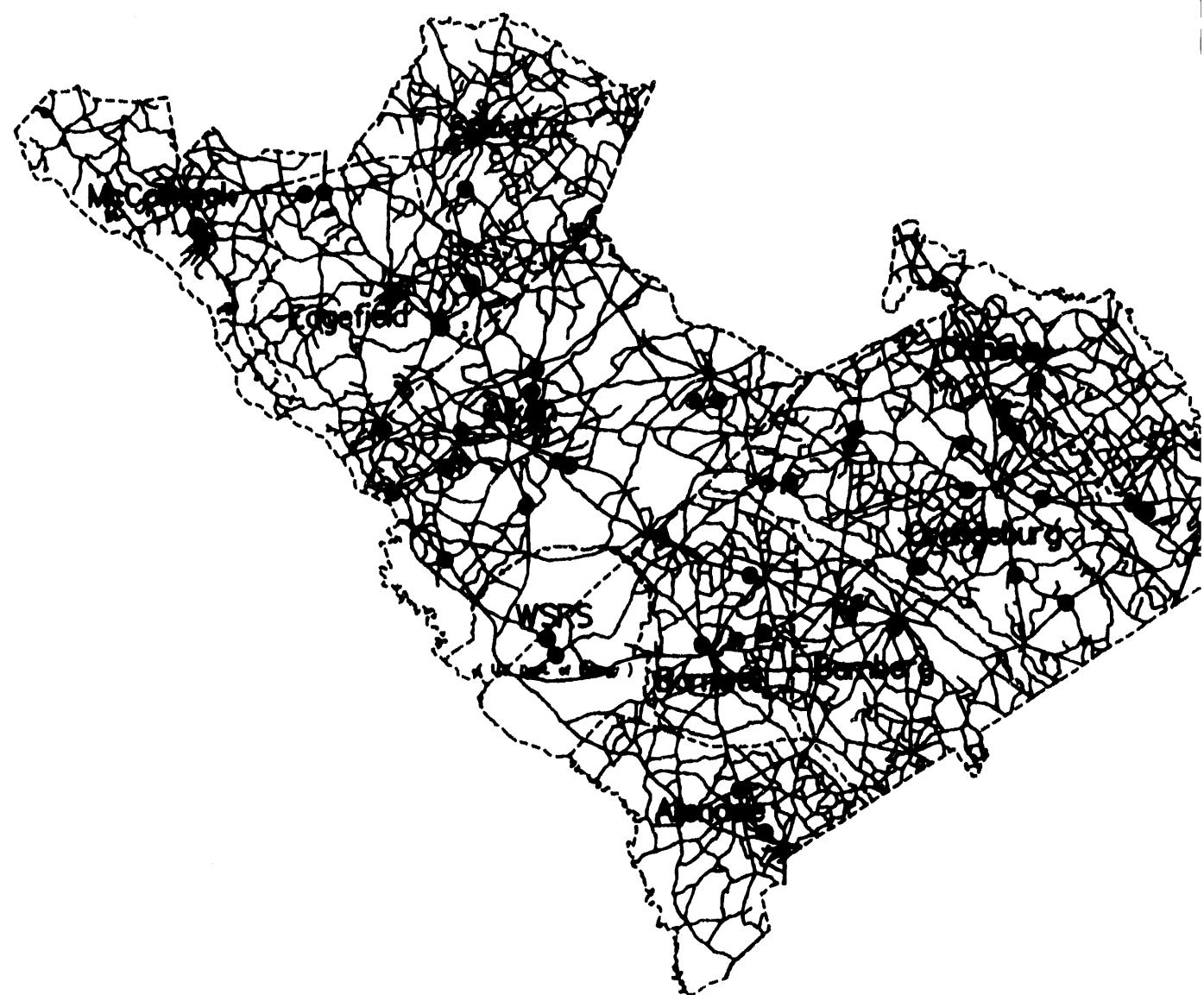
### LANDFILL NEEDS PROJECTIONS

CCD	COUNTY	1997 MSW	BEST CASE LANDFILL MSW	ESTIMATED LANDFILL MSW
Aiken	Aiken	89128	53477	62390
B. Island	"	5420	2905	3794
Edis-Shaw	"	2342	1405	1640
Jackson	"	2014	1208	1410
Monetta	"	2120	1272	1484
New Ellenton	"	4343	2606	3040
N. Augusta	"	74003	44402	51802
Salley	"	2039	1223	1427
Wagener	"	2375	1425	1663
Windsor	"	1362	817	953
Allendale	Allendale	4802	2881	3361
Fairfax	"	2695	1617	1887
Millett	"	420	257	294
Sycamore	"	737	442	516
Bamberg	Bamberg	7095	4257	4967
Denmark	"	6677	4006	4674
Ehrhardt	"	1016	610	711
Olar	"	1165	699	816
Barnwell	Barnwell	7216	4330	5051
Blackville	"	5521	3313	3865
Kline-				
Snelling	"	1422	853	995
Williston	"	4484	2690	3139
Cameron	Calhoun	1463	878	1024
Fort Motte/				
LoneStar	"	531	319	372
St. Matthews	"	4044	2426	2831
Sandy Run/				
Staley	"	5570	3342	3899
Edgefield	Edgefield	8339	5003	5837
Johnston	"	3597	2158	2518
Pleasant Lane	"	724	434	507
Trenton	"	2792	1675	1954
Stevens Creek	"	3834	2300	2684

### LANDFILL NEEDS PROJECTIONS (cont.)

CCD	COUNTY	1997 MSW	BEST CASE LANDFILL MSW	ESTIMATED LANDFILL MSW
McCormick	McCormick	4262	2557	2983
Mt. Carmel	"	735	441	515
Parksville	"	1032	619	722
Bowman	Orangeburg	3007	1804	2105
Branchville	"	1589	953	1112
Cope	"	1095	657	767
Elloree	"	3121	1873	2185
Eutawville	"	2728	1637	1909
Holly Hill	"	3192	1915	2234
Neeses	"	1807	1084	1265
North	"	2061	1237	1443
Norway	"	1616	970	1131
Orangeburg	"	53675	32205	37573
Orangeburg West	"	9917	5950	6942
Springfield	"	1834	1100	1284
Vance	"	2841	1705	1989
Batesburg	Saluda	3986	2392	2790
Ridge Spring	"	2573	1544	1801
Saluda	"	5936	4155	4155
Saluda River	"	984	590	689
TOTALS		367251	220618	257099

As with the chart on pages 24 and 25, this chart uses data collected in this study to make projections on a per CCD basis. Specific industry data is calculated into the total projection numbers. For instance, if a specific industrial wastestream has a high potential for recycling, then the "best case" MSW projections for that CCD may reflect a noticeably different percentage deviation when compared to other CCD's.



## SOLID WASTE STUDY AREA

### WASTE MANAGEMENT SITES

Thursday October 22, 1992

### MAP FEATURES

Drop Off Sites

Transfer Sites

Yard Waste / Inert  
/ Compost Site

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## SOLID WASTE STUDY AREA

MOST DESIRABLE SITING  
Thursday October 22, 1992

### MAP FEATURES

-  USDA Soil Conservation Service identified sanitary landfill soil suitabilities.
-  Most likely subtitle D landfill location based on transportation logistics. (geographic center)
-  Landfill / Transfer Point

### ACKNOWLEDGEMENTS:

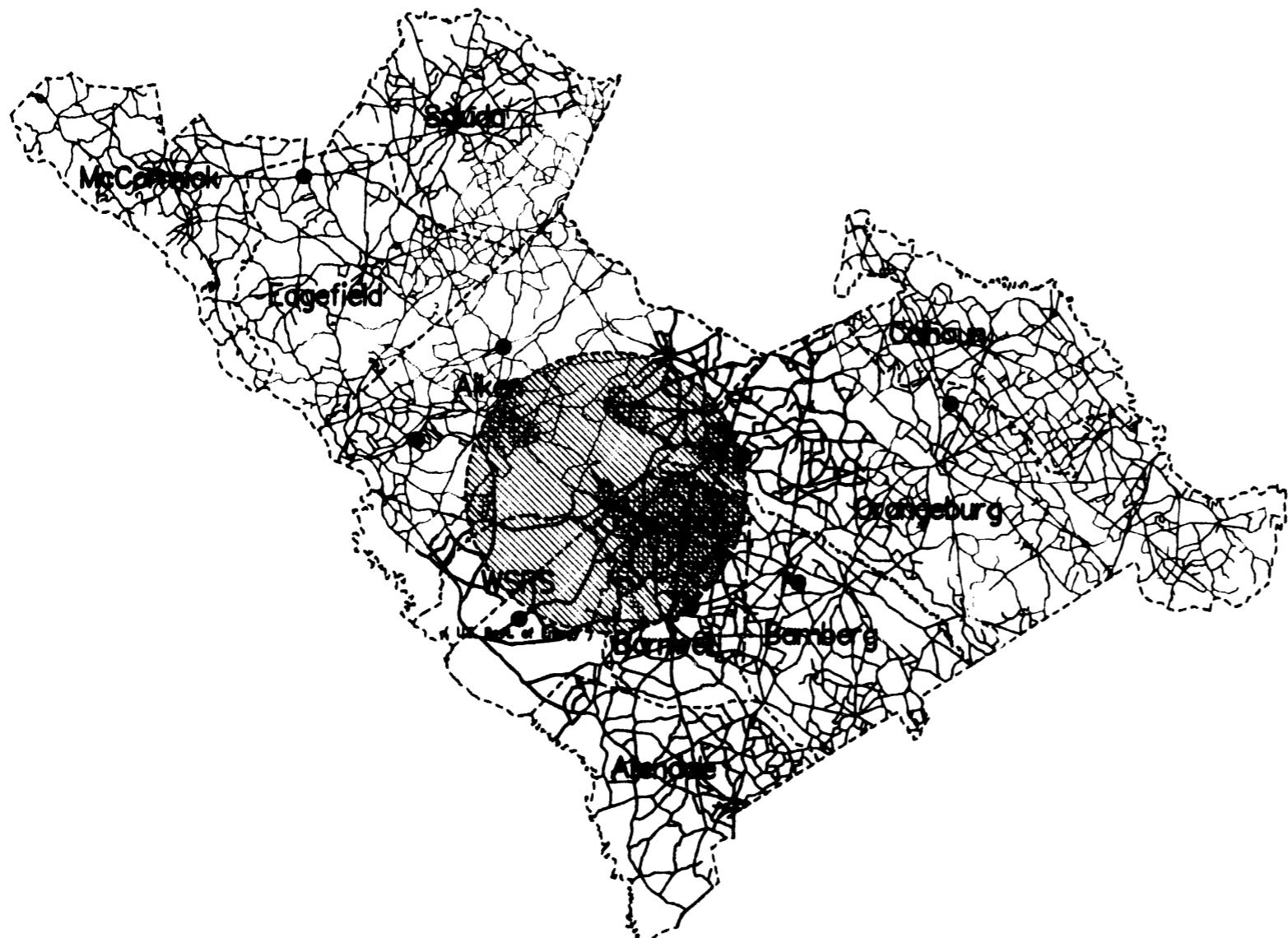
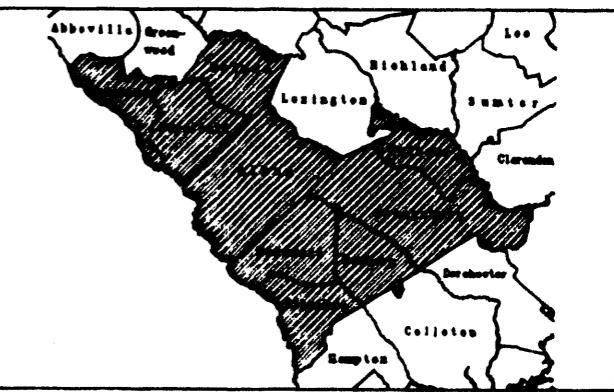
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The following chart relates to employment of in-county manufacturing/industrial facilities and their relationship to MSW.

**COMPARISON OF MANUFACTURING JOBS AND MSW**

County	# MFG JOBS	MFG AS % OF EMPLOYMENT	MFG AS % OF MSW
Aiken	21,375	18 %	25 %
Barnwell	3,599	18 %	10 %
Calhoun	2,103	16 %	28 %
Orangeburg	10,268	12 %	17 %
Allendale	1,252	11 %	11 %
Edgefield	1,918	10 %	8 %
Bamberg	1,543	9 %	28 %
McCormick	808	9 %	5 %
Saluda	1,342	8 %	8 %

Several manufacturing industries interviewed during this study indicated that they were in the process of implementing recycling programs which could greatly affect the amount of MSW buried at the landfill. A vast majority, however, had no definite recycling plans. As stated, it is impossible to accurately predict what individuals and businesses will do in the future, but cost considerations should lead a number of industries to begin recycling and source reduction programs. It is the recommendation of this study that local government leaders begin working with industry leaders to assist with the implementation of such programs. The MSW projections in this study are calculated so as to reflect a normal growth in the MSW stream, including industrial waste. Many industries are in a position to help the counties reach the goals of 30% reduction of landfilled MSW and 25% recycling by May, 1997. Education and waste management efforts should be concentrated in these industries.

Most of the counties in this region are instituting incentive or disincentive programs to encourage reduction of MSW originating from the industrial sector. The disincentive comes in the form of greater tipping fees at the landfill. As a practical matter, it may be found that urban populations and industrial economies have the greatest opportunity for meeting reduction and recycling goals; or, alternatively, in the absence of recycling and reduction, it may be found that those sectors of the economy will have to contribute more to the overall costs of supporting the MSW management system.

## COLLECTION AND TRANSPORT

Another important factor to be considered in determining cost allocation is cost of collection and transport. While remote areas do not contribute significantly to the volume of MSW, the transportation and handling costs can be inordinately high. Excessive attention given to remote areas is also of questionable environmental benefit. Vehicle emissions, wear and tear on equipment and roads, plus increased littering and open dumping can all combine for a negative impact on the environment. The CCD's are listed according to MSW generated in remote areas, and transportation and handling charges are calculated by the following method: transfer trucks for this purpose are assumed to be 16 yard capacity, and total tonnage per trip is assumed to be four tons. Transportation costs are calculated at \$2.00 per loaded mile.

### TRANSPORTATION COST IN RURAL AREAS

CCD	COUNTY	ANNUAL TONS	MILES TO LANDFILL	TRIPS	TOTAL 1-WAY MILEAGE (4t/T)	ANNUAL COST (\$2/mi)
Edisto/ Shaws	Aiken	2054	20	514	10,280	\$20,560
Jackson	"	1526	15	382	5,723	11,445
Monetta	"	2053	25	513	12,825	25,650
Salley	"	2011	10	503	5,030	10,060
Wagener	"	2321	8	580	4,642	9,284
Windsor	"	1273	15	318	4,774	9,548
TOTAL PERCENTAGE OF COUNTY'S MSW				7.6 %		
Millett	Allendale	422	10	106	1,060	2,110
Sycamore	"	698	10	175	1,750	3,500
TOTAL PERCENTAGE OF COUNTY'S MSW				13.8 %		
Ehrhardt	Bamberg	1016	20	254	5,080	10,160
Olar	"	1165	12	291	3,495	6,990
TOTAL PERCENTAGE OF COUNTY'S MSW				15.0 %		
Cameron	Calhoun	1477	20	370	7,385	14,770 Ft.
Motte/ Lone Star	"	554	5	139	695	1,390
TOTAL PERCENTAGE OF COUNTY'S MSW				19.2 %		

**TRANSPORTATION COST IN RURAL AREAS (cont.)**

CCD	COUNTY	ANNUAL TONS	MILES TO LANDFILL	TRIPS 1-WAY	TOTAL MILEAGE (4t/T)	ANNUAL COST (\$2/mi)
<b>Pleasant</b>						
Lane	Edgefield	721	5	180	900	1,800
TOTAL PERCENTAGE OF COUNTY'S MSW				5.0 %		
Mt Carmel	McCormick	690	30	173	5,190	10,380
Parksville	"	1009	20	252	5,040	10,080 TOTAL
PERCENTAGE OF COUNTY'S MSW				33.6 %		
Cope	Orangeburg	1046	20	262	5,240	10,480
Elloree	"	3078	15	770	11,550	23,100
Eutawville	"	2451	35	613	21,455	42,910
Holly Hill	"	3237	35	809	28,315	56,630
Neeses	"	1790	25	448	11,200	22,400
North	"	2090	20	523	10,460	20,920
Norway	"	1587	30	397	11,910	23,820
Springfield	"	1878	35	470	10,450	32,900
Vance	"	2702	30	676	20,280	40,560
TOTAL PERCENTAGE OF COUNTY'S MSW				27.0 %		
<b>Saluda</b>						
River	"	975	35	244	8,540	17,080
TOTAL PERCENTAGE OF COUNTY'S MSW				8.4 %		
<b>TOTAL PERCENTAGE OF REGION'S MSW 13.0%</b>						

As stated earlier, urban areas contribute significantly more to the total MSW than rural areas. Costs associated with handling the wastes, however, are much larger per ton for rural areas. When recommending treatment options, then, it seems logical that source reduction is even more critical for rural areas than for urban areas.

The Lower Savannah Council of Governments has purchased the computer hardware and software necessary to analyze transportation and collections alternatives through a Geographic Information System (GIS). A map entitled "Most Desirable Siting" depicts locations of existing sanitary landfills. These areas may be used for collection/ separation/ and transfer of waste materials.

Attached maps illustrate volumes of MSW that are generated per geographic location, current and projected. Other maps illustrate populations and growth trends, using County Census Divisions (CCDs) as the base unit.

This study recommends drop-off sites as a means for collecting MSW. In a number of instances, however, the volume of waste generated within a serviceable area would not warrant the expense associated with operating the drop-off site (also called convenience stations in some areas).

On the other hand, it is the spirit of the law to clean up and give attention to all geographical service areas. It is also often a consensus among leaders that all areas of the counties be given the opportunity to participate in recycling programs.

As stated previously, transportation costs are of critical concern in rural areas; so the added collection costs associated with the Drop-Off sites may be offset if transportation is reduced. A recommendation of this study is that the responsible entities continue to collect the most rural waste at unmanned collection sites. At these sites, however, more attention should be given to aesthetics, and bins should be provided so that citizens can separate recyclables for direct shipment to other transfer points. At a minimum, citizens should be able to put recyclables into a "blue bag" for eventual separation at a Materials Recovery Facility (MRF). These sites will be called "Rural Collection Sites" in this study.

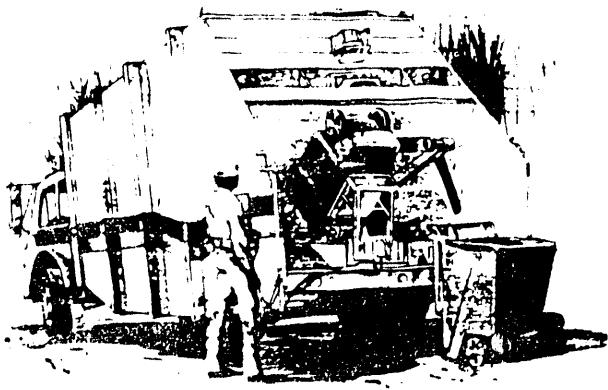
It is important to understand that many citizens are reluctant to accept change. It has been learned in other counties that if the convenience of green box sites is taken away too quickly, many people will simply discard their trash along a roadside or in a wooded area. The only way to combat this reality is to have a large and effective litter control force, such as using Sheriff's Deputies. This idea has not been well received in other areas, so the conclusion seems to be that citizens will have to be weaned off of green boxes while concurrently being educated on the new system. By forming a Region, litter control officers could cross county boundaries to more effectively police litter. While these officers may not have specific authority in the counties, they could serve to patrol and report violations to the proper authorities.

In reality, rural collection of MSW is a costly effort. However, as this study points out, the handling of rural MSW is not going to have a great impact on the overall reduction and recycling for the region as a whole. It may be more prudent that the monies could be spent more effectively in other areas. Meanwhile the rural citizens could still participate in recycling through the Blue Bag system and Rural Collection Centers, and attention can be given to methods for reducing transportation costs.

Once several counties have formed a region, the total MSW stream can be used as the basis for calculating recycling and reduction goals, and this method of calculation should result in a financial savings for all involved. It would represent a tremendous savings to the region as a whole if the urban centers could meet mandated goals, because of the incremental costs of meeting these goals in the rural areas.

Drop-off sites cost approximately \$ 60,000 to construct and \$ 35,000 per year to operate. Remote areas should probably be handled by the Rural Collection Site system. Exceptions should be made if consolidation would prove feasible. For example, Stevens Creek and Trenton in Edgefield could be consolidated with areas of Aiken County.

In Orangeburg, Holly Hill, Eutawville, and Vance could be consolidated, as well as North, Neeses, Norway, and Springfield. Perhaps one drop-off site could be used to serve Batesburg (Saluda County), Ridge Spring (Saluda County) and Monetta (Aiken County). Ellmore and Santee (Orangeburg County), and Cameron (Calhoun County) might support a drop-off site. While Rural Collection Sites would still be necessary to serve the outlying areas of these communities, incentive programs could be instituted to encourage delivery to the drop-off sites.



The cost figures on pages 30 and 31 are intended to reflect costs associated with transportation of commingled MSW from the rural areas listed. The following costs reflect costs associated with hauling MSW in the total system described in this report:

**REGIONAL TRANSPORTATION COSTS**

Collection point	Tons/ Day	Truck loads per day	One-way miles per day	Costs/ Year
Vance drop-off rural sites (7)	15 20	3 5	105 175	\$ 54,600 91,000
Cameron drop-off rural sites (3)	9 7	2 2	40 40	20,800 20,800
Orangeburg drop-offs (4) city pickup	57 35	12 4	108 36	98,280 32,760
St. Matthews drop-off rural sites (3)	8 8	2 2	16 16	12,480 12,480
Rowesville drop-off rural sites (2)	8 4	2 1	40 20	20,800 10,400
Bowman City	4	1	25	10,400
Bowman drop-off rural sites (2)	4 4	1 1	25 25	10,400 10,400
Neeses drop-off rural sites (2)	8 4	2 1	16 8	14,560 7,280
Springfield drop-off rural sites (3)	7 7	2 2	4 10	3,640 7,800

**REGIONAL TRANSPORTATION COSTS (cont.)**

<b>Collection point 2nd category</b>	<b>Tons/ Day</b>	<b>Truck loads per day</b>	<b>One way miles per day</b>	<b>Costs/ Year</b>	
Bamberg/Ehrhardt					
city	12	3	15	\$ 11,700	
drop-off	8	2	10	7,800	
rural sites (2)	4	1	5	3,900	
Denmark/Olar	city	16	3	11,700	
rural sites (2)	4	1	5	3,900	
Allendale/Fairfax					
city	10	2	48	24,960	
drop-off	8	2	48	24,960	
rural sites (4)	7	2	48	24,960	
Barnwell	drop-off	5	1	3	2,730
city	15	3	9	7,020	
rural sites (2)	4	1	3	2,730	
Blackville	drop-off	4	1	14	10,920
Blackville	city	4	1	14	10,920
rural sites (1)	3	1	14	10,920	
Williston	drop-off	4	1	17	8,840
Williston	city	5	1	17	8,840
rural sites (2)	4	1	17	8,840	
Wagener	drop-off	9	2	30	15,600
rural sites (1)	4	1	15	7,800	
Aiken					
drop-offs (5)	132	27	108	98,280	
city pickup	70	18	72	65,520	
N. Augusta					
drop-offs (3)	73	15	90	81,900	
city pickup	57	15	90	81,900	
Jackson	drop-off	8	2	22	17,160
rural sites (1)	3	1	11	8,580	
Ridge Spring	city	5	1	17	8,840
Monetta	drop-off	4	1	17	8,840
rural sites (4)	8	2	34	17,680	

**REGIONAL TRANSPORTATION COSTS (cont.)**

<b>Collection point 2nd Category</b>	<b>Tons/ Day</b>	<b>Truck loads per day</b>	<b>One way miles per day</b>	<b>Costs/ Year</b>
Johnston city	5	1	13	\$ 6,760
Trenton drop-off	4	1	13	6,760
rural sites (3)	7	2	26	13,520
Edgefield city	5	1	16	8,320
drop-off	5	1	16	8,320
rural sites (2)	4	1	16	8,320
Saluda city	10	2	36	18,720
drop-off	10	2	36	18,720
rural sites (2)	4	1	18	9,360
McCormick city	5	1	17	8,840
drop-off	5	1	17	8,840
rural sites (3)	7	2	34	17,680
O'burg/Calhoun				
to LF	126	9	540	280,800
to MRF	62	12	60	54,600
Springfield				
to LF	63	5	120	62,400
to MRF	32	6	216	112,320
Bamberg				
to LF	24	2	60	31,200
to MRF	9	2	60	31,200
to incin.	23	2	70	36,400
Barnwell				
to LF	57	4	80	52,000
to MRF	18	4	216	112,320
Aiken North				
to LF	185	13	390	202,800
to MRF	70	14	336	174,720
Aiken South				
to LF	130	9	270	140,400
to MRF	60	12	24	21,840

### REGIONAL TRANSPORTATION COSTS (cont.)

Collection point 2nd Category	Tons/ Day	Truck loads per day	One way miles	Costs/ Year per day
Tri-county				
to LF	42	3	198	\$ 102,960
to MRF	14	3	120	62,400
SRS				
to MRF	20	4	168	87,360
TOTAL TRANSPORTATION COSTS				\$ 2,722,980

Though costs are calculated here for the entire region, private or municipal haulers of MSW will charge directly to their customers and then contract with the region for disposal. Construction and Demolition debris will go directly to Inert Landfills via private haulers, and those costs are not reflected in the above estimates.

In some municipalities, recycling programs have been designed to reduce the end-disposal amounts of waste. In practice, the isolated improvements made by individuals or neighborhoods have had only nominal effect on the overall wastestream management. The two largest criticisms of neighborhood and curbside programs, based on interviews with other jurisdictions, has been that 1) they are not cost-effective due to the efforts expended and volumes produced, and 2) they do not consistently segregate a good quality of useable recyclables. Contamination of the segregated recyclables by a few can negate the efforts of the majority who have correctly classified the recyclables.

As public education and industrial recycling efforts are expanded, some of the above projections may change dramatically. More detailed study should be made as collection and transport infrastructure is put into place for the region.

## **TREATMENT AND DISPOSAL OPTIONS**

In addition to normal considerations of cost and convenience, all counties and entities involved with MSW management must comply with statutory and regulatory requirements. Treatment and disposal options include:

- 1) Source reduction
- 2) Reuse
- 3) Recycling
- 4) Waste-to-Energy plants (WTE)
- 5) Composting
- 6) Landfilling
- 7) Special Waste Handling
- 8) Litter Control



### **Source Reduction:**

Source reduction activities fall into several basic categories: product reuse; reduced material volume; reduced toxicity of products; increased product lifetime; and decreased consumption. Efforts to promote source reduction will take the form of education and research, financial incentives and disincentives, and regulation. It is hoped that interviews with business, government, and industrial leaders will result in programs to implement source reduction on a regional basis.

The most effective means of achieving source reduction is the boycotting of consumer products that neglect conscientious packaging by the manufacturer. Organization and education of consumers in this area could dramatically help reduce landfill volumes.

### **Reuse:**

Public education will be the primary method to promote reuse of materials presently disposed of in municipal waste landfills. Use of washable eating utensils and dinnerware is an example of a reuse opportunity, and many other opportunities also exist.

### **Recycling:**

Recycling alternatives are being explored by a number of organizations within the region. Primary considerations are economics, logistics, social concerns, and markets. There are currently recycling programs in North Augusta, Aiken, Orangeburg, Fairfax, Edgefield, and Ellerbe that are in startup phases. There are several ongoing projects, primarily for paper, aluminum, scrap metal, glass, and used oil that are being carried out in many communities. Markets and economics have been worked out to a large degree and can be duplicated in other communities. Materials such as plastics, yard wastes, tires and demolition debris can be recycled after more market development.

Again, a collections system with transfer stations, coupled with individual participation, would set the groundwork for a successful program. The location of two materials recovery facilities (MRFs) is a recommended option for the region. Additional information contained in this report expands on the associated economics and social concerns.

### **Waste to Energy Plants:**

A regional waste-to-energy facility producing 25 megawatts of electrical power could be built to extract the usable energy from approximately 450 tons per day of high-BTU MSW. The economic feasibility is dependent upon transportation and energy cost scenarios that lead to very restrictive siting criteria. Because of the rural nature of the region, transportation and economies of scale for an energy plant would indicate that no more than one such facility could be built. That facility would likely need to be located so that it could utilize some high-BTU burnables from other regions as well, such as Augusta, Georgia, or Columbia, S.C. Because of costs and regulatory considerations, it is not recommended that this region construct and operate a waste-to-energy facility at this time.

### **Composting:**

The Solid Waste Management Act of 1991 requires that no landfill will accept yard wastes and debris beginning May 27, 1993. The law states that composting will be encouraged, but final regulations have not been adopted. A preferred way to comply with the law at that time may be to either compost or mulch, or have a combination of facilities working in tandem with neighborhood projects. As with recycling, finding a market for composted materials is of principal concern, although technical considerations are not to be underestimated.

For the past three years a private group, Aiken City Composting has processed horse stable bedding and manure that they collect during the peak 6-month training period each year. This facility currently composts about 100 cubic yards per day during that time period. The compost from this facility has been successfully marketed locally both in bags and in bulk. The company is also doing research and development for composting hazardous household waste, which is an area of great concern for MSW planners.

It is recommended that this region begin working toward the creation of ten (10) composting locations. The region can collectively own equipment and manage the operations, or contract with a private organization. It is possible to divert approximately twenty percent (20%) of the region's MSW (62,400 tons) to composting facilities.

Two large facilities, handling about 100 tons per day each, would be preferable, but transportation costs would be prohibitive. Ten smaller sites, handling 10-20 tons per day, could be used as depositories for compostable material, with mobile equipment used weekly or bi-weekly to manage the facility.

It is a well-established fact that compost is a very valuable component for the growth of all types of crops. The farmland in the region covered by this study could be especially enriched through widespread use of composted MSW. In addition to the MSW that has been the subject of research here, there is a vast amount of agricultural wastes which could be added to the composting feedstock stream. Eventually, perhaps, the area's compost could help lead to a stronger agricultural economy.

### **Landfilling:**

Any waste management plan ultimately includes the use of landfills. At present, based on geographical considerations, along with an appraisal of each existing landfill, it is concluded that this region could only support one or two Subtitle D landfills. Prior to landfilling, existing landfills could be used as transfer/separation stations. There will be a need for several inert landfills to handle material that does not need placement go in a Subtitle D landfill, and present landfill locations could handle some of those needs.

A map entitled "Most Desirable Siting" indicates that a central, Subtitle D landfill could be located in the area around the intersection of Aiken, Orangeburg, and Barnwell Counties. All transfer stations in the region would be within 60 miles of this point. Soil conditions appear to be among the best in the region. Transportation routes are good, and the most densely populated areas of the region are less than forty miles away.

### **Special Waste Handling:**

Special wastes include used oil, tires, wood wastes, construction and demolition debris, batteries, and white goods. Presently, only a few landfills are accepting any of these special wastes. On May 27, 1992, used oil and lead batteries were prohibited from placement in county landfills. On May 27, 1993, yard wastes and land-clearing debris will have to go to a composting facility or, possibly, an inert landfill. On May 27, 1994, white goods cannot be accepted in county landfills. Networks are being established by private handlers for some of these products. Again, current landfill areas could serve as collection and transfer points.



**Waste Tire Disposal:**

The Solid Waste Policy and Management Act of 1991 provides for separating waste tires from the solid waste stream and disposal of tires in DHEC-approved processes and sites. Since November 1, 1991, any new tire purchased at the retail level has an added \$2.00 charge, which is to be used for waste tire disposal. The S.C. Tax Commission will collect the \$2.00 fee and refund \$1.44 to the counties for disposal of tires. The Act requires each county to submit a plan to DHEC detailing tire disposal and recycling methods. Should a county fail to prepare and submit a plan to DHEC, then the agency shall prepare the plan.

Waste tires, if not properly processed and/or disposed of, present a potentially serious health and environmental risk for counties. With the funds counties have received and those to be received for the next five years from the \$1.44 per tire county rebate, they should develop recycling and disposal plans and initiate the process of waste tire disposal. Several DHEC-approved firms are engaged in tire disposal. Waste tire disposal should be seen as an early candidate for counties to initiate solid waste management and planning, designed for meeting their waste reduction volume goals. Though regional cooperation will save time and money, the counties will be individually responsible for paying for waste tire cleanup within their borders, using the money the State Treasurer earmarked for that purpose.

**Litter Control:**

An increase in litter is one of the inevitable consequences brought about by changes in methods of solid waste management. As people incur added expenses involved with modern waste handling, there will be a growing number of abuses of the system. Several counties in South Carolina have litter control officers, with the normal fine of over \$200 per offense. It is critical that a program such as this be in place in every county once disposal becomes less convenient for waste generators. With a loss convenience, there will be an increase in litter, and experience shows that enforcement of litter laws is imperative in order to ensure proper disposal. Increases in fines for litter are included in the Solid Waste Policy and Management Act.

As stated earlier, urban areas contribute significantly more to the total MSW wastestream than do rural areas. The costs per ton associated with handling the MSW is much greater for the rural areas. It would seem logical, then, that these areas be encouraged to practice source reduction so as to allow for fewer pickups. Although programs which rely on individual separation of materials generally show only nominal success, any success at reducing the volume of trash in rural areas will result in significant savings. Therefore, regional Drop-Off Centers are recommended for rural areas, with separate bins for recyclable materials and onsite personnel for education and assistance.

The number of Rural Collection Sites should be reduced gradually, and citizens could be directed to the Drop-Off Centers, but Rural Collection Sites will be necessary for some time in remote areas. Whereas urban populations may have to pay a greater percentage of overall MSW management costs, people living in rural areas may have to incur an added expense of transportation necessary to get their waste materials to the collection sites. Incentive coupons could be given in proportion to recyclables separated so that the users of Drop-Off Centers could get certain rebates or allowances on their county taxes. Again, the savings in collection and transportation costs would be significant. Another similar approach would be to have tipping fees for the citizens, based on weight, tabulated and recorded by computer as the citizen deposits his garbage at the Drop-Off Center. Recyclables could be received free of charge.

Maps attached to this report show recommendations for locations of the following: 1) Drop-off sites for residential waste delivery and transfer; 2) Transfer stations for regional collection, separation, and transfer of MSW brought in from drop-off sites; 3) Materials Recovery Facilities (MRFs); 4) Yard waste and land-clearing debris treatment facilities (including composting and/or landfilling); and 5) Subtitle D locations.

**(1) Drop-off sites** are staffed collection areas where public education and facilities upkeep are emphasized. Citizens have the option of separating recyclables, using a "blue bag" system, or disposing of total MSW without separating. It is recommended that incentives be devised in addition to constant education programs. MSW is transported directly from the Drop-off Site to the Transfer Station.

It is assumed that municipal pickup will continue as in the past. Municipalities with curbside pickup would take their bulk or separated MSW directly to Transfer Stations. Municipalities would contract with the Regional Authority for services.

Most industrial and commercial MSW generators have wastes picked up by private haulers. This practice could continue, with the haulers taking the trash to the Transfer Stations. These generators could also haul their own MSW. Transfer stations would usually be located at the present landfill sites, so transportation routes would not change.

**(2) Transfer Stations** are "break-bulk" locations where four to five employees separate the mass of materials that are shipped in from the Rural Collection Sites, Drop-Off sites, Municipal pickups, and Industrial or Commercial points. Recyclable materials are placed into bins of like materials for further separation at the area MRFs. Separation would be accomplished largely by trained employees working a conveyor line. No separation would be attempted for the mass MSW stream, but employees would pull out the blue bags and other recyclables.

As the total system matures, more separation could be accomplished at these Transfer Stations. Identification of recyclables could expand into a number of areas, including cellulosic materials that could be converted into Refuse-derived Fuel (RDF). Education would allow for the expansion of recyclable materials over time. The primary goals accomplished by this early separation process would be: 1) Identification of source and type of materials would be enhanced because the Transfer Station is closer to the generation point, and 2) Compaction of non-recyclables could be accomplished before the major transportation hauls occur.

The bulk of the costs for these Transfer Stations would be for the compactor, the building, and the grounds, all of which would be permanent parts of the facility. Eventually, if the central MRF proves to be the most viable route for recovery of recyclables, the separation aspect of the Transfer Station could be abandoned. Meanwhile, non-recyclables are compacted at the Transfer Station and shipped directly to landfills.

As long as non-recyclables make up the majority of the MSW stream, the system described here would be the most cost effective. When and if education allows for more recycling, and if the MRF is able to sort and process compacted materials, the separation aspect of the Transfer Station could be abandoned, and mass MSW could be sent directly to the MRF.

**(3) Materials Recovery Facilities (MRFs)** are automated or semi-automated facilities designed for preparing the finished product to go into the recyclables market. The MRFs generally employ about twenty-five people and are designed to handle large amounts of MSW, generally 200 tons or more per day. Conveyor systems are at the center of the process. Bags are broken open at the beginning of the conveyor line, and separation is accomplished through manual and mechanical means.

MRFs can be designed in many different ways. Because of the rural nature of the region under study, the initial use of MRFs is aimed at separation of already identified recyclables, rather than the mass MSW stream. This concept is intended to reduce transportation costs initially, but eventually the MRFs could be expanded to separate mass MSW streams. The technology involved with MRFs is evolving rapidly. It may be prudent to keep initial design simple, with the goal of adapting operations and procedures to fit the needs that emerge as the total system develops.

**(4)** Currently used landfills are seen as being appropriate for **yard waste and construction debris treatment**. Treatment may be accomplished through combinations of grinding, mulching, and landfilling. It is recommended that the region share the equipment necessary for grinding, mulching, and composting. This equipment would not be needed on a day-to-day basis at any one facility due to the nature of processing and the volumes generated, so sharing of transportable equipment on an as-needed basis would be most cost effective.

**(5) Subtitle D** of the Federal Resource Conservation and Recovery Act regulates non-hazardous municipal solid waste. Sanitary landfills will have to follow these guidelines after October, 1993, thereby making landfilling more complex as well as expensive. Among the issues that must be addressed are 1) location restrictions, 2) design criteria, 3) operating criteria, 4) closure and post-closure care, and 5) financial assurance.

## **RECOMMENDATIONS AND ANALYSIS OF OPTIONS**

Continuing education should be provided in all areas that can bring about reduced landfill volumes. Counties should provide leadership, possibly through the use of advisory councils, to promote education in the areas of source reduction, reuse, recycling, and litter control. Schools, churches, and other organizations should provide the forum for presentations and dissemination of materials.

The costs for collection and transportation in this region become inordinately high if the region attempts to treat all areas equally across-the-board with regard to recycling and reduction goals. Likewise, if any of the individual counties attempt to meet all state and federal MSW requirements alone, their economies of scale are very poor.

In order to meet legal requirements in the most cost-effective manner, the following recommendations are being made as a result of this study. Maps attached to this report show recommendations for locations of the following:

### **1) Rural Collection sites per county**

	Immediate	Long Range
Aiken	1	3
Allendale	1	4
Bamberg	1	4
Barnwell	1	5
Calhoun	1	6
Orangeburg	2	16
Edgefield	1	5
McCormick	1	3
Saluda	1	6



Rural Collection Sites are unstaffed areas for collection of household MSW. These areas would be equipped with bins for collecting recyclables through a "blue bag (mixed recyclables) system", roll-offs for yard trash, bins for specific special wastes such as old refrigerators or mattresses, and a bin for all other MSW. These sites would replace green box cluster sites. They are designed to service the most rural areas, and people using these sites would be educated through signs at the site, public information programs, and periodic assistance from volunteers. Their cost would be in the range of \$ 10 - 20,000 each, depending on the type of surface treatment, and there would be little maintenance required. Each would be sized and sited to collect about 2 tons per day.

## 2) Drop-off sites per county

	Immediate	Long range
Aiken	5	10 *
Allendale	1	1
Bamberg	0	2
Barnwell	3	3
Calhoun	1	1
Orangeburg	2	10
Edgefield	0	2 *
McCormick	0	1
Saluda	0	2 *
SRS	1	3

\* Two sites in Aiken County could actually serve parts of Edgefield County, and one site in Saluda County could serve a part of Aiken County.

Drop-off sites cost approximately \$ 60,000 each to construct and \$ 35,000 per year to operate. The total recommended for operation in this region for the first year is 12. Each drop-off site must be staffed, and they are generally open five days a week, from around 7 a.m. to 7 p.m.

At the Drop-Off Centers, employees greet citizens and interact in such a way so as to educate and encourage recycling. Separate bins and areas are set up to allow people to deposit materials according to type. A compactor is used to reduce the volume of non-recyclables prior to further transportation. Recommended daily volumes are between 8 and 20 tons.

### 3) Regional Transfer Stations

<u>Area</u>	<u>Number</u>	<u>Size</u>
Aiken	1	250 ton/ day
Aiken East/		
Orangeburg West/	1	100 ton/ day
Aiken West/		
Edgefield East	1	200 ton/ day
Allendale/		
Bamberg/		
Barnwell	1	100 ton/ day
Orangeburg East/		
Calhoun	1	250 ton/ day
Bamberg	1	50 ton/ day
Edgefield West/		
McCormick/		
Saluda	1	100 ton/ day
SRS	1	50 ton/ day

Capital cost for a Transfer Station is around \$ 1,000 per ton of daily operating capacity, which pays for the building, tipping floor, and related support systems. In the Transfer Stations recommended for this region, additional costs for a pre-sorting conveyor system would add around \$ 50,000 each. Total costs, then, for the above would be around \$ 1,400,000. The smaller transfer stations would require 2 compactor trailers each, and the larger stations would require 3 trailers each. Labor costs associated with running the conveyor system would be around \$ 75,000 per year, and utilities and upkeep run around \$ 12,000 each per year.

At the Transfer Stations, the total waste stream would be separated along manned conveyor lines according to recyclables and nonrecyclables. There would be no mechanical separation or processing would be accomplished until the recyclables reached the MRF. For recyclables coming from the Drop-Off Centers or curbside programs, there would be no need to run these materials on the conveyor, and they could be processed directly for transfer to the MRF.

Pre-sorting and compaction may not be necessary at all Transfer Stations. The determining factors will be the transportation and labor costs to be saved. It is not recommended that recyclables be compacted due to possible contamination of products. Therefore, if it is the intent of the region to maximize recycling while minimizing costs, the pros and cons for pre-sorting will be determined by an analysis of the following:

- 1) transportation costs saved through compaction, and 2) benefits reaped from recycling; versus,
- 3) the extra capital and operating costs associated with putting in conveyor, separation, and compaction systems.

Again, if the Transfer System is close to a MRF, it would be possible to ship mass-collected MSW directly into the MRF where total processing could take place. In that case, neither a conveyor system nor a compactor would be necessary at the Transfer Station. Distance, in that case, would need to be no more than ten miles from Transfer Station to MRF.

#### **4) Materials Recovery Facilities**

<u>County</u>	<u>Location</u>	<u>Size</u>
Aiken	North Augusta	400 tons/ day
Orangeburg	Orangeburg	200 tons/ day

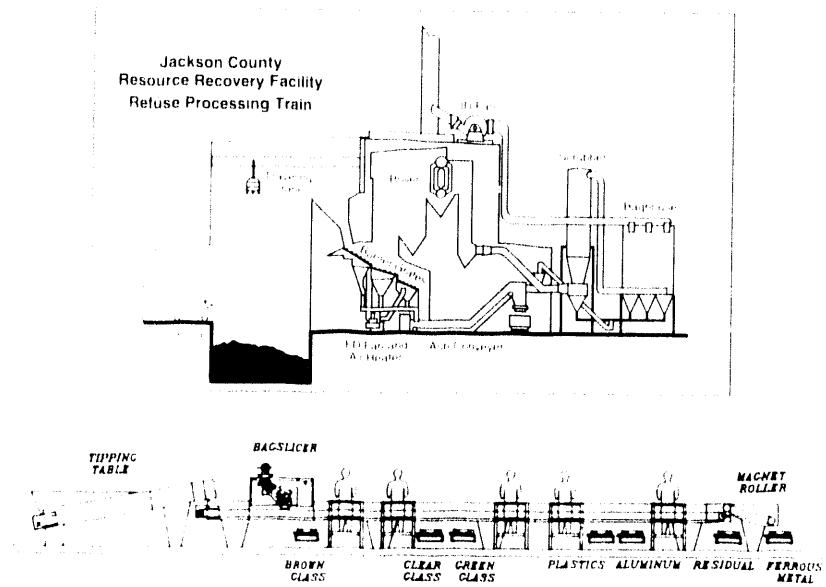
In light of the above recommendations, i.e. the use of rural collection sites, drop-off centers, and regional transfer stations, it is obvious that curbside recycling is not recommended for this region. For municipalities that are already practicing curbside recycling, the practice can be continued, but it should be studied as to how it could be integrated most efficiently into the regional collection system. With that, most MSW moving through this region will be mixed and must be broken out into separate components in order to be recycled. A "Blue Bag" system would enable participating citizens to put recyclables into separate bags which would expedite separation at the Transfer Station/MRF.

There are a number of designs and operating philosophies associated with Materials Recovery Facilities (MRFs). Designs range from fully manual operations to mostly automated systems. The design chosen usually depends on labor availability and the basic choice between whether one believes that human error is more likely than machine error or vice-versa. As has been stated, North Augusta is already considering a MRF which could separate up to 250 tons of trash in an eight hour shift.

Economically and operationally, there have been mixed signals coming out of successful MRFs nationwide. Recycling markets are depressed, and return on investment is questionable. Many MRFs are running far below projected recyclables recovery rates, and capital investment in mechanical separation and processing equipment is high. In this region, the pre-sorting of recyclables, coupled with a semi-automated MRF, is recommended as a way to hedge against the downside that could result from poor markets or mechanical problems. It is hoped that a system would be designed so as to allow for expansion as markets and technology improve. Philosophically, most experts agree that MRFs hold promise for the greatest amount of recycling at the least cost. Technologies are improving constantly, but are still outpacing markets. Recycling is a fledgling industry, and long-term commitment, regulation, and industry acceptance will likely improve the markets and technologies in the future.

## MATERIALS RECOVERY FACILITIES

### Layout Examples



Based on current markets, the following financial proforma would represent a probable scenario. (Also see Attachment A)

**12-Month Proforma Income**

**100 Ton/Day MRF 5 days/ Week  
66% Diversion Rate**

<u>Income</u>	<u>Monthly</u> (x1000)	<u>Annual</u> (x1000)
Paper (500 tons)	\$ 8	\$ 96
Plastic (80 tons)	3	36
Glass (100 tons)	2	24
Aluminum (50 tons)	30	360
Cardboard (200 tons)	6	72
Refuse-Derived Fuel (400 tons)	4	48
Tipping Fees (1320 tons)	<u>33</u>	<u>396</u>
Total Income	\$ 86	\$ 1032

Expenses

Debt Svc.	\$ 31	\$ 374
Labor	25	300
Utilities	3	36
Maintenance	3	36
Supplies	4	48
Handling, etc.	<u>15</u>	<u>180</u>
Total Expenses	\$ 81	\$ 972
Net	\$ 5	\$ 60

Assumptions:

- 1-Paper: Recovery of 15% of MSW @ \$15/ton average
- 2-Plastic: Recovery of 2% of MSW @ \$40/ton average
- 3-Glass: Recovery of 2% of MSW @ \$20/ton average
- 4-Aluminum: Recovery of 1% of MSW @ \$600/ton average
- 5-Cardboard: Recovery of 4% of MSW @ \$30/ton average
- 6-Refuse-  
derived fuel: Recovery of 5% of MSW @ \$10/ton average
- 7-Tipping Fees: \$25/ton avoided cost for recoverables only
- 8-Debt Service: \$2 million @ 10% for 10 years

12-Month Proforma Income

200 Ton/Day MRF 5 days/ Week  
66% Diversion Rate

<u>Income</u>	<u>Monthly</u> (x1000)	<u>Annual</u> (x1000)
Paper (1000 tons)	\$ 15	\$ 180
Plastic (160 tons)	6	72
Glass (200 tons)	4	48
Aluminum (100 tons)	60	720
Cardboard (400 tons)	12	144
Refuse-Derived Fuel (800 tons)	8	96
Tipping Fees (2640 tons)	66	792
Total Income	\$171	\$ 2052

EXPENSES

Debt Service	\$ 31	\$ 374
Labor	25	300
Utilities	3	36
Maintenance	3	36
Supplies	4	48
Handling, etc.	15	180
Total Expenses	\$ 81	\$ 972
Net	\$ 90	\$1080

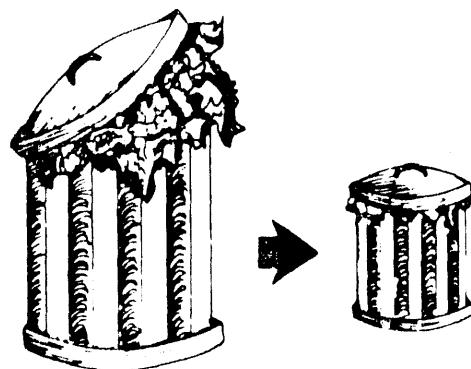
Assumptions:

- 1-Paper: Recovery of 15% of MSW @ \$15/ton average
- 2-Plastic: Recovery of 2% of MSW @ \$40/ton average
- 3-Glass: Recovery of 2% of MSW @ \$20/ton average
- 4-Aluminum: Recovery of 1% of MSW @ \$600/ton average
- 5-Cardboard: Recovery of 4% of MSW @ \$30/ton average
- 6-Refuse-derived fuel: Recovery of 5% of MSW @ \$10/ton average
- 7-Tipping Fees: \$25/ton avoided cost for recoverables only
- 8-Debt Service: \$2 million @ 10% for 10 years

Generally speaking, a MRF has a capital cost of around \$ 20 per annual ton processed. That is, a 400 ton per day (104,000 ton per year) MRF would cost around \$ 2,080,000 to build. This figure can change by as much as double or half, depending on the amount of automation. Operating costs have a direct correlation to capital costs, because highly automated systems require little labor, while some MRFs can employ as many as 20 people per conveyor line. It is beyond the scope of this study to make detailed recommendations as to the type of MRF which should be chosen, but concerns about automation and markets have already been enumerated. In this region, it appears that MRFs will represent the most viable route for reaching reduction and recycling goals in a cost-effective manner.

The proforma on the preceding page uses 66% as the diversion factor; that is, 66 % of the material going to the MRF is expected to be recovered and produce a revenue from sales into recyclables. Likewise, 66% of the MSW entering the MRF will be diverted from a landfill. The proforma also assumes that the responsible entities will pay the MRF a fee of \$ 25/ton as an avoided cost. It should be noted that when determining the avoided cost, calculations should take into consideration the fact that diverted MSW could increase the cost per ton of landfilling. That is, if a finite number of tons can go into a landfill (because of regulatory, regional, or other requirements), then the cost of landfilling on a "per ton" basis will increase due to economies of scale. This concern is elaborated on in more detail in the section on Subtitle D Landfills. Illustrations at the end of this report demonstrate the economics involved.

Also, the diversion rate of 66% would be considered small by most people who work with Materials Recovery Facilities, because pre-sorting has already diverted the vast majority of the MSW from the MRF. This figure is used as a starting point for this region, but some MRFs report recovery of recyclables out of the mass MSW stream as high as 75%. As the MRFs become more efficient, capital and labor costs generally escalate.



It should also be expected that many industrial MSW generation points will recover their own recyclables. Should the region covered by this study build its own landfill, it should be prepared to deal with the consequences of implementing the legislated recycling and reduction goals. The intent of current legislation is clearly to reduce amounts of MSW going into landfills. If this intent is achieved, then regions and counties should realize that economies associated with building Subtitle D landfills will be substantially impacted.

### 5) Yard Waste and Debris Treatment

<u>Area</u>	<u>Locations</u>	<u>Type</u>
Aiken	2	Compost
Aiken/ Edgefield	1	Compost
Aiken/ O'burg West	1	Compost
Allendale/ Bamberg/ Barnwell	2	Compost
Orangeburg/ Calhoun	2	Compost
Orangeburg Bamberg	1	Compost
McCormick	1	Compost
Edgefield	1	Compost
Saluda	1	Compost
SRS	1	Compost

The original draft regulations for the 1991 Solid Waste Policy and Management Act mandated composting of yard trash, beginning August 27, 1992. The regulations were amended, and the date is now May 27, 1993. The regulations which cover yard trash and debris treatment are not final as of this writing, and it is unclear as to whether inert landfills will still be allowed to operate as in the past. The locations recommended in this report for compost facilities are also recommended for use as inert landfills if allowed by law. Inert landfills, as now operated, can be expected to cost a fraction of Subtitle D landfills of

comparable size. It would be difficult to justify the transporting of yard trash and debris for any great distance, and a weak market for compost would make inert landfills more attractive, assuming regulatory requirements are not too stringent.

Composting is more difficult and technical than many people understand, but the technology is readily available. Composting sites require approximately 50 acres of land, which, at a minimum, would cost \$ 50,000. There are several regulatory requirements as to buffers, grading, water tables, etc., which, when added to other necessary land improvements, will probably add another \$ 50,000 to the cost. Other cost estimates follow:

A) Front end loader -	\$ 75,000
B) Water tank truck -	65,000
C) Specialized aerating & turning equipment -	80,000
D) Tub Grinder -	<u>120,000</u>
TOTAL (including above)	\$ 440,000

The operations costs for a composting facility is estimated at between \$ 4 and \$ 8 per cubic yard. A 100 cubic yard per day facility, therefore, is estimated to incur approximately \$100,000 to \$ 200,000 per year for operating costs. No costs for collection and transport are included in this estimate.

Markets for compost are questionable at this time. There is no doubt that compost would add a significant value to much of the poor agricultural land found in this region. Once the value and markets are established, compost should bring about \$ 10 per cubic yard. The facility outlined above might be able to expect gross revenues of \$ 300,000/ year, and that facility could likely supplement its supply of feedstock from agricultural wastes that are abundant in this area. It is likely that private entities would be interested in taking on all or part of the composting responsibilities.

Alternatively, significant cost savings could be realized by the sharing of equipment among all facilities in the region. The volumes of compostable waste in all instances here would not support the use of dedicated machinery, as listed above, at each site. Almost all of the equipment necessary could be loaded onto trailers and moved, perhaps on a weekly basis, among the ten sites in this region. Private companies have expressed an interest in providing this type of service if enough sites could be dedicated to support the cost of equipment and operations.

Composting can be successful on a small scale, also, if individuals can be motivated to do so.

**6) Subtitle D locations**

<u>Area</u>	<u># of Subtitle D Landfills</u>
Central Region (area of Orangeburg, Barnwell, and Aiken boundary intersection)	1

The primary waste disposal method used by responsible parties in the past has been landfilling. Subtitle D of the federal Resource Conservation and Recovery Act places stringent regulatory requirements upon landfills which accept MSW in the future. These requirements are costly and time-consuming and, in many cases, are not practical, especially for small counties.

The capital cost for building a Subtitle D landfill today is estimated at between \$ 200,000 and \$ 600,000 per acre. Operational costs are about \$ 20 per ton of material that is buried, not including collection and transportation costs.

In order to ensure compliance with the RCRA and the SWPMA of 1991, SRS is currently developing a Subtitle D landfill to handle its current waste generation. Although some concerns exist with security, SRS/DOE have shown a willingness to explore the various options of a regional MSW disposal plan through the funding of this feasibility study.

This region generates 312,000 tons of MSW per year today, and there are about 700 pounds of MSW in each compacted cubic yard landfilled. Each ton, therefore, represents about 3 cubic yards, and the region's MSW could be expressed as being 954,000 cubic yards per year. If projections in this study hold true, 1997 landfill tonnage figures will be 256,078 tons, or about 732,383 cubic yards.

Assume that a landfill site must be found to handle twenty year's of the region's MSW at 260,000 tons per year (743,000 cubic yards), or 14,872,000 total cubic yards. If average depth of material is assumed to be thirty feet, then each acre of landfill space could hold 48,400 cubic yards of material. Total landfill acreage needed, then, would be 307.27 acres, not including buffer areas, and necessary buildings, treatment areas, and storage areas.

Estimated costs for such a facility in today's dollars would amount to around \$ 153,635,000 at \$ 500,000 per acre. Additional development costs would also be necessary for support facilities on site, at approximately \$ 50,000 per acre. If 100 additional acres were developed at these facilities, total capital costs would then be \$ 158,635,000.

If the nine-county region sent 260,000 tons annually to a regional landfill, then the cost per ton for burial, calculated on capital costs alone, would amount to \$ 30.51. (158,635,000 divided by 20 years, divided by 260,000 tons per year). Add operational costs of \$ 10 per ton, and the total costs for landfilling is \$ 40.51 per ton.

It is impossible to accurately predict the cost of landfilling in a Subtitle D facility for this region. A multitude of factors would affect the calculations. It must be realized that economies of scale play an important role in cost models for landfills, and site suitability makes a tremendous impact on costing analyses. That is, an ideal site would be one that could accommodate large vertical deposits of garbage, while being geographically located so as to minimize transportation and treatment costs.

In South Carolina, as well as the rest of the nation, ideal Subtitle D locations have not been located without significant predevelopment costs. In one county in this state, local officials studied seven different locations, incurring engineering, consultative, and legal fees along the way, before abandoning their efforts.

MSW growth rates have exceeded population growth rates by 4 to 6 % in most regions of the country over the most recent past. When making projections for this study, it is assumed that latent MSW growth rates will continue to surpass population growth rates, but education, source reduction, and recycling programs are expected to impact the real growth rate significantly. The result assumed here is that landfilled MSW will flatline somewhere around 1997 and hold steady into the early part of the next century.

To completely build a 400 acre Subtitle D landfill, or two 200 acre landfills, would be costly. Revenues may have to support periodic expansion efforts. A large portion of the total cost (20-year capitalization) will have to be borne upfront, based on the nature of engineering and construction of the facility. Construction and operation of Subtitle D landfills are heavily dependent on economies of scale; hydrogeologic investigations, legal fees, liners, boundary buffers, monitoring wells, slopes, equipment, administrative costs, and permitting costs are just some of the examples of savings associated with larger landfills.

Transportation costs are evaluated elsewhere in this report; however, it is consistent throughout this report that recycling and reduction are intended to reduce the amounts of landfilled MSW. Accordingly, transportation costs will receive less attention when determining overall costs, in proportion to the reduction of MSW going to the landfill(s).

Any Subtitle D landfills that are constructed in this area

should be able to handle the MSW coming out of the two MRFs. Presumably, the MRFs and the landfills should be sited so as to service the two largest urban areas in the region: Orangeburg and Aiken/ North Augusta. It is not necessary that these landfills be operated by governmental entities. Private options are available which might provide a better economy of scale. In a Subtitle D landfill, the three most important factors are 1) size of the MSW stream; 2) incremental costs of landfilling as impacted by design and operational criteria; and 3) transportation/ collection costs.

If one Subtitle D landfill is to be constructed in this region, then it should be sited in the area around the boundary intersection of Orangeburg, Aiken, and Barnwell Counties. If two or more Subtitle D landfills are constructed, they should be located in the Orangeburg and Aiken/ North Augusta areas.

The preceding example is given as a "ballpark" estimate for determining landfill costs. The following cost analyses are presented as a guideline for assessing more specific Subtitle D landfill costs:

#### PRE-DEVELOPMENT COSTS

#### EXAMPLE

Siting the facility (engineering, legal fees & preliminary geotechnical investigations)	\$ 250,000
Hydrogeologic investigations	500,000
Site mapping (topographic/boundary surveys) & final geotechnical investigation	100,000
Engineering design & regulatory permit application	200,000
Legal & public hearings	50,000
Land purchase and/or brokerage fees (400 acres)	400,000
Regulatory permitting fees	5,000
Administrative support services	50,000
Unanticipated costs	<u>50,000</u>
<b>TOTAL PRE-DEVELOPMENT COST</b>	\$ 1,605,000
(a) Multiply by 3 for failed sites	\$ 4,815,000

## INITIAL CONSTRUCTION COSTS

For pricing purposes, it was assumed that the entire landfill was excavated, lined, and otherwise constructed at one time. In reality, construction would likely proceed in phases, but these phases have to be carefully planned in order to avoid losses otherwise afforded through economies of scale. Total capital costs are amortized over twenty years.

### EXAMPLE

Entrance & access roads	\$ 300,000
General site excavation & land clearing (307 ac. @ \$1/cu.yd. @30')	14,858,800
Erosion & sediment control facilities	450,000
Liners & liner cushion system (2 liners @ \$.60/sq.ft. ea.)	16,047,500
Leachate treatment system	300,000
Sand for drainage	1,000,000
Landfill Gas Monitor wells	40,000
Groundwater Monitor wells	250,000
Stormwater controls	30,000
Site landscaping	50,000
Weighing scales & scale system	60,000
Scalehouse & office building	30,000
Equipment maintenance facility	100,000
Public convenience area	30,000
Miscellaneous site paving (including lighting, gates, signs, etc.)	40,000
Construction engineering & quality control testing	50,000
Subtotal	<u>\$33,685,500</u>
Contingency	<u>3,368,500</u>
<b>(b) TOTAL INITIAL CONSTRUCTION COST</b>	<b><u>\$37,054,000</u></b>

**ANNUAL OPERATIONAL COSTS****EXAMPLE**

Site personnel & management	\$ 375,000
Facility overhead (including building & grounds, site maintenance, electric, phone, etc.)	50,000
Equipment operations & maintenance	75,000
Equipment financing	220,000
Road maintenance	25,000
Routine environmental monitoring (ground water, surface water & landfill gas)	50,000
Engineering services	40,000
Site & equipment insurance/closure bonding	50,000
On-going development & construction costs	\$ 150,000
Leachate treatment at a municipal sewer system	10,000
Pre-treatment of leachate prior to disposal into municipal sewer system	50,000
Unanticipated costs	<u>50,000</u>

**(c) ANNUAL OPERATIONAL COSTS**      \$ 1,145,000  
TOTAL FOR TWENTY YEARS      \$ 22,900,000



## **CLOSURE AND POST CLOSURE COSTS**

This model assumes the final cap on the landfill is part of the on-going development cost while the landfill is operating. The annual amount should be set aside during the operational years of the landfill because closure costs will be incurred for years after the facility is closed and tipping fees have ceased.

Costs include the following:

Engineering fees for preparation of a closure plan  
Regulatory approvals of the closure plan  
Final site grading & re-vegetation  
Maintenance of erosion & sediment control facilities  
Maintenance of landfill gas system  
Operation & maintenance of leachate collection and treatment system  
Leachate treatment of offsite treatment plant

(d) **ANNUAL SET-ASIDE FOR CLOSURE/POST CLOSURE COSTS** \$ 50,000

## **ANNUAL COSTS**

### **EXAMPLE**

(e) Capital costs (a + b)	\$ 41,869,000
(f) Amortization of capital costs - straight line depreciation over 20 years at 8%	4,202,509
(g) Annual operating cost (c)	1,145,000
(h) Annualized closure & post- closure costs (d)	50,000
(i) Total annual cost (f + g + h)	5,397,509
(j) Annual tons per year (833.33 tons/day x 6 days/week x 52 weeks/year)	260,000
(k) Cost per ton (i/j)	20.76/ton
(l) Transportation/ collections	10.00/ton
(m) Host community fee for capital improvements	
(n) State or local assessment fee	
<b>TOTAL TIPPING FEE</b>	
(k + l + m + n)	\$ 30.76/ton
(o) Annual cost (260,000 @ 30.76)	\$ 7,997,600
(p) Population - 341,753*	
(q) Cost per person (o/p)	\$ 23.40

## 7) Waste-to-Energy (WTE) Plants

<u>Area</u>	<u>Location</u>
Aiken	SRS
Aiken	Urquhart Generating Station, Beech Island
Orangeburg	SCE&G, Cope

Waste-to-Energy plants are plants which use waste materials to produce energy. Forms of energy normally produced from MSW include steam and electricity. WTE plants which produce ethanol (motor fuel) and methane gas (boiler fuel) are presently in the development stages.

This study is not recommending that the region construct Waste-to-Energy Plants. Alternatively, it is recommended that the MRF's produce a refuse-derived fuel (RDF) that could be sold as a boiler fuel in existing locations. Applications would include any large coal or wood-fired boilers.

The S.C. Solid Waste Policy and Management Act restricts the utilization of MSW Incineration. The Act prohibits the permitting of any incinerator with a daily capacity of over 600 tons. Any incinerators with daily capacities over 100 tons cannot be located within three miles of each other. There is presently a moratorium on new incineration facilities, due to expire in January, 1994.

Westinghouse Savannah River Company (WSRC), South Carolina Electric and Gas Company (SCE&G), and others have expressed a willingness to evaluate RDF in some of their boiler operations.

The primary environmental concerns surrounding MSW incineration have been the control of air and ash emissions. Under the Clean Air Act, air emission standards for MSW incinerators are far more stringent than for industrial boilers of like capacities. EPA requirements restrict ash disposal to single-lined monofills or double-lined codisposal landfills.

The regulatory requirements for siting, design, construction, and operations of MSW incinerators tend to greatly increase costs associated with such facilities. The costs for transporting typical MSW make siting these facilities in rural areas less attractive than siting in urban areas.

The attractiveness of MSW incineration remains due to the ability to optimize landfill space (due to decreased volumes) and generate steam and/or electricity. The South Carolina Public Service Commission released a report to the Governor and General Assembly which encourages the development of Waste-to-Energy facilities. According to the report, "as landfilling is the most expensive and least desirable method of waste disposal, incineration emerges as the most viable option for the largest portion of solid waste."

The Public Service Commission report also encourages the General Assembly to immediately lift the moratorium on new incineration facilities. The report states that environmental concerns over WTE operations are largely unfounded today because "newly constructed waste-to-energy facilities are smaller, clean, efficient, odor-free, and safe."

This study has investigated the two major combustion technologies, mass burn and refuse-derived fuel (RDF) systems. Mass burn systems are engineered for total waste stream requirements, and RDF systems are designed to handle only a portion of the MSW stream that has been specially prepared for boiler fuel. BTU values in the total MSW stream could be expected to be around 4000 BTUs per pound as opposed to 8500 BTUs per pound of RDF. While moisture is relatively high in either material, the variation in consistency of moisture is of greater concern in the mass burn applications. Mass burn units must also deal with the inconsistency in types of material, i.e., glass, metal, and other non-burnables. Therefore, engineering, design, and operations are more complex and costly for mass burn units.

Some mass burn systems use imbedded water tubes in the furnace walls to generate steam; others have fire boxes which are attached to boilers. The first system is often called "water wall", and the latter is called "modular." Generally, the total MSW stream is dumped into storage pits, or tipping floors, where a crane lifts the material and feeds it into the combustion chamber. The steam that is generated can be used in heating applications or for

electricity generation.

The Public Utility Regulatory Policy Act (PURPA) provides for the Public Service Commission to set rates which must be paid to producers of electricity from MSW based on "avoided cost" to the purchasing utility. The complex formulas used for determining rates result in varying figures throughout the state, but South Carolina rates are generally in the range of \$.04 per KW. Direct use of MSW-generated electricity may result in greater revenues or cost savings.

Capital costs associated with mass burn MSW incinerators are very high. In the region covered by this study, 450 tons of MSW daily could produce approximately 25 megawatts of electricity. Using a rule-of-thumb number, \$ 100,000 per ton per day, the capital cost for such a facility would be around \$ 45,000,000. At an avoided cost of \$.04 per KW, 25 megawatts would generate only \$ 1000 per day in revenues. The WTE plant would have to supplement its revenues by charging tipping fees to the suppliers of MSW.

For a 450 ton per day WTE plant, as described above, the amortization costs for capital would amount to \$ 18,000 per day (8% APR for 10 years). Tipping fee for capital repayment alone would have to be \$ 40 per ton. Once transportation and operating costs are added in, the total tipping fee would be in excess of \$ 60 per ton. Added to that will be the cost of burying the residual ash.

Because of the large capital costs, operational, and transportation costs, mass burn incineration does not seem to offer the flexibility needed in this region.

A WTE technology that is gaining recognition and acceptance is the burning of refuse-derived fuel (RDF). The RDF is generated in Materials Recovery Facilities (MRFs), and is a segregated form of MSW. Machines used at the Materials Recovery Facility (MRF) sort and shred burnable waste into a boiler fuel which can be mixed in with coal or wood feedstock for boilers. Little, if any, special handling or retrofit is necessary at the boiler houses, particularly if the RDF has been pelletized. Also, in most cases, the RDF is not classified as MSW after it has been pelletized, so the same ash and air emissions standards that apply to mass burn plants do not apply to RDF plants.

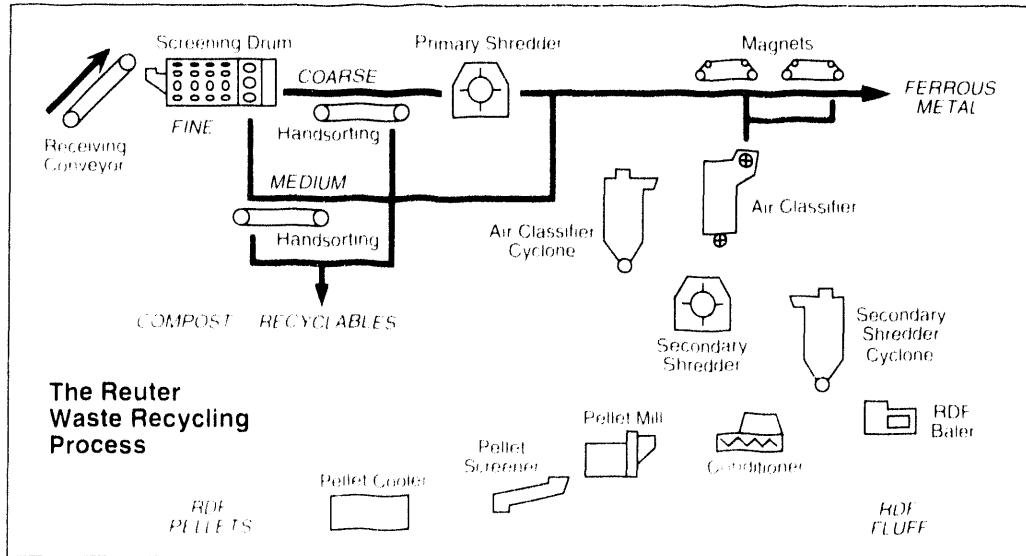
In this study, the manufacture of refuse-derived fuel (RDF) is the WTE option that is recommended. This option is recommended in conjunction with the construction of Materials Recovery Facilities. The RDF, in essence, would be another recycled product for which markets would determine revenues. In the proforma used in this study, it is assumed that only 5% of the total MSW would be

converted into RDF, with revenues projected to be \$ 10 per ton. The conversion rate used here is far below numbers used by MRF vendors, who claim conversion rates as high as 90%. The conservative figures used in this report, however, are intended to reflect the poor market for recyclables in general as of this writing. Also, there is an allowance for poor recovery efficiencies at the MRF despite assurances from MRF manufacturers. The option of selling RDF as a "fluff" rather than a pellet may be preferred, depending on markets and operations costs.

It is the contention of the authors of this report that MRF-derived RDF could provide a very valuable source of revenues as well as being a highly useful tool for MSW management. The recommendation with regard to all MSW management principles delineated in this report is to build as much flexibility as possible into the system so that positive experiences can be capitalized on, and negative experiences can be eliminated with minimum effects.

Under a different set of circumstances, a mass burn WTE plant in this region could be an attractive waste disposal tool. In Europe and the Far East, because of population density and public acceptance, WTE plants are prominently used for waste treatment. The uncertainties surrounding the mass burn option make its use here unattractive at this time.

#### WASTE-TO-ENERGY FACILITY SCHEMATIC



## **TOTAL SYSTEM COSTS**

A preliminary cost estimate for the total system follows. Projections are made for two years, assuming total completion of the system during that time. This assumption, though probably not realistic, allows for conservative financial estimates. No revenues are shown for composting and sale of recyclables, which should begin to provide positive revenues in the first year or two.

### **1) Pre-Development Costs**

Engineering	\$ 250,000
Planning/ Administration	200,000
Underwriting	400,000
Legal/ Public hearings	150,000
Permitting	250,000
Land purchases	400,000
Landfills (one site investigation)	<u>2,000,000</u>
	<u>3,650,000</u>

### **2) Initial Construction Costs**

Rural Collection Sites (10 @ \$10K)	\$ 100,000
Drop-off sites (13 @ \$ 60K)	650,000
Composting facilities (8 @ \$100K)	800,000
Inert landfills (10 @ \$ 50K )	500,000
Transfer Stations (1100 tons)	1,100,000
MRFs (2 @ \$ 1.5mm each)	3,000,000
Subtitle D (amortized)	<u>4,202,509</u>
Subtotal	<u>\$10,402,509</u>

### **3) Rolling stock Costs**

Composting Equipment	440,000
Transportation and Heavy Equipment	<u>2,500,000</u>
Subtotal	<u>\$2,940,000</u>

4) Operations Costs

Personnel ( 50 @ \$25K ea.)	2,500,000
Overhead	300,000
Equipment Maintenance	300,000
Environmental Monitoring	150,000
Fuel (1,600,000 miles)	<u>800,000</u>
Subtotal	\$6,540,000
	13,080,000
<b>Total Two-Year Start-Up Costs</b>	<b>\$30,072,509</b>
Costs per person (341,753*)	\$ 87.99
Costs per person / year	\$ 44.00

The above estimates are not presented in a spreadsheet form, and it should be noted that many variables will affect actual expenditures. Also, no revenues are shown for MRFs and composting facilities for the two-year start-up period.



## MANAGEMENT STRUCTURE AND RECOMMENDATIONS

The results of this study make clear that there are very substantial benefits, both from an economic and an efficiency standpoint, from regionalization. Thus, a portion of the funding for the study was devoted to evaluating various management systems for implementing a regional approach.

It is the recommendation of the authors of this study that the counties utilize the provisions of an existing state statute which authorizes the formation of a "joint agency" to manage municipal solid waste systems. Enacted in 1980, the Solid Waste Disposal Resource Recovery Facilities Act, S.C. Code Ann. §§ 6-16-10 et seq., was patterned after the Joint Municipal Electric Power and Energy Act, S.C. Code Ann. §§ 6-23-10 et seq., which authorizes the creation of a joint agency to provide for the ownership and operation of electric generation and transmission facilities. Pursuant to this statute, enacted in 1978, ten up-state municipalities formed the Piedmont Municipal Power Agency (PMPA) which presently owns an undivided interest in the Catawba Nuclear Station located in York County.

Both of these laws are the statutory implementation of the Constitutional authorization to jointly perform certain governmental functions. Article VIII, Section 13(A) of the South Carolina Constitution specifically provides that "[a]ny county, incorporated municipality, or other political subdivision may agree with the State or with any other political subdivision for the joint administration of any function and exercise of powers and the sharing of costs thereof."

The Solid Waste Disposal Resource Recovery Facilities Act authorizes two or more "governing bodies," which includes any political subdivision responsible for disposal of solid waste, to undertake a solid waste project. A project is broadly defined and includes collection, transfer, or disposal of solid wastes and the recovery, processing, or sale of recovered materials.

A solid waste joint agency may be formed by two or more governing bodies which adopt a resolution or enact an ordinance (counties should enact ordinances) determining that it is in their best interests to form a joint agency. The ordinance must contain one or more of the following findings: (i) that the joint agency may be able to finance the project in a more efficient and economical manner, (ii) that a better financial market acceptance for bonds may result, or (iii) that fiscal savings and other advantages may be obtained. The governing bodies must then notice the enactment of the ordinance for two consecutive weeks in a newspaper of general circulation within the county. If no objection is filed within 20 days of the last notice, the governing

bodies each appoint one representative to serve as a member of the Board of Directors of the proposed joint agency. Two or more representatives may then file an application with the Secretary of State to form the joint agency. Once the Secretary of State determines that the application meets statutory requirements, he will issue a corporate certificate and the joint agency is officially formed.

A county may withdraw at any time upon the enactment of an ordinance by its council. If, however, the joint agency has issued any bonds prior to the county's withdrawal, the county may still withdraw, but it remains obligated to pay its pro rata share of the debt incurred. Other counties may join at a later date by enacting the required ordinance and submitting an application to the joint agency. The application must then be approved by the county council of each member county. The Secretary of State must be notified of any changes.

The joint agency would be run by a board of directors. The county council of each member county would appoint one representative to serve as a director. Each director serves at the pleasure of the appointing body and thus may be removed from office at any time for any reason. (The chart at the end of this section demonstrates the structure of the proposed joint agency). The directors may not be compensated, but they may be paid a per diem and compensated for actual expenses. Each director has no less than one vote, but may be given additional votes if a majority of the joint agency approves an alternative voting plan. Action may be taken by resolution approved by a majority of the board, with a quorum present. A quorum is a majority of all directors. The board must annually elect a chairman and vice chairman (who must be board members) and other officers (who need not be board directors).

A joint agency has very broad powers relating to solid waste projects. It has a number of powers listed specifically in the statute, as well as "all rights and powers necessary or convenient to carry out and effectuate" its responsibilities under the statute. Some of the more significant of the twenty listed powers include the power to issue bonds; the power to charge fees for solid waste disposal and other services; the power to own and operate landfills or similar facilities; the power to enter into contracts with persons, firms, corporations, and others; the power to apply for permits and licenses; the power to hire engineers, attorneys, financial advisers, and other consultants; and the power of eminent domain.

With regard to the issuance of revenue bonds, an important protection included in the statute is a provision stating that the joint agency may not issue bonds without the specific approval of the county council of each member county. It is also important to

note that these bonds are revenue bonds, not general obligations bonds. Moreover they are issued by the joint agency itself, not the member counties. Thus, they do not count against the general obligation debt level of the member counties.

If the joint agency decides -- with approval by the member counties -- that it wants to issue bonds to finance a particular solid waste project, it must conduct a feasibility study to determine whether the project is financially viable and whether it will produce a revenue stream sufficient to pay the bond holders. If the feasibility study is positive, the joint agency will negotiate contracts between the joint agency and the member counties to purchase the services provided by the proposed project. The joint agency also negotiates contracts between the joint agency and vendors who will design, construct, and possibly operate the necessary facilities. Once the necessary contracts are in place and have been approved by the member counties, the joint agency, again with approval of the member counties, will issue the bonds. An underwriter will then market the bonds. Upon receipt of the proceeds of the bond sales, the joint agency will construct and operate the necessary facilities to carry out the project. When the member counties receive the solid waste management services provided by the project, they will pay the joint agency pursuant to the contracts they entered into with the agency. The joint agency then uses the contract proceeds to pay operating expenses and to pay principal and interest on the bonds. This cycle continues until the project is completed and the bond holders are paid in full. (The flowchart at the end of this section demonstrates how this process would work).

There are a number of benefits of forming a joint agency, including financial benefits and a greater ability to comply with new state and federal solid waste management requirements. The most significant financial benefit is the substantial economies of scale that will result from having regional facilities, rather than individual county facilities. As this study demonstrates, the cost of providing solid waste management services, particularly construction and operation of landfills, has increased dramatically as a result of recent federal regulatory changes and state law. Regionalization is the best way to meet the increasing cost of providing solid waste services in a manner that complies with current requirements. Another financial benefit is the enhanced ability of regions to obtain grant funds. DHEC has a program to award grants from the Solid Waste Management Trust Fund which is funded by fees imposed by the new state Solid Waste Act. DHEC is directed by the Act to encourage regionalization, and one of the best ways to do that is to provide financial assistance to regions.

In addition to financial benefits, forming a joint agency to provide services on a regional basis will make it easier to comply

with the new requirements. The State Act, for example, establishes a 25% recycling goal and a 30% waste reduction goal to be met by 1997. If a region is formed, these goals will be measured on a regional basis. The inclusion of as many urban areas as possible will make achieving the goals much easier. Also, instead of each county filing its own comprehensive, twenty-year local plan, the joint agency can file one plan for the entire region. Other statutory requirements, such as public education programs, operator training, and waste tire management, can also be more efficiently and effectively handled on a regional basis.

Finally, the joint agency may decide not to own and operate its own facilities but to contract with one or more private vendors. In that situation, a joint agency would still be beneficial in that it will enhance the bargaining capability of each member county. Aside from the larger waste volumes involved, the joint agency will have the time and expertise to carefully evaluate each vendor's offer and to negotiate the best contractual arrangement for its member counties.



## COUNTY-SPECIFIC FINANCIAL CONSIDERATIONS

The following pages are used to illustrate the effect on the separate entities financially should they decide to proceed with similar MSW management plans on their own. When studying the financial analyses that follow, it should be kept in mind that the same cost model was used for each county, as well as for the region as a whole. In reality, none of the counties could afford to build such a modern and complete MSW management system on its own. If any of the counties was forced to build its own system, expenditures would be lower than shown here, but the level of services would also be lower.

Additionally, although each county will benefit substantially from regionalization, Aiken County shows the least amount of economic incentive from the following calculations. Compared to the regional approach, Aiken County saves "only" around \$2,000,000 per year, or \$15.00 per person. Much of the activities surrounding the waste management plan, however, will be centered in Aiken County, with a resulting economic impact of much significance.

"Costs per person" should not be interpreted as suggesting that individuals will have to pay these amounts. As in the past, actual costs will be covered through various mechanisms, included but not limited to taxes, penalties, user fees, and special industrial charges. See pages 66 - 67 for a more detailed breakdown of items included in the cost analysis for total systems.

Items included in landfill cost analyses are delineated on pages 58 - 62. "Annual Operating Costs" for landfills include amortized costs of rolling stock. Additional "Rolling Stock" costs, as calculated for the Total System, assume that the additional items required for recycling and composting will be expensed in the year purchased.

It should be kept in mind that, as the region progresses in the areas of recycling and source reduction, the amount of landfilled materials will be reduced. Even if population growth rates continue as projected, a comprehensive solid waste management plan will result in smaller amounts of landfilled waste.

The assumption used in the following calculations is that counties will be landfilling only 75% of present levels of MSW. As pointed out repeatedly in this report, the smaller level of solid waste that is buried results in a higher cost per ton at the landfill. When analyzing costs, this is an important fact to bear in mind. For instance, quotes from private companies that only offer landfill services will have to be analyzed relative to the financial impact on the entire management system.

**AIKEN COUNTY**

1) Landfill Costs

A.	Pre-development Costs / year	\$ 802,500
B.	Construction Costs (amortized)	2,257,254
C.	Annual Operating Costs	1,145,000
D.	Annual Set-Aside	<u>50,000</u>
E.	Annual Costs	4,254,754
1.	Annual Tons	110,413
2.	Cost per ton	38.54 / ton
3.	Transportation/Collections	6.00 / ton
4.	Tipping Fee	44.54 / ton
5.	Cost per person (122,800)	34.65

2) Total System Costs Annually

A.	Pre-Development Costs	\$ 1,752,000
B.	Amortized Construction Costs	2,885,000
C.	Rolling Stock	1,000,000
D.	Operations Costs	<u>1,745,000</u>
E.	Total System Start-up	7,382,000
F.	Costs per person (122,800)	60.11
G.	System Cost without landfill	3,127,246
H.	Cost of recycling, composting, etc., per person	25.47
I.	Total System Cost per ton (147,217)	50.14

**ALLENDALE COUNTY**

1) Landfill Costs

A.	Pre-development Costs / year	\$ 250,000
B.	Construction Costs (amortized)	332,175
C.	Annual Operating Costs	125,000
D.	Annual Set-Aside	<u>50,000</u>
E.	Annual Costs	757,175
1.	Annual Tons	6,058
2.	Cost per ton	124.99 / ton
3.	Transportation/Collections	6.00 / ton
4.	Tipping Fee	130.99 / ton
5.	Cost per person (11,600)	65.27

2) Total System Costs Annually

A.	Pre-Development Costs	\$ 475,000
B.	Amortized Construction Costs	447,122
C.	Rolling Stock	500,000
D.	Operations Costs	<u>660,000</u>
E.	Total System Start-up	2,082,122
F.	Costs per person (11,600)	179.49
G.	System Cost without landfill	1,324,947
H.	Cost of recycling, composting, etc. per person	\$ 114.22
I.	Total System cost per ton (8,094)	257.24

**BAMBERG COUNTY**

1) Landfill Costs

A.	Pre-development Costs / year	\$ 250,000
B.	Construction Costs (amortized)	442,895
C.	Annual Operating Costs	175,500
D.	Annual Set-Aside	<u>50,000</u>
E.	Annual Costs	918,395
1.	Annual Tons	10,870
2.	Cost per ton	84.49 / ton
3.	Transportation/Collections	6.00 / ton
4.	Tipping Fee	90.49 / ton
5.	Cost per person (16,902)	54.34

2) Total System Costs Annually

A.	Pre-Development Costs	\$ 525,000
B.	Amortized Construction Costs	490,095
C.	Rolling Stock	740,000
D.	Operations Costs	<u>660,000</u>
E.	Total System Start-up	2,415,095
F.	Costs per person (16,902)	142.91
G.	System Cost without landfill	1,496,700
H.	Cost of recycling, composting, etc. per person	\$ 88.56
I.	Total System cost per ton (14,493)	166.64

**BARNWELL COUNTY**

1)	Landfill Costs	
A.	Pre-development Costs / year	\$ 250,000
B.	Construction Costs (amortized)	442,895
C.	Annual Operating Costs	175,500
D.	Annual Set-Aside	<u>50,000</u>
E.	Annual Costs	918,395
1.	Annual Tons	11,644
2.	Cost per ton	78.87 / ton
3.	Transportation/Collections	6.00 / ton
4.	Tipping Fee	84.87 / ton
5.	Cost per person (22,500)	40.82
2)	Total System Costs Annually	
A.	Pre-Development Costs	\$ 525,000
B.	Amortized Construction Costs	490,095
C.	Rolling Stock	740,000
D.	Operations Costs	<u>660,000</u>
E.	Total System Start-up	2,415,095
F.	Costs per person (22,500)	107.34
G.	System Cost without landfill	1,496,700
H.	Cost of recycling, composting, etc. per person	\$ 66.52
I.	Total System cost per ton (15,525)	156.56

**CALHOUN COUNTY**

1)	Landfill Costs	
A.	Pre-development Costs / year	\$ 250,000
B.	Construction Costs (amortized)	442,895
C.	Annual Operating Costs	175,500
D.	Annual Set-Aside	<u>50,000</u>
E.	Annual Costs	918,395
1.	Annual Tons	7,917
2.	Cost per ton	116.00 / ton
3.	Transportation/Collections	6.00 / ton
4.	Tipping Fee	122.00 / ton
5.	Cost per person (12,753)	72.01
2)	Total System Costs Annually	
A.	Pre-Development Costs	\$ 525,000
B.	Amortized Construction Costs	447,122
C.	Rolling Stock	740,000
D.	Operations Costs	<u>660,000</u>
E.	Total System Start-up	2,402,122
F.	Costs per person (12,753)	188.36
G.	System Cost without landfill	1,483,727
H.	Cost of recycling, composting, etc. per person	\$ 116.34
I.	Total System cost per ton (10,556)	227.56

**ORANGEBURG COUNTY**

1) Landfill Costs

A.	Pre-development Costs / year	\$ 750,000
B.	Construction Costs (amortized)	1,317,952
C.	Annual Operating Costs	945,000
D.	Annual Set-Aside	<u>50,000</u>
E.	Annual Costs	3,062,952
1.	Annual Tons	55,146
2.	Cost per ton	55.54 / ton
3.	Transportation/Collections	6.00 / ton
4.	Tipping Fee	61.54 / ton
5.	Cost per person (84,803)	36.12

2) Total System Costs Annually

A.	Pre-Development Costs	\$ 2,055,000
B.	Amortized Construction Costs	1,571,393
C.	Rolling Stock	900,000
D.	Operations Costs	<u>1,545,000</u>
E.	Total System Start-up	6,071,393
F.	Costs per person (84,803)	74.22
G.	System Cost without landfill	3,008,441
H.	Cost of recycling, composting, etc. per person	\$ 36.78
I.	Total System cost per ton (73,528)	82.57

**EDGEFIELD / MCCORMICK / SALUDA COUNTIES**

1)	Landfill Costs	
A.	Pre-development Costs / year	\$ 500,000
B.	Construction Costs (amortized)	653,366
C.	Annual Operating Costs	315,000
D.	Annual Set-Aside	<u>50,000</u>
E.	Annual Costs	1,518,366
	1. Annual Tons	21,222
	2. Cost per ton	71.55 / ton
	3. Transportation/Collections	6.00 / ton
	4. Tipping Fee	77.55 / ton
	5. Cost per person (43,600)	34.82
2)	Total System Costs Annually	
A.	Pre-Development Costs	\$ 1,000,000
B.	Amortized Construction Costs	723,627
C.	Rolling Stock	740,000
D.	Operations Costs	<u>1,095,000</u>
E.	Total System Start-up	3,558,627
F.	Costs per person (43,600)	81.62
G.	System Cost without landfill	2,040,261
H.	Cost of recycling, composting, etc. per person	\$ 46.79
I.	Total System cost per ton (28,296)	125.76

**WESTINGHOUSE SAVANNAH RIVER SITE**

1) Landfill Costs

A.	Pre-development Costs / year	\$ 1,755,000
B.	Construction Costs (amortized)	482,540
C.	Annual Operating Costs	705,000
D.	Annual Set-Aside	<u>50,000</u>
E.	Annual Costs	2,992,540
1.	Annual Tons	7,507
2.	Cost per ton	398.63 / ton
3.	Transportation/Collections	6.00 / ton
4.	Tipping Fee	404.63 / ton
5.	Cost per person (24,000)	124.69

2) Total System Costs Annually

A.	Pre-Development Costs	\$ 2,355,000
B.	Amortized Construction Costs	527,708
C.	Rolling Stock	1,440,000
D.	Operations Costs	<u>911,000</u>
E.	Total System Start-up	5,233,708
F.	Costs per person (24,000)	218.07
G.	System Cost without landfill	2,241,168
H.	Cost of recycling, composting, etc. per person	93.38
I.	Total System cost per ton (10,009)	522.90

## TRANSITION CONCERNs

Participating counties must first agree to form a joint agency as described in the section titled "Management Recommendations," and the counties should each name a representative to the Agency Board of Directors. The joint agency must form its bylaws and procurement policies.

The agency should make contractual arrangements for management and consultative services to help its Board provide initial services necessary until such time as a full-time staff can be hired. A Regional Solid Waste Advisory Council should be formed as required under the state law. A Technical Advisory Council should also be established, with representatives from industry, government, and academia.

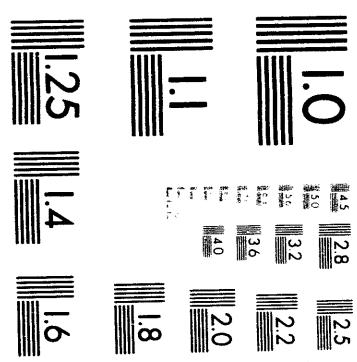
The joint agency should establish a standard cost accounting methodology, consistent with DHEC guidelines, which will then be used to appraise the various waste handling capabilities of the participating counties. An inventory of equipment, personnel, and facilities within the region should be made, and talks should begin with all governing entities in the region which will be impacted by the joint agency's decisions.

The joint agency should adopt a long-range and a one-year Waste Management Plan. Using standard cost accounting methods, the agency should develop the budget, coordinating projected expenditures and goals with those of the individual counties. Developments in waste management for the region should be coordinated so that there is minimum duplication, with all local governments working simultaneously toward common goals.

It is anticipated that no construction of facilities will begin in the first year. Infrastructure development and coordination should receive primary consideration. Staff and consultants should continue to monitor and have input into legislative and regulatory developments. Public education programs should be initiated and networks established to insure the continuance of these programs through schools, churches, public broadcasting companies, and others.

The joint agency should contract with the Lower Savannah Council of Governments to provide administrative and housing needs for the Agency in the first year. The LSCOG should continue to work with the joint agency to insure the smooth transition of information and responsibility.

The joint agency should analyze the practical considerations involved with moving away from existing waste disposal facilities operating in the region. If vertical expansion of sanitary landfills in the region is deemed to be feasible, the agency should incorporate the use of those landfills into its management plan. Provisions for burial of other wastes generated in the region should be accomplished through a contract with a private company.



2 of 2

A Request for Qualifications or, alternatively, a Request for Proposals should be designed, and a contract for services should be let for a minimum of three years.

The agency should explore the options of public versus private management for all aspects of its plan. This report should serve as an important resource tool when making decisions, but this report contains no specific engineering data with regard to the individual components of the total plan. The Board is encouraged to have analyses made in each specific area before determining best options.

Treatment of yard wastes is one of the first areas that needs to be addressed. Beginning May, 1993, yard wastes can no longer be buried in municipal landfills. The region needs to pursue grant applications for assistance with funding of equipment that can be used for grinding. Composting, mulching, and burial options need to be explored. The practicality of converting present sanitary landfills into inert sites should be studied. A regional plan for treatment of yard wastes should be implemented as soon as is practical.

The region should work actively with the S.C. Department of Health and Environmental Control, the United States Department of Energy, and the Governor's Office, to pursue available grants for MSW management and treatment systems.



## GLOSSARY

**Baler** - A machine used to compress materials into bundles. Baling reduces volumes and is useful in transportation or landfilling applications. Baling is most often applicable to recyclables, such as paper, plastic, aluminum, and cardboard.

**Biodegradable material** - Organic wastes which can be broken down by microorganisms through bacterial activity.

**Broker** - an agent between sellers and buyers of recyclables.

**BTU** - (British Thermal Unit), the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit. Often used as a measure to compare heating values of different materials, such as coal to wood, etc. When comparing different fuels, other factors such as moisture or toxic byproducts, should be considered.

**Buffer Zone** - Neutral area required around many solid waste handling facilities, which segregates these facilities from surrounding land uses. The buffer zone is intended to minimize the impact of the facility on its neighbors.

**Composting** - The decomposition of biodegradable material (such as yardwastes, brush, and food wastes) through aerobic and thermophilic action to produce a humus.

**Commercial Wastes** - Wastes generated by commercial establishments, such as retail or office industries.

**Commingled Recyclables** - the practice of collecting all recyclables in single containers for further separation at a later time and/or place.

**Construction and Demolition (C&D) Debris** - Waste material generated by the construction industry in the course of building, remodeling, or destroying buildings, bridges, roads, and other structures. Some materials used in buildings, such as asbestos, are not treated as C&D debris, but are called "Special Wastes."

**Convenience Center** - (also called a Drop-off Site in this report) - A site where citizens can bring household wastes for further handling and transport. Recyclables are generally presorted through the use of separate bins, and non-recyclables are put into a compactor for transport to a landfill. These sites are staffed by personnel who assist the public with separation of their MSW and also aid in education and dissemination of information. The sites are permitted through DHEC and must conform to certain regulations regarding their construction and operation.

**Curbside programs** - Collection system where household MSW is picked up in neighborhoods where individuals place their wastes at the curb, often in specially marked containers. Trained personnel keep the recyclables separated, either through the use of separate collection routes or through the use of special compartmentalized trucks.

**Diversion Rate** - The rate at which previously landfilled materials are diverted to other avenues through recycling, source reduction, incineration, or other means.

**Drop-Off Center** - see Convenience Center

**Flow Control** - a means through which waste is directed by law to go to a particular treatment and /or disposal facility.

**Garbage** - Food and associated wastes discarded by restaurants, hotels, hospitals, open markets, and similar institutions. It is also called wet or wet food waste. Its only possible recyclable use would be as a compost material.

**Ground Water** - Water that flows beneath the earth's surface, generally considered to feed into aquifers (underground pockets of water).

**Hazardous Waste** - Waste material that is deemed to pose a potential threat to health or the environment. This waste is regulated under Subtitle C of the Resource Conservation and Recovery Act (RCRA).

**Humus** - Organic materials resulting from the decomposition of plant matter. Also referred to as compost.

**Hydrogeology** - the study of surface and subsurface water.

**Incineration** - the controlled burning of waste materials, often used to generate energy in the form of steam.

**Industrial Wastes** - MSW generated through manufacturing processes, factories, processing plants, and similar industries.

**Inert Landfill** - A disposal landfill for materials such as yardwastes and construction and demolition debris not subject to Subtitle D landfilling regulations.

**Integrated Solid Waste** - the integration of the various components of solid waste management into an overall system in order to optimize available resources. The management of the larger system is usually managed by one body which can coordinate the individual components, such as source reduction, recycling, transportation, incineration, public education, composting, special waste handling, and litter control.

**Leachate** - Liquid which has percolated through wastes. This liquid will be collected, monitored, and treated in Subtitle D landfills due to the potential for collecting hazardous materials from the waste.

**Liner** - As it applies to landfills, either a layer of low-permeability soil (clay) or synthetic material (e.g. high density polyethylene), or a combination of both.

**Manual separation** - the separation of recyclable materials through hand sorting, generally by individuals working on conveyor lines.

**Mass Burn** - the incineration of MSW without prior sorting or processing.

**Mass-collected MSW** - MSW that has been collected without any separation of recyclables.

**Materials Recovery Facility (MRF)** - A facility for separating and processing recyclables for sales to a processor. MRFs can be designed as any combination of the following: Manual separation; Mechanical separation; Separation of Mass- collected MSW; or Separation of commingled recyclables.

**Mechanical Separation** - The separation of wastes at Materials Recovery Facilities (MRFs) through the use of mechanical means, such as magnets, air classifiers, screens, shredders, balers, densifiers, grinders, crushers, and pelletizers.

**Methane** - An odorless, colorless, gas produced by decomposition of organic materials. Methane is emitted from landfills and must be monitored, preferably used to produce energy.

**Mixed Waste** - Traditionally refers to a mixture of hazardous and non-hazardous wastes, subject to two or more regulatory jurisdictions, with the more stringent applied. Today, the term is being used by some people in the non-hazardous waste field to mean the same as "Mass-collected MSW".

**Mulch** - Ground or chipped organic materials used to prevent evaporation of moisture around plants. Mulch is not made from decayed material and is not to be confused with compost.

**Municipal Solid Waste** - Non-hazardous wastes generated in households, commercial and business establishments, institutions, some industrial processes, and some sludges. In practice, definitions vary and traditionally mean the materials that can be accepted in a municipal landfill. MSW is often further categorized into the following terms which are defined in this glossary: Trash, Rubbish, Refuse, and Garbage.

**NIMBY** - acronym for "Not in My Back Yard" usually referring to public opposition to location of a solid waste facility.

**Privatization** - An arrangement where a private, for-profit entity provides a service for which a public entity is otherwise responsible. In MSW management, the term usually refers to private landfills, MRFs, collection systems, etc.

**Recyclables** - Materials that can still be processed into a useful state after they have served their original purpose.

**Refuse** - Combination of rubbish and garbage, this portion of the waste stream is typically household wastes. Moisture content is high and BTU content is low, but a relatively high BTU boiler fuel (see below) can be derived from refuse when processed correctly at a Material Recovery Facility.

**Refuse-Derived Fuel (RDF)** - Combustible portion of MSW that remains after other recyclables have been removed from the waste stream, usually at a Materials Recovery Facility (MRF). This material can often be used to fire industrial boilers and can be utilized in a pellet form or as a fluff.

**Regionalization** - An arrangement where two or more counties or political subdivisions agree to work cooperatively to provide solid waste management for their constituents

**Resource Recovery** - The utilization of materials or energy from the waste stream, often used synonymously with "Energy Recovery."

**Reuse** - The use of a product more than once, such as aluminum foil for cooking, or returnable soft drink bottles.

**Roll-off container** - A large metal container used for MSW collection that can be mechanically loaded and unloaded onto flatbed trucks for transportation.

**Rubbish** - Mixture of combustible waste: paper, cardboard, wood scrap, foliage, floor sweepings, and the like. It has a BTU value of about 6500 BTUs per pound.

**Sanitary landfill** - permitted depository for Municipal Solid Waste (MSW).

**Sludge** - A semi-liquid residue remaining from the treatment of water, sewage, or wastewater.

**Source Reduction** - Reducing the quantity of waste materials that eventually become MSW by changing packaging, manufacturing, or use patterns.

**Source Separation** - Separating recyclables at the point of waste generation, such as curbside separation.

**Special Wastes** - Items that require special handling and should be separated from the rest of the MSW stream. Examples are waste oil, tires, white goods, lead acid batteries, and some sludges.

**Subtitle D** - The section of the federal Resource Recovery Act (RCRA) which regulates solid, non-hazardous wastes.

**Subtitle D Landfill** - The type of landfill that is required for disposal of MSW beginning October 9, 1993. As opposed to Sanitary Landfills of the past, more stringent regulations will apply with regard to location, design, operations, closure, and post-closure care.

**Tipping fee** - A disposal fee, usually stated in dollars per ton or cubic yard. Tipping fees can be set by responsible entities and apply to wastes at Landfills, Transfer Stations, Materials Recovery Facilities, Waste-To-Energy facilities, or any other location receiving solid waste.

**Tipping Floor** - Unloading area for vehicles which are unloading MSW at a disposal or treatment facility.

**Transfer Station** - A site where waste materials are brought in from satellite collection centers and processed in some way so as to make the overall collection and transport system more efficient. In some cases, the recyclables brought in to a Transfer Station may be pre-sorted before being sent to a MRF for further processing, and the nonrecyclables may be compacted and transported by larger trucks, rail, or barges to a landfill.

**Trash** - Common term for MSW, this is also the term used to specifically refer to the dry, most combustible (highest BTU) portion of MSW.

**Tub Grinder** - Grinding machine, generally used for wood and construction debris, which consists of grinding blades located inside a tub. The materials to be ground are placed in the tub where they pass through the grinding apparatus before falling onto a conveyor.

**Waste Stream** - The flow of solid waste, used to describe any portion of MSW, such as "residential waste stream" or "industrial waste stream."

**Water Table** - Level below the earth's surface at which the ground becomes saturated with water.

**White Goods** - Metal appliances, such as refrigerators, stoves, washers, dryers, etc.

**Yard Wastes** - Organic materials produced by lawn and landscaping work, such as grass, small brush, and leaves.

## **RECOMMENDATIONS**

- Counties should begin immediately to form a Joint Agency for the region.
- Joint Agency should establish cost accounting methodology and implement uniformly for all participating counties.
- Joint Agency and/or counties should establish a regional Solid Waste Advisory Council.
- Joint Agency should review and adopt a regional waste management plan and file with the S.C. Department of Health and Environmental Control.
- The Joint Agency should contract with the Lower Savannah Council of Governments to develop required staffing and administrative services until the Joint Agency is fully functional.
- The Joint Agency should coordinate with the Lower Savannah Council of Governments to act as liaison between counties and affected municipalities.
- Draft, review, and publish "Request for Qualifications (RFQ)" or "Request for Proposals (RFP)" for private companies to provide a minimum of three years Subtitle D services for total MSW landfill disposal.
- Draft, review, and publish RFQ or RFP for siting, constructing, and/or operations of the following in the region:
  - 1) Subtitle D landfill
  - 2) Transfer Stations
  - 3) Inert landfills
  - 4) Drop-Off Sites
  - 5) Rural Collection Centers
  - 6) Materials Recovery Facilities
- Region should make an application to DHEC for Trust Fund monies by January 8, 1993, to help fund the system
- Joint Agency should begin working with S.C. DHEC regarding public information and education
- Joint Agency should industrial and commercial contacts to explore methods of recycling and source reduction

**ATTACHMENTS**

# RECYCLED MATERIALS MARKETS

*for*  
LOWER SAVANNAH COUNCIL OF GOVERNMENTS

MATERIAL	PRICE	SPECIFICATIONS	MARKET STABILITY/REMARKS	BUYERS
Glass	.0125 to .025 per pound	<ol style="list-style-type: none"> <li>1. Colors must be separated.</li> <li>2. <u>All</u> metals must be removed.</li> <li>3. No dirt, ceramic containers, or plate glass allowed.</li> <li>4. Seller must ship.</li> </ol>	Stable for the last 9 months. No changes expected this year.	1., 2.
Lead Batteries	.05 to .065 per pound	<ol style="list-style-type: none"> <li>1. Trailer load quantities, less than trailer load, the generator ships.</li> <li>2. On pallets, plastic strapped or shrink wrapped.</li> <li>3. No leaking batteries.</li> </ol>	Stable	3., 4., 5..
White Goods	.01 to .02 per pound	<ol style="list-style-type: none"> <li>1. Trailer load Quantity.</li> <li>2. Seller ships.</li> <li>3. No flammable products.</li> <li>4. (*)Motors, compressors, and capacitors must be removed</li> </ol>	Stable	6., 7., (*)
Steel Cans	.005 to .035 per pound accepted	<ol style="list-style-type: none"> <li>1. Rail car quantities (90 tons).</li> <li>2. Baled, high density.</li> <li>3. (*) Loose or Baled.</li> <li>4. Cans must be dry!</li> </ol>	Stable when a buyer can be found	11. (*), 12., 8., 22.
Aluminum Cans	.41 per pound	<ol style="list-style-type: none"> <li>1. Densified, trailer load quantities.</li> <li>2. No steel or trash.</li> </ol>	Seasonal fluctuations	8., 9., 10., 11..
Aluminum (Other)	.08 Irony* .30 siding			8., 11
Plastics	-.02 to .025 per pound	<ol style="list-style-type: none"> <li>1. Baled</li> <li>2. Trailer load Quantities (30,000 lbs +)</li> <li>3. Separation by type essential for better price <ul style="list-style-type: none"> <li>- Polystyrene</li> <li>- Soda Bottles (PET)</li> <li>- Milk Jugs (HDPE)</li> <li>- PVC</li> </ul> </li> </ol>	Markets not stable, glutted	13., 14., 15., 16., 17., 18..

**RECYCLED MATERIALS MARKETS**  
*for*  
**LOWER SAVANNAH COUNCIL OF GOVERNMENTS**

MATERIAL	PRICE	SPECIFICATIONS	MARKET STABILITY/REMARKS	BUYERS
Paper				
News	.01 to .0175 per pound	1. Baled, no magazines	Stable for the last 9 months. No changes expected this year.	19., 20., 21.
Corrugated	.015 to .0175 per pound	1. Clean, baled	Price is expected to increase \$10 to \$15 per ton by years' end.	
Office	.0125 per pound	1. Clean, no metals in gaylords of baled.	Stable, may drop in fall	

**RECYCLED MATERIALS MARKETS**  
*for*  
**LOWER SAVANNAH COUNCIL OF GOVERNMENTS**

**BUYERS**

1. Ball Incon, Inc. Laurens, SC	Claude Dover 803-984-2541	2. Owens Brockway Atlanta, GA	Hazel Mobly 404-765-8626	3. Exide Corporation 645 Penn Street Reading, PA	Bob Jordan 1-800-437-8495
4. RSR Corp. 1111 W. Mockingbird Ln. Dallas, TX 75247	Jim Porter 1-800-527-9452	5. Regency Battery Co. Columbia, SC	Bill Hobbes 803-252-3071	6. Addleston International Georgetown, SC	Mike Berlin 803-546-2591
7. Owens Industrial Products Two Notch Road Lexington, SC	359-6137	8. K & W Alloys Clinton, SC	803-833-3444	9. Common Wealth Spartanburg, SC	Michael Toney 1-800-967-4226
10. Arco Aluminum Hartsville, SC	803-332-3123	11. Columbia Steel Shop Road Columbia, SC	Hart Levy 803-799-3582	12. AMG P.O. Box 141 Whitehouse Stat., NJ 08889	Roger Levine 908-534-6626
13. Martin Fiber Corporation Trenton, SC	Joan Philips 803-275-4592	14. Wellman Industries Johnsonville, SC	Bob Dastou 803-386-2011	15. PMG (Plastic Materials Group) P.O. Box 2345 Fayetteville, NC	Kenneth Poole 1-800-752-5237
16. National Polystyrene Recycling Brigepoint, NJ	Don Deveau 804-494-2560	17. Plastic Services of Am. P.O. Box 964 Montgomery, AL 36101	Mariana 205-264-9578	18. Jefferson Smurfit Corp. Tampa, FL	Don Conaty 813-238-6433
19. Jefferson Smurfit Augusta, GA	Ed Burch 702-722-9603	20. Paper Stock Dealers Columbia, SC	Bobby Hall 803-779-0500	21. Lin Pac Cowpens, SC	Bob Morgan 803-436-9090
22. Steel Can Recycling Institute 1 Park West Circle, Ste. 101 Midlothian, VA 23113	Charles Nettleship 804-378-2302				

## CALCULATING THE REAL COST OF LANDFILL DISPOSAL: WORKSHEET

## Pre-Development Costs

	Example	Your Calculation
Siting the facility (engineering, legal fees & preliminary geotechnical investigations)	\$75,000	_____
Site mapping (topographic/boundary surveys) & final geotechnical investigation	75,000	_____
Engineering design & regulatory permit application	100,000	_____
Legal & public hearings	50,000	_____
Land purchase & brokerage fees (250 acres)	250,000	_____
Regulatory permitting fees	5,000	_____
Administrative support services	25,000	_____
Unanticipated costs	50,000	_____
<b>(a) Total Pre-Development Cost</b>	<b>\$630,000</b>	_____

## Initial Construction Costs

Entrance & access roads	\$100,000	_____
General site excavation & land clearing	750,000	_____
Erosion & sediment control facilities	50,000	_____
Liners & liner cushion system	550,000	_____
Leachate collection & landfill gas venting system	50,000	_____
Leachate treatment system	100,000	_____
Site landscaping	50,000	_____
Weighing scales & scale system	50,000	_____
Scalehouse & office building	20,000	_____
Equipment maintenance facility	75,000	_____
Public convenience area	30,000	_____
Miscellaneous site paving	30,000	_____
Miscellaneous facilities (including lighting, gates, signs, etc.)	50,000	_____
Construction engineering & quality control testing	50,000	_____
<b>Subtotal</b>	<b>1,955,000</b>	_____
Contingency (2-10%)	45,000	_____
<b>(b) Total Initial Construction Cost</b>	<b>\$2,000,000</b>	_____

Note: These costs are for a new facility with a double lining system and a leachate detection system. Other initial construction costs which may be required include upgrading the local sewer service to accept leachate discharge and upgrading of local roads, utilities, etc. for the host community.

## Annual Operational Costs

Site personnel & management	\$200,000	_____
Facility overhead (including building & grounds, site maintenance, electric, phone, etc.)	50,000	_____
Equipment operation & maintenance	50,000	_____

Equipment financing*	150,000	_____
Road maintenance	25,000	_____
Routine environmental monitoring (ground water, surface water & landfill gas)	25,000	_____
Engineering services	30,000	_____
Site & equipment insurance/closure bonding	50,000	_____
On-going development & construction costs	250,000	_____
Leachate treatment at a municipal sewer system	10,000	_____
Pre-treatment of leachate prior to disposal into municipal sewer system	50,000	_____
Unanticipated costs	50,000	_____
<b>(c) Total Operational Costs</b>	<b>\$940,000</b>	_____

\* Assumes the financing of the operations equipment with a lease purchase agreement or a reserve fund for routine equipment replacement.

## Closure and Post Closure Costs

This model assumes the final cap on the landfill is part of the on-going development cost while the landfill is operating. The annual amount should be set aside during the operational years of the landfill because closure costs will be incurred for years after the facility is closed and tipping fees have ceased.

Costs include the following:

Engineering fees for preparation of a closure plan
Regulatory approvals of the closure plan
Final site grading & re-vegetation
Maintenance of erosion & sediment control facilities
Maintenance of landfill gas system
Operation & maintenance of leachate collection and treatment system
Leachate treatment at offsite treatment plant

<b>(d) Annual Closure/Post-Closure Costs</b>	<b>\$50,000</b>	_____
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## Annual Cost

<b>e Capital costs (a + b)</b>	<b>\$2,630,000</b>	_____
<b>f Amortization of capital costs — straight line depreciation over 20 years at 9% (ex. 108)</b>	<b>285,000</b>	_____
<b>g Annual operating cost (c)</b>	<b>940,000</b>	_____
<b>h Annualized closure &amp; post-closure costs (d)</b>	<b>50,000</b>	_____
<b>i Total annual cost (f + g + h)</b>	<b>1,275,000</b>	_____
<b>j Annual tons per year (200 tons/day x 6 days/week x 52 weeks/year)</b>	<b>62,400 tons</b>	_____
<b>k Cost per ton (i + j)</b>	<b>20/ton</b>	_____
<b>l Host community fee for capital improvements</b>	<b>—</b>	_____
<b>m State or local assessment fee</b>	<b>—</b>	_____
<b>n Total Tipping Fee (k + l + m)</b>	<b>\$20/ton</b>	_____

## Cost Per Household Per Month

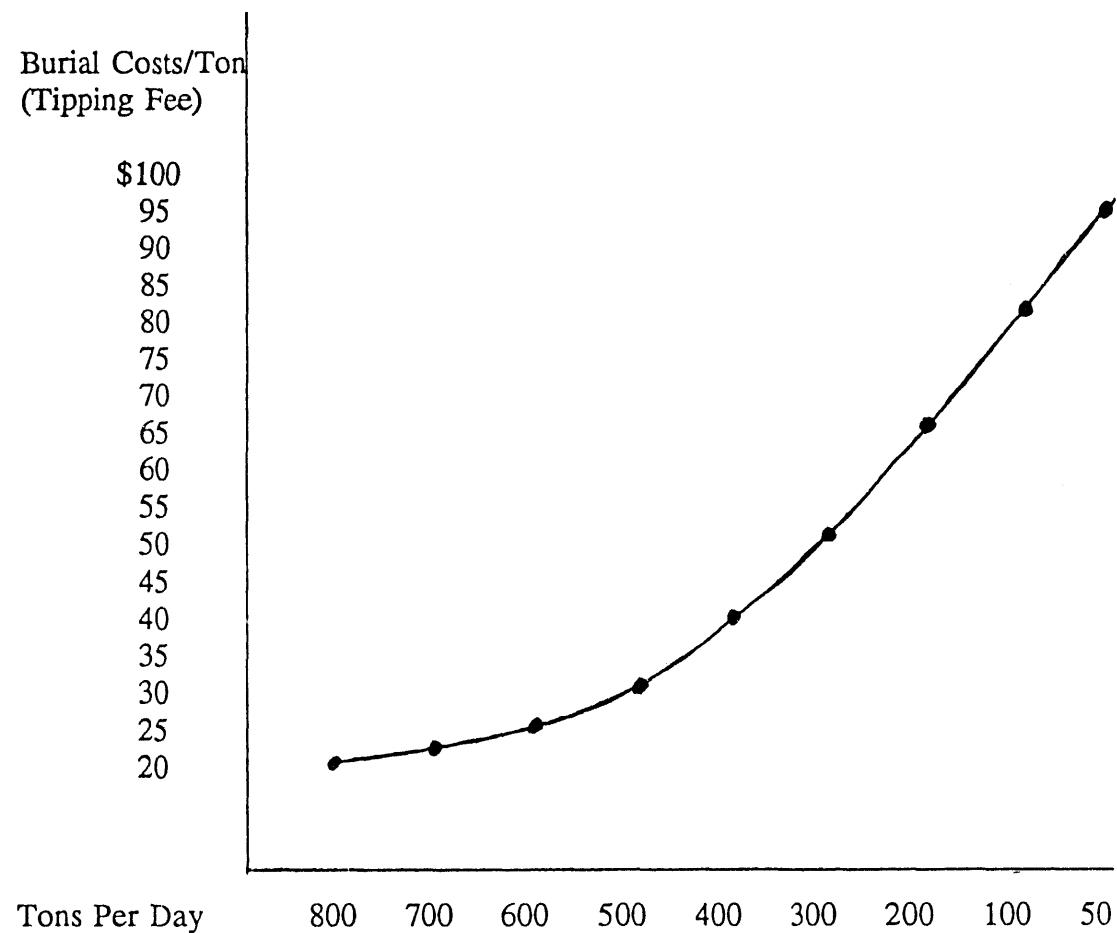
<b>o Annual cost (i)</b>	<b>\$1,275,000</b>	_____
<b>p Population</b>	<b>80,000 people</b>	_____
<b>q Cost per person (o + p)</b>	<b>\$16.00/year/person</b>	_____
<b>r Persons per household</b>	<b>\$1.33/month/person</b>	_____
<b>s Cost per household (q + r)</b>	<b>3.5</b>	_____
<b>t Cost per household (\$5.00/month/household)</b>	<b>\$5.00/month/household</b>	_____

LANDFILLING ALONE VS. LANDFILLING AND RECYCLING

NET COST OF ALTERNATIVE METHODS OF HANDLING  
REGION'S CURRENT MUNICIPAL SOLID WASTE.

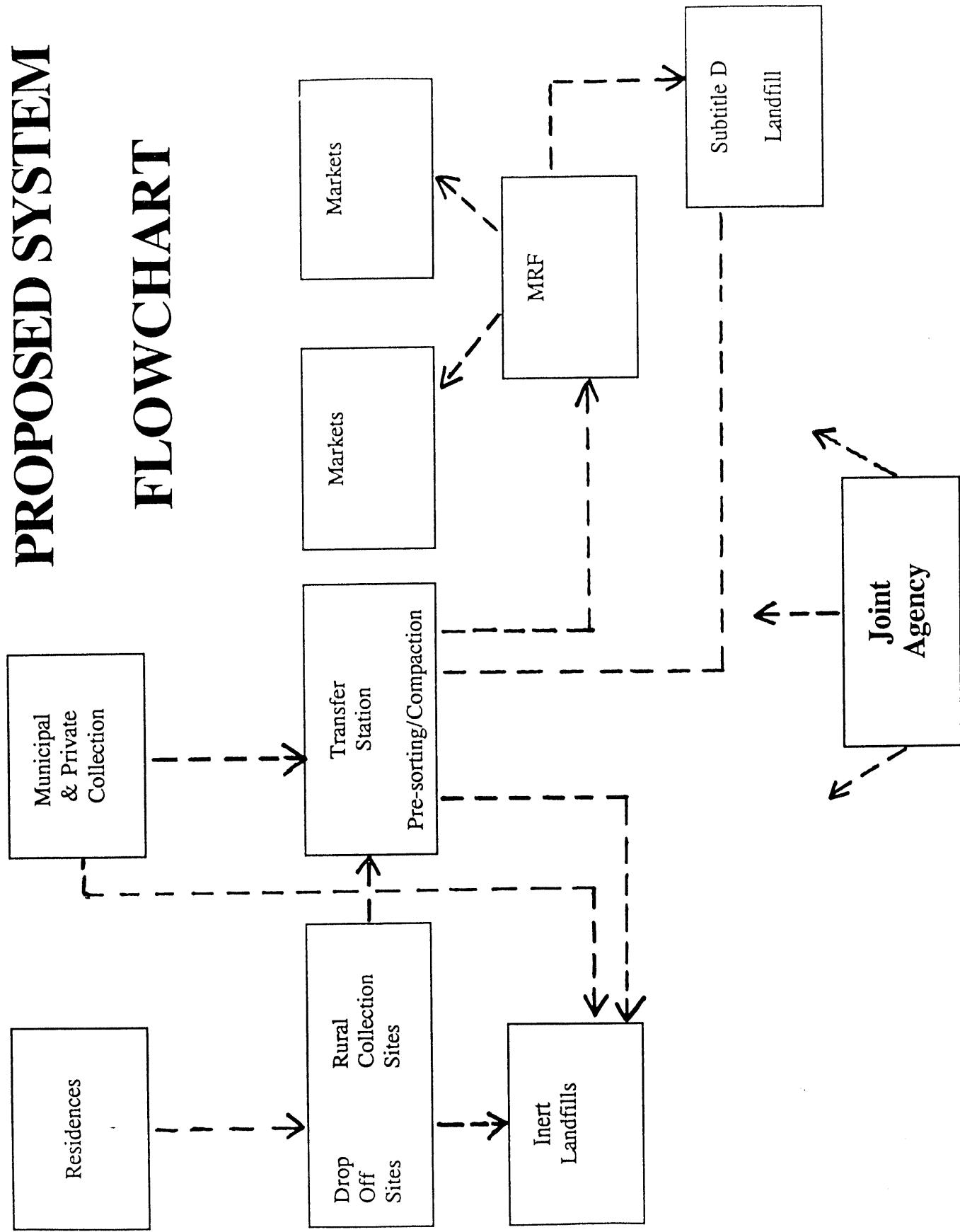
ALTERNATIVES	ANNUAL MSW LANDFILL COST	ANNUAL MRF LANDFILL COST	ANNUAL MSW COLLECTION COST	TOTAL MSW ANNUAL COST	ANNUAL RECYCLING REVENUE	ANNUAL MSW NET COST
LANDFILL ONLY	\$5,397,509				\$ 0	\$5,397,509
PROPOSED SYSTEM 200 TPD MRF	\$5,130,134	\$257,140	\$1,125,000	\$6,512,274	\$1,080,000	\$5,432,274
PROPOSED SYSTEM 400 TPD MRFS	\$4,652,632	\$514,280	\$1,525,000	\$6,691,912	\$2,160,000	\$4,531,912

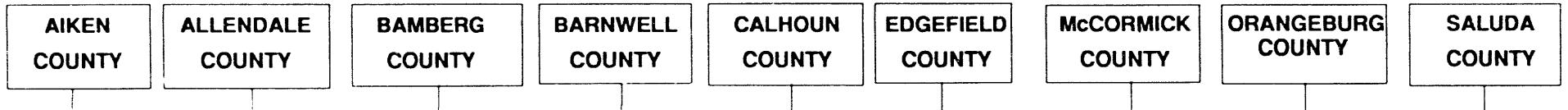
## LANDFILL COSTS RELATIVE TO VOLUME



# PROPOSED SYSTEM

## FLOWCHART





Each County Council Appoints A Member  
of the Board of Directors of Joint Agency

**JOINT AGENCY**  
(public body and body corporate and politic)

**BOARD OF DIRECTORS**

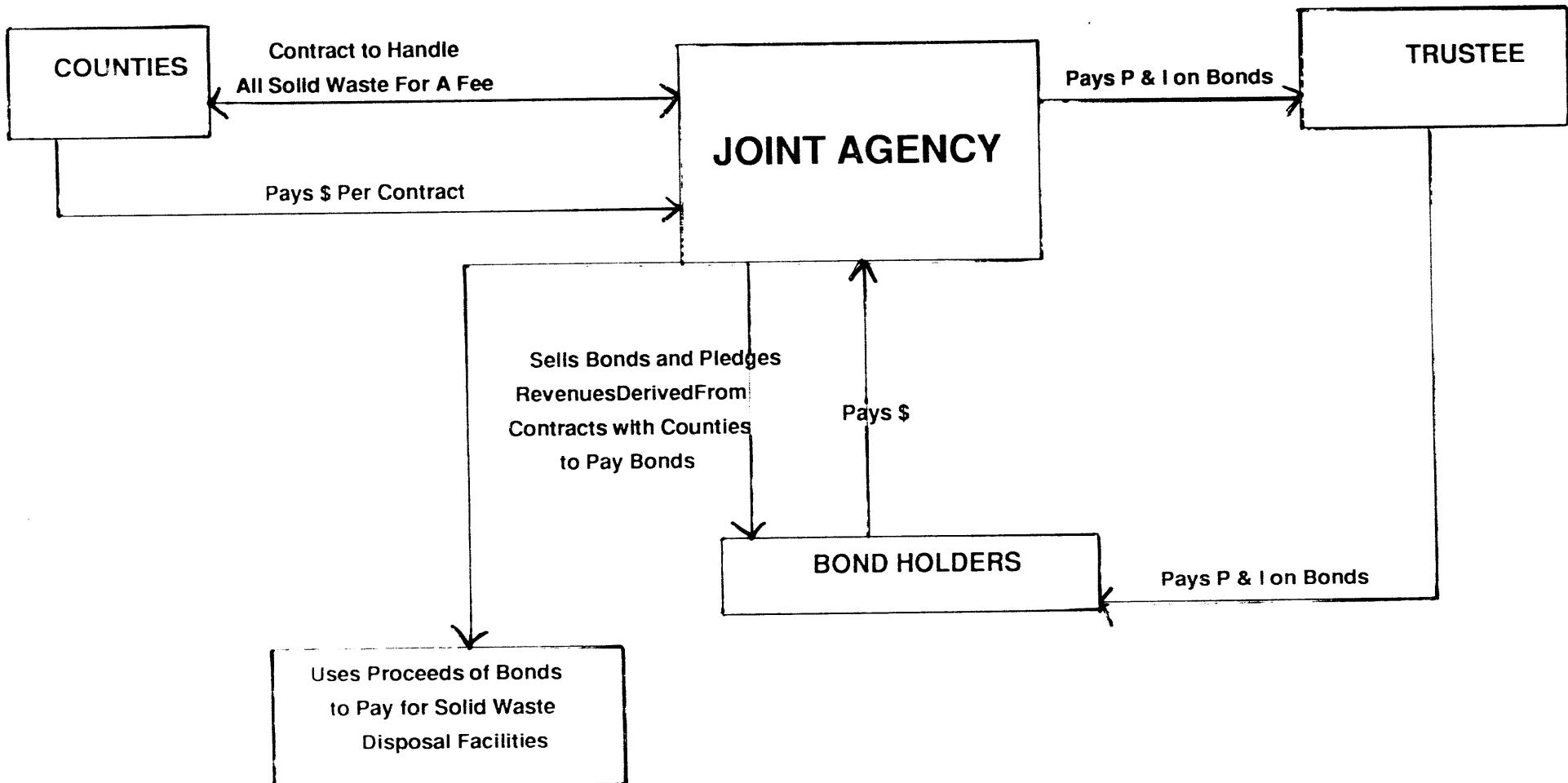
**STAFF**

**STAFF**

**STAFF**

**STAFF**

**STAFF**



100-5194

DATE  
EXPIRED  
12/1994

